Integrating with External Directories

Overview

Service Catalog Directory Integration simplifies security administration and enhances user convenience and productivity by implementing centralized user authentication and synchronization with an enterprise directory.

Service Catalog enables customers to integrate with an external directory (typically using the LDAP protocol) for user information synchronization. This synchronization is invoked whenever a user is selected for Order-on-behalf (OOB) or during Person Lookup.

Single Sign-On (SSO) integration enables centralized user authentication, eliminating the need for a separate login mechanism. When the SSO event is enabled, users who are already logged in to an enterprise portal with which Service Catalog has been integrated do not have to login again. Service Catalog relies on the SSO tool to protect all Service Catalog URLs and to perform authentication. Service Catalog requires that the SSO tool provide person identification information for each successful authentication to a Service Catalog URL via the HTTP header or cgi header. Once a person has been authenticated, their information can be synchronized to the application database.

If SSO is not enabled, then the Service Catalog login screen is presented to all users so they can provide a valid username and password combination. By default, these credentials are authenticated against the internal database. Alternatively, Directory Integration could be configured to authenticate to an external system (generally an LDAP directory). Users who wish to access Service Catalog must be present in this source for successful authentication.

The Directory Integration Framework provides the above capabilities for many frequently deployed SSO and directory server products through configuration options available in the Administration module. The framework also includes an application programming interface (API) which can supplement predefined configuration capabilities. The API allows programmers to access additional SSO portals and directory servers, as well as to alter or supplement default behavior for synchronizing user information between Service Catalog and the external directory.

This chapter describes how to configure directory integration for Service Catalog using the Administration module. It also describes the set of public APIs and interfaces available for customizing the integration options available, best practices for compiling and deploying custom code, and steps to configure the custom code using the Administration module.

Prerequisites

Configuring directory integration requires the following:

- A working Service Catalog installation.
- Directory server installed and directories populated with corporate data. Directory entries for all potential users must contain non-null values for all attributes that are mapped to fields required for integration operation, as explained in the Defining Mappings.
- An SSO system that is responsible for the authenticating and authorizing access to Service Catalog, if Single Sign-On (SSO) is to be used.
- A user login with a role that includes the capability to "Manage Global Settings". This capability is automatically included in the "Site Administrator" role and assigned to the "admin" user, but may be assigned to other roles or users as appropriate, using the Roles option in the Administration module.

Note Access to an LDAP browser is strongly recommended.

Prerequisites for Configuring Directory Integration

To configure directory integration, you need to have handy information about the current implementation of SSO (if used) and directory servers at your company, and to document the requirements for integrating these systems with Service Catalog. This section provides a set of worksheets for collecting this information.

These worksheets should help you collect the information required to configure directory/SSO integration, and to identify issues which need to be resolved before the integration can be implemented. This, in turn, can help in estimating the amount of development and testing time required for the directory integration.

Defining Datasources

Service Catalog defines a "datasource" for each directory which stores personnel and organization data to be accessed. The datasource definition includes all information required to connect to the external directory and extracting information from that directory.

You will need to define one datasource for each external directory. For example, different development and production directories may be used. In addition, Service Catalog supports LDAP directory referrals—a datasource needs to be defined for each directory in the referral chain.

Table 8-1 Datasource Definition Table

Setting	Value	Description
Datasource Name		The name of the datasource. Do not use spaces or special characters.
Datasource Description		Optional description of the datasource.
Protocol	• LDAP	LDAP is the only supported protocol at this time. If directory information is stored using another protocol, you need to create custom code to access this information.

Table 8-1 Datasource Definition Table

Setting	Value	Description
Server Product	• Sun™ ONE Directory • Microsoft® Active Directory® • IBM® Tivoli®	Choose the directory server product you are using. If the server is not currently supported, you will need to create custom code to access the server and extract directory information.
Authentication Method	• Simple • Anonymous • SASL	**Simple** means plain text user/password. **SASL** (Simple Authentication and Security Layer) is also available, but SASL only works with Sun ONE Directory Server.
Connection Mechanism	• SSL • Non SSL	Only needed if you choose **Simple** or **SASL** as the authentication method. Choose **SSL** to send encrypted information.
BindDN		Bind distinguished name field. BindDN is used to connect to the LDAP server when Service Catalog performs a directory operation. You may want to create a service account for this purpose. When this datasource is used in an External Authentication step, you will provide an EUA Bind DN in the Options area to override this value. For more details, see the External User Authentication (EUA) Operation.
Password		Required if you choose **Simple** or **SASL** authentication; the password for the user specified as the Bind DN. If the account uses password aging, you will need to update this password periodically.
Host		Fully qualified domain name or IP address of the LDAP directory server.
Port Number		Port number to connect to the directory server. Port Number 389 is typically used for non-SSL access.
User BaseDN		The directory from which to start searching for persons in the directory; since corporate directories may include many branches, specifying a base DN for the user data will optimize directory searches.
AuthzID		Required if you choose **SASL** authentication.
Optional Filter		This filter are added to other search filters you use, and it can be used to effectively change the search results. The filter expression must be enclosed in parentheses; for example, the filter: (&(!(msExchHide=true)(ISC-GID=*))) will return only those entries for which the msExchHide attribute is true and for which an ISC-GID attribute is defined.

Table 8-1 Datasource Definition Table

Setting	Value	Description
Security Certificate Name		Required if you choose SSL as the connection mechanism. Do not use spaces or special characters in the certificate alias name. Ensure that you have the certificate data ready to enter.
Referral Datasource		You can add one or more datasources as a referral. When a datasource search does not return results, the system searches the referral datasources as well. Referrals are supported for searches only, not binding. *You cannot set up cyclic referrals. Cyclic referrals are those where one datasource has another datasource as a referral, while that datasource has the original as a referral. For example, datasource A has datasource B as a referral, while datasource B has datasource A as a referral.*

Defining Mappings

A “mapping” is a set of rules that gives instructions for how data is to be transferred from the external directory to Service Catalog. It maps between source attributes in the directory and target fields in the Service Catalog database. The rules are used to transfer data from the directory to the designated target field when the Service Catalog database is synchronized with the directory.

Directory User Data
Mapping
Request Center User Data

The same mapping can be applied to multiple directories (datasources).

A mapping includes the user/person’s profile along with all related entities: addresses, contacts, locations, one or more group associations, one or more organizational unit (OU) associations, and one or more RBAC (role-based access control) role associations.

A person profile includes seven mandatory fields, listed in the “Mandatory” section of the Mapping Worksheet below. Directory records which do not provide a value for any of these fields cannot be imported. Other fields which are part of the person profile can also be mapped. For more information, see People section, in Organization Designer chapter of Cisco Prime Service Catalog Administration and Operations Guide.

Most of the fields on the person profile are used to drive the Service Catalog functionality, and the mapping should ensure that mapped attributes provide a source value appropriate for the field; that is, do not try to overload these fields with more information than would be suggested by the field name, or with information that does not match the field name.

Service Catalog also includes fields which provide an extension to the standard personnel data. These fields are denoted as “Extension” on the following table and appear on the Extensions page of the Person information in Organization Designer. Some of the most frequently required extended fields have been assigned meaningful names (such as Company Code and Division), but others have the names Custom 1 through Custom 10, and are intended to be freely used, with no preconceived semantics. If you have additional personnel information in the LDAP directory that needs to be exposed in Service Catalog, map the attributes containing that information to one of the personnel extended fields.

The "Directory Attribute" column in the worksheet below should be filled in for all Person profile fields for which the directory must supply data. The Attribute should be one of the following:

- The directory attribute name or names, if two or more attributes can be concatenated (with optional literals) to form the value for the field.
- "Custom mapping", following by a number or description. All custom mappings should be explained in detail in the Custom Mappings or noted briefly in the "Comments" column. Custom mappings may assign the result of a regular expression to the attribute, or may be implemented via a module of custom Java code. Details for implementing these mappings are given in the Configuring Mappings.

Mandatory Mappings

Table 8-2 Mandatory Mapping Field Description Table

Field	Comments
First Name	
Last Name	
Login ID	Unique identifier to be used as the person's login name for Service Catalog.
Person Identification	The Person Identification should map to an attribute that provides a unique value for each person. For example, specify an attribute that contains the employee id or social security number. Ideally, the same attribute should map to both the Login ID and the Person Identification; at a minimum, the two should be tightly coupled.
Email Address	
Home Organizational Unit	The Home OU is always a business unit, not a service team.
Password	Directory servers will typically not return a password. However you can use this field to create, for example, default passwords for new users.

Optional Mappings

Table 8-3 Optional Mapping Field Description Table

Field	Comments
Title	
Social Security Number	
Birthdate	The return type of the LDAP attribute being mapped must return a long. Service Catalog does not support other formats.
Hire Date	The return type of the LDAP attribute being mapped must return a long. Service Catalog does not support other formats.

Table 8-3 Optional Mapping Field Description Table

Field	Comments
Timezone ID	The mapped attribute must return a value in one of the following formats: • GMT+- Offset • Country/Language As of the March 2008, the familiar three-letter time zone designations (for example, “EST” for Eastern Standard Time) should not be used. For a list of supported values for the above formats, see the Supported Time Zones. If the return value does not match one of the valid formats, Service Catalog uses PST as the default time zone.
Locale ID	The mapped attribute must return a value in the form: language_COUNTRY where language is a two-letter language code and the country is a two-letter country code. Directory integration supports the following locales: • en_US (United State English) • de_DE (German) • es_ES (Spanish) • fr_FR (French) • ja_JP (Japanese) • zh_CN (Mainland Chinese) • zh_TW (Taiwanese Chinese) • Korean
Employee Code	
Supervisor	This field represents the identification of manager. For more details, see the Import Manager Operation.
Notes	
Company Street 1	
Company Street 2	
Company City	
Company State	
Company Postal Code	
Company Country	
Building	
Level	
Office	
Cubicle	
Personal Street 1	

Table 8-3 Optional Mapping Field Description Table

Field	Comments
Personal Street 2	
Personal City	
Personal State	
Personal Postal Code	
Personal Country	
Work Phone	
Home phone	
Fax	
Mobile Phone	
Pager	
Other	
Main Phone	
Primary Phone	
Primary Fax	
Sales Phone	
Support Phone	
Billing Phone	
Other Contact Information	
Company Code	Extension
Division	Extension
Business Unit	Extension
Department Number	Extension
Cost Center	Extension
Management Level	This should return a number. When used with the Import Manager event, Management Level is expected to be in increasing order according to the hierarchy. For example, if there are two designations, Junior Engineer and Senior Engineer, Management Level returned for Junior Engineer should be less than the Management Level of Senior Engineer.
Region	Extension
Employee Type	Extension
Location Code	Extension
Custom 1	Extension
Custom 2	Extension
Custom 3	Extension
Custom 4	Extension

Table 8-3 Optional Mapping Field Description Table

Field	Comments
Custom 5	Extension
Custom 6	Extension
Custom 7	Extension
Custom 8	Extension
Custom 9	Extension
Custom 10	Extension
Organizational Unit List	Use this mapping to associate the person with one or more Organizational Units. The mapping may return multiple values. For this field Service Catalog uses all values returned by multivalued LDAP attributes. Input for this field should be in one of the following formats: • Name of the Java class that returns the multiple values as defined in Directory Integration API documentation. • One or more simple mappings separated by "::". For example, ou::departmentNumber. • One or more expression mappings separated by "::", as in: expr:#memberOf#=(cn=(.*),cn=Users,dc=celosis,dc=com)?($1):Default:: expr:#memberOf#=(cn=(.*),ou=Users,dc=celosis,dc=com)?($1):Default
Group List	Similar to Organizational Unit List.
Role List	Similar to Organizational Unit List. The returned roles may be either system- or user-defined. For system-defined roles, the names must be exactly as they appear in a browser with language US English. Other languages are not supported. For example, "My Services Executive" should be returned to associate a user with this role. For user-defined roles, the name must exactly match the user input in user language while creating the role.

Custom Mappings

You may use the worksheet below to document requirements for custom mappings.

Table 8-4 Custom Mapping Field Description Table

Field	Type	Requirements
	Expression Java	
	Expression Java	

Defining Integration Events, Operations and Steps

Integration events are the interfaces between Service Catalog and an external directory or SSO program—the only times in the use of Service Catalog that the external program or directory is accessed. These events consist of a series of operations which are executed in sequence.

Events

Service Catalog supports four directory integration events:

- The "**Login**" event occurs when a user's credentials are validated and the user connects to Service Catalog. This event occurs when a user initially starts a Service Catalog session. It also occurs if a session times out (the administrator-specified time-out period expires) and the user must reconnect.
- A "**Person Lookup**" event occurs every time user information must be retrieved. There are actually three types of Person Lookup events:
  - **Person Lookup for Order on Behalf**: A user requests a service on behalf of another person, and must choose the person who is the customer for the service.
  - **Person Lookup for Service Form**: A service form includes a Person field, which allows the user to designate another person as part of the service data.
  - **Person Lookup for Authorization Delegate**: A user responsible for reviewing or authorizing service requests modifies his/her profile to designate another person as a temporary authorization delegate.

Operations

You can configure events to perform various types of operations. The operations are specified for each event in a series of steps, which determines the sequence in which each operation in invoked.

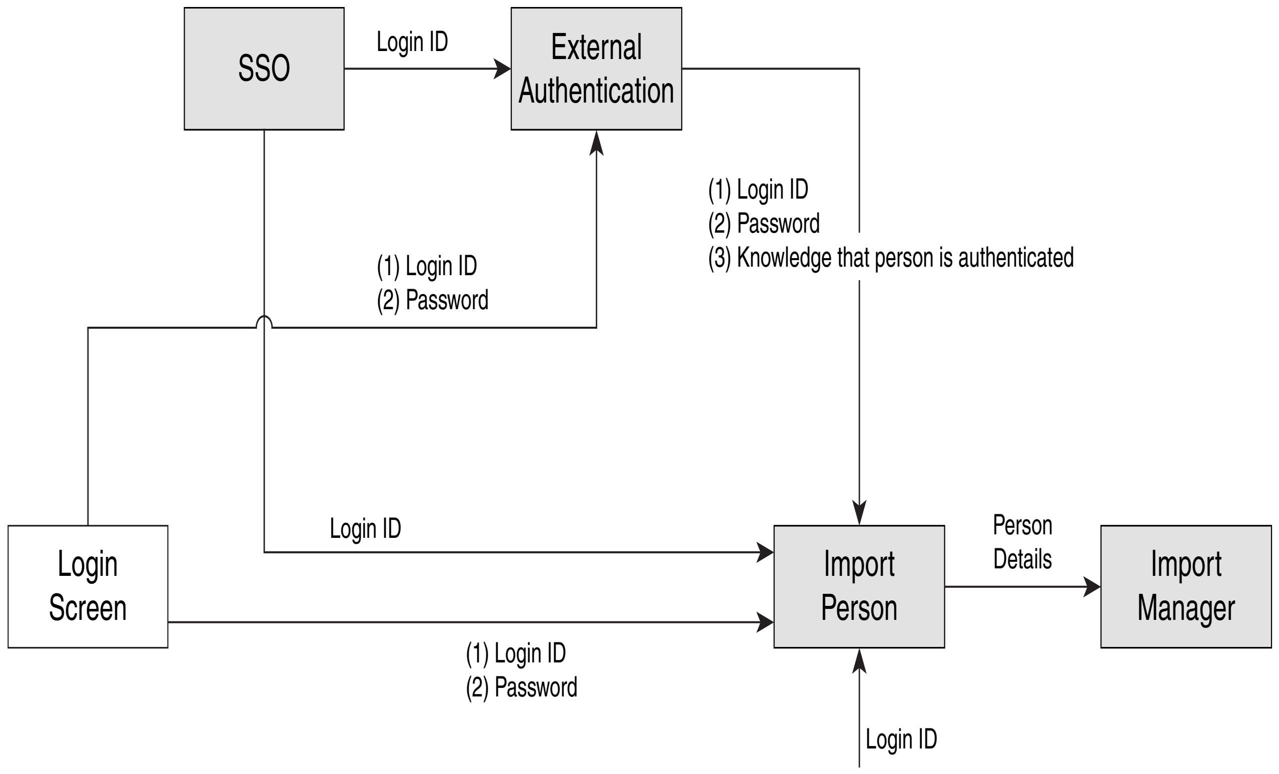
The directory framework includes the following operations:

- **Single Sign-On** (SSO) is always the first step in the Login event. The SSO operation identifies the login name of the user.
- **External Authentication** can occur after the SSO operation or, if an SSO operation is not used, after the default Login screen. External Authentication uses the login name and password of the user and authenticates them against an external datasource.
- **Person Search** is triggered when the user invokes a search on a datasource. Person Search uses the First Name and Last Name of the user to provide a list of matched items.
- **Import Person** can occur after External Authentication or after SSO, or after a person is chosen in the Person Search dialog box. Import Person uses the login name of the person searched or logging in to query a datasource and import the person into the database.
- **Import Manager** can only occur after Import Person. The Import Manager operation will use the imported person information to import the managers of this person.

Each operation can be customized via implementation of custom code interfaces.

Trigger Order below shows the sequence in which operations are triggered.

Figure 8-1 Trigger Order



Login Event

If a directory integration login event is not configured, the default behavior is to present the login screen and validate the credentials entered (user name and password) against the contents of the application database.

If the directory integration event is enabled, the Login event may be configured with either one of the following operations as its first step:

- Single Sign-On: In a corporate environment where all users are preauthenticated using SSO vendors, automatically extract the login id of the user from request headers or CGI headers and allow transparent login, bypassing the application login screen.
- External User Authentication: Present the application login screen and validate the credentials entered against the specified external directory. External User Authentication may also follow an SSO operation.
- Mixed Mode Authentication: Avoids NTLM authentication via application server port. When DB Credentials(both Username and Password) are passed via the Application server Port and NTLM Authentication is enabled on the web Server, Database Authentication triggers and database user owns the session.

  If EUA is enabled and both Username and Password is passed , an LDAP authentication is triggered. The Password provided must be the LDAP Password and LDAP user owns the session..

Once the user credentials have been validated, the Login event may include additional operations to synchronize user data between the external datasource and Service Catalog:

- The “Import Person” operation may be the next step. This operation imports the profile of the authenticated person selected to Service Catalog, synchronizing the data.

- The "Import Manager" operation may follow the "Import Person" step. This operation retrieves information on the managers of the selected person from the external directory and updates the Service Catalog database with that information.

Single Sign-On Operation

Integration with Single Sign-On (SSO) solutions can use one of the following two mechanisms/protocols:

1. Active Directory Services (ADS)/NT LAN Manager (NTLM)-based authenticated user
   - The third-party IM/AM/SSO product is not needed to log into Service Catalog.
   - The logged in user credentials from any POSIX-compliant OS are returned by the browser to Service Catalog.
   - This is also called integration through CGI Headers for SSO.
2. HTTP Request Headers
   - This is for non-ADS/NTLM integration.
   - It requires the third-party IM/AM/SSO product to log into Service Catalog using RequestHeaders in the http protocol.

For customers who plan to use SSO for both Portlet and Directory Integration, only HTTP Header SSO is supported. Custom SSO plug-ins within the Directory Integration framework are not supported.

Setting	Value	Description
Single Sign-On Type	HTTP Header Remote User	Specify the type corresponding to your SSO solution. Be sure to verify that login ID information is accessible. Check HTTP Header to use http Request Header protocol. Check Remote User to use ADS/NTLM protocol.
Login ID Mapping		Login ID mapping for HTTP Sign-Ons should be the exact name of the Http Request Header that contains the login name of user signing in. Login ID mapping for ADS/NTLM Sign-Ons should be of the following format: #AnyDomain#\#LoginId# For example, celosis\#LoginId# limits users to the "celosis" domain, while #AnyDomain#\#LoginId# allows logins across multiple domains. If multiple domains are in use, the LoginId must be unique across domains.
Redirect URL		The URL of the corporate portal from which users typically access Service Catalog products. Users are redirected to this URL if authentication fails, or when the application user session times out.

Administrative Bypass of SSO

It is sometimes necessary to allow some users to bypass the Single Sign-On and login directly to Service Catalog. This capability is typically required for:

- System administrators who need to investigate problems with Single Sign-On

- Testers who need to emulate the performance of multiple users in order to validate a service design and task plan

Service Catalog provides a mechanism for allowing users to access the login screen and enter a user name and password. The newscale.properties file (located within the RequestCenter.war) specifies a value for the “BackDoorURLParam”; for example:

```
BackDoorURLParam=AdminAccess
```

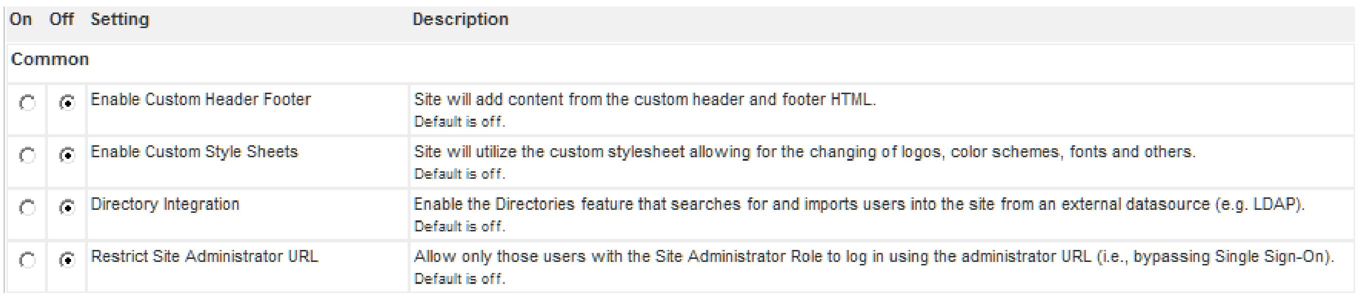
The URL used to access Service Catalog via the login screen must include a parameter. For the above value of the backDoorURLParam; for example, a sample URL might be:

```
http://prod.RequestCenter.com:<app_server_port>/RequestCenter?AdminAccess=true
```

<app_server_port> is the port number of application server.

It is the responsibility of the administrator to establish policies for aging out the value of the BackDoorURLParam according to corporate guidelines and for controlling administrative access to Service Catalog. Access via the administrative URL can be restricted to only those users who have the “Site Administrator” role via the corresponding Administration Setting:

Figure 8-2 Administration Setting



On	Off	Setting	Description
Common			
○	●	Enable Custom Header Footer	Site will add content from the custom header and footer HTML. Default is off.
○	●	Enable Custom Style Sheets	Site will utilize the custom stylesheet allowing for the changing of logos, color schemes, fonts and others. Default is off.
○	●	Directory Integration	Enable the Directories feature that searches for and imports users into the site from an external datasource (e.g. LDAP). Default is off.
○	●	Restrict Site Administrator URL	Allow only those users with the Site Administrator Role to log in using the administrator URL (i.e., bypassing Single Sign-On). Default is off.

The administrator must also ensure that the URL is directly accessible to users—access to the Service Catalog application may have previously been restricted to the SSO software via web server or network configuration parameters.

The Service Catalog service must be restarted for a change to this parameter to take effect.

External User Authentication (EUA) Operation

Use External Authentication to authenticate all Service Catalog users with a corporate directory. This way you do not have to worry about synchronizing user passwords.

External User Authentication must follow a login attempt—either via a configured Single Sign-On operation or through the application login screen. The LoginId retrieved from the previous operation is available to the EUA operation. However, validating this user in the external directory requires additional information, so that the BindDN can be located.

The EUABindDN setting allows the application to automatically extrapolate the bind DN of the user trying to sign on.

Table 8-5 EUABindDN setting

Setting	Description
External Authentication EUABindDN	EUABindDN is of the format: `Prefix#LoginId#Suffix.` Service Catalog will replace #LoginId# with the loginId of the user signing in from EUABindDN and use it as BindDN for authentication. For example, you can provide the EUABindDN like this: `uid=#LoginId#,OU=People,dc=example,dc=com` In such case if the user provides scarter as the login id in the logic screen during sign up, Service Catalog will use `uid=scarter,OU=People,dc=example,dc=com` to bind the user with external datasource.

Person Lookup Events

All Person Lookup events (Order on Behalf, Service Form, and Authorization Delegate) share the same behavior and configuration options.

If the directory integration event is not enabled, the Person Search window searches personnel information in the Service Catalog database. If a person is selected, their information is used. Personnel information is not updated.

If the directory integration event is enabled, the Person Lookup event may be configured with the following operations:

- The “Person Search” operation must be the first step. This operation retrieves personnel information from the external directory and displays it in the Person Search window. If the user selects a person, additional information on that person is retrieved, according to the mapping specified for the event, and supplied to the calling context.
- The “Import Person” operation may be the next step. This operation imports the profile of the person selected from the external directory to Service Catalog, synchronizing the data.
- The “Import Manager” operation may follow the “Import Person” step. This operation retrieves information on the managers of the selected person from the external directory and updates the Service Catalog database with that information.

Person Search Operation

Settings for the Person Search operation determine the appearance and behavior of the window that displays people meeting the search criteria.

In order for a person to be imported into Service Catalog, all mandatory fields must have a valid attribute mapping, which returns in a nonblank value. If any required values are missing, the default behavior is to exclude that person from the Search Results. The alternative is to include such people in the Search Results, and flag them as having incomplete information.

People with incomplete information cannot be chosen.

When configuring a Person Search operation

Table 8-6 Person Search Operation

Setting	Value	Comments
Search Selectivity	• Show People with Incomplete Information	Default is to exclude people with incomplete information from the Search Results window.
Sort By	• First Name • Last Name First Name • First Name Last Name • Last Name • No Sort	Default is to sort by Last Name.
Max Results		Default for the number of rows to display in the Search Results is 1000.

The * (Asterisk) Wildcard Character and Person Search

When configuring and testing a Person Search, you need to be aware of the use of the asterisk (*) as a wildcard character.

Transparent to the user, the system always appends an * to the end of the search string. Therefore, if a user enters john in the Last Name field, and clicks **Search**, the system returns all persons in the directory whose last name begins with the word john, such as “John”, “Johnson”, and “Johnston”.

A user may also explicitly enter the * character in the search string of the Search Person dialog box. Some examples of the usage for wildcard search are:

- Enter * in the **Last Name** field, and click **Search**. The system returns all persons in the directory.
- Enter **john*** in the **Last Name** field, and click **Search**. This is essentially the same as typing just **john** in the **Last Name** field. The system returns all persons in the directory whose last name begins with the word “john”.
- Enter ***john** in the **Last Name** field, and click **Search**. The system returns all persons whose last name contains the word “john,” including “John”, “McJohn”, and “Johnson”.
- Enter ***john*son** in the **Last Name** field, and click **Search**. The system returns all persons whose last name contains the word “john,” followed (not necessarily immediately) by the word “son.” These include “Johnson”, “Mcjohnson”, and “Upjohningson”.

Note The * is always treated as a wildcard character in the search string. Therefore, the user is NOT able to search for a value in the directory that contains the character *. Any other special characters may be used in the search string.

Configuring the Search Results Window

By default, the Search Results window in the Select Person Popup displays the person's first name followed by the last name. Additional fields can be added to the display by changing the Setting for the Person Popup available in the Administration module.

Import Person Operation

Import Person settings govern whether person information in the application is refreshed from current information about the selected person (when Import Person is used in a Person Search event) or the person who has logged in (when Import Person is used in a Login event).

Table 8-7 Import Person Operation

Setting	Value	Comments
Refresh	• Refresh Person Profile • Refresh Period (Hours)	Leave the refresh period blank or zero to refresh on every import—this will ensure that the Service Catalog database always reflects recent changes in the external directories. Alternatively, you can designate that a user's profile should be refreshed only after the designated period has passed since this last refresh.
Create Associations	• Do Not Create Organizational Unit • Do Not Create Group	Default is to create organizational units and groups if they do not exist. Roles cannot be created via directory integration and must exist before the person is imported.
Remove Existing Associations	• Organizational Unit • Group • Role	Default is not to remove existing organizational unit, group, or role associations.

Import Manager Operation

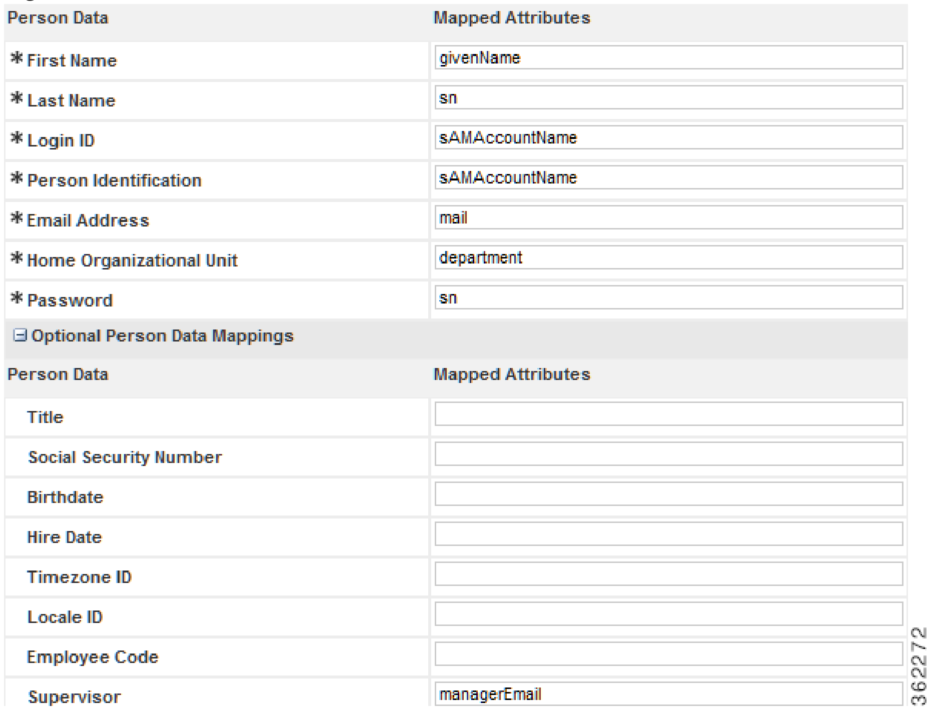
Service Catalog allows authorizations and reviews to be dynamically assigned. For example, a request with a dollar value greater than a specified threshold might need approval by the director of a particular department. Another request might need to be reviewed by the requestor's immediate superior.

To implement business rules like these, the managers of an employee who can request a service must also be present in the Service Catalog database. The Import Manager operation supports this requirement, importing manager (supervisor) data in conjunction with the employee's data.

To govern the behavior of the Import Manager operation:

- Identify the attribute in the employee's directory entry that is to designate his/her manager.
- For all employees, ensure that the designated attribute is populated with a value that uniquely identifies their manager. This is typically the login id or email address.
- In the mapping for the Supervisor field (listed in the Optional Person Data Mappings) specify the attribute in the employee data that holds the manager information. In the sample below, the managerEmail attribute is used.

Figure 8-3 Person Data



Person Data	Mapped Attributes
* First Name	givenName
* Last Name	sn
* Login ID	sAMAccountName
* Person Identification	sAMAccountName
* Email Address	mail
* Home Organizational Unit	department
* Password	sn

⊟ Optional Person Data Mappings

Person Data	Mapped Attributes
Title	
Social Security Number	
Birthdate	
Hire Date	
Timezone ID	
Locale ID	
Employee Code	
Supervisor	managerEmail

- In the Import Manager settings, specify as the "Key Field for Manager ID" the field in the manager's directory record whose value corresponds to the Supervisor attribute specified for the original person.

In one possible scenario, a single attribute exists in each person's directory record which uniquely identifies the person's supervisor. Assume, for example, that the person's directory record contains the manager's email ID within the attribute **manager_email**. No other manager information is present.

Table 8-8 Key Field for Manager ID

Solution	Supervisor	manager_email
	Key Field for Manager ID	email (the email attribute in the manager's directory record)

An alternative scenario may be that the directory record contains an attribute that is exactly the DN of the person's supervisor. Assume the name of this attribute is **manager**.

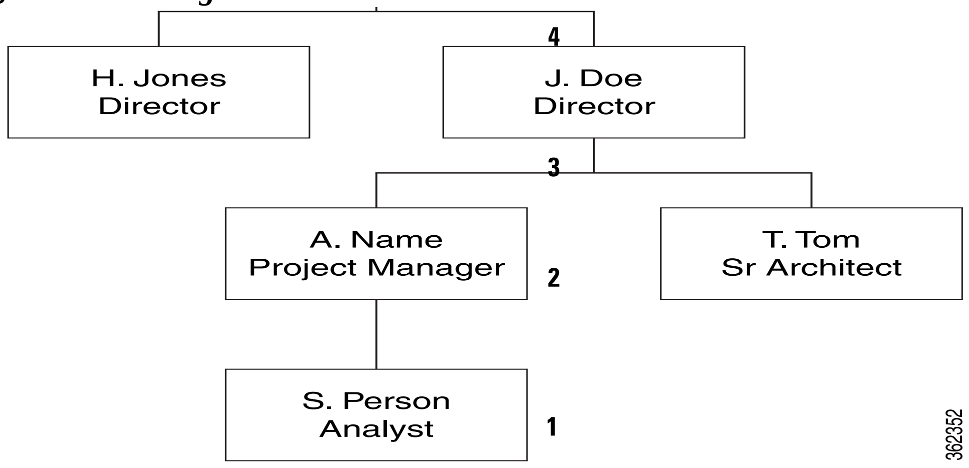
Table 8-9 Key Field for Manager ID

Solution	Supervisor	manager
	Key Field for Manager ID	dn (DN is a special attribute and is not prefixed before the search string)

Supervisory hierarchies may also need to be accommodated.

For example, consider this organizational chart:

Figure 8-4 ***Organizational Chart***



1	Level 1	**3**	Level 3
2	Level 2	**4**	Level 4

If requests were subject to an immediate supervisor's approval, a "relative" search is needed, going up the tree one level.

Alternatively, if certain requests were subject to, for example, a Director's approval, an "absolute" search is needed. People (managers) would be imported until the position of the current person was "Director". In the example above, in the case of S. Person, two additional people would be needed—her immediate manager, A. Name, and his manager, J. Doe, who is their Director. For T. Tom, only one import would be required.

If you are using an absolute search (import all managers with successively higher levels of authority until you find one with the specified position), you must assign numeric equivalents to the positions:

- Analyze the corporate hierarchy, assigning numeric equivalents to all management positions.
- Identify the attribute in the employee's directory entry that is to designate his/her management level. For example, perhaps an attribute named "paygrade" could be used.
- For all employees, ensure that the designated attribute is populated.
- In the mapping for the Management Level field (listed in the Optional Person Data Mappings) specify the attribute that holds this information.
- Enter the highest level of manager to be imported as the "Maximum Level" in the Import Manager settings.

You may configure a search terminator if you do not want to synchronize supervisors beyond a known value. You can specify multiple values in the format: #value1#, #value2# and so on.

For example, you may not want to import any supervisors who rank above a person with uid as "scarter." His Supervisor attribute is mapped to his email (scarter@email.com). In this case set the Search Terminator to #scarter@email.com#. The directory integration will stop supervisor synchronization as soon as a record is found with scarter@email.com as the supervisor.

Supervisor synchronization stops as soon as either limiting condition is met—Maximum Level or Search Terminator.

Table 8-10 Import Manager Operation

Setting	Value	Comments
Key Field for Manager ID		The directory attribute that uniquely identifies the employee's manager (supervisor).
Maximum Level		For absolute search this indicates the highest management level for a manager to be imported. For relative search this indicates the number of managers above the current employee that need to be imported.
Search Mode	• Absolute • Relative	
Search Terminator		The value or values that match the key field for managers that stop the search.
Refresh options	• Refresh Person Profile • Refresh Period (Hours)	Check the **Refresh Person Profile** check box to indicate that the manager's profile within Service Catalog is to be refreshed. If the Refresh Period is left blank, the profile is refreshed every time the Import Manager event takes place for the same person. If a number is provided, the manager's profile is refreshed only once within the specified period.
Associations	• Do Not Create Organizational Unit • Do Not Create Group	Identical to settings for Import Person.
Remove Existing Association	• Organizational Unit • Group • Role	Identical to settings for Import Person.

Custom Code Operations

Use a custom code operation to invoke routines not supported by the application. A custom code operation may replace or supplement Service Catalog operations.

Table 8-11 Custom Code Operations

Setting	Value	Comments
Custom Code Operation Type	• Single Sign-On • External Authentication • Import Person • Import Manager • Custom Code • Person Search	Use a Java class to provide the name of your mapping. For more details about the Java class see the Javadocs.

Configuring SSO With ADS

Create a file **jboss-web.xml** with the following contents in the directory **ServiceCatalogServer/RequestCenter.war/'WEB-INF'**.

Contents

```
<?xml version="1.0" encoding="UTF-8"?>
<jboss-web>
<security-domain>mySSO</security-domain>
</jboss-web>
```

Modify web.xml

Note You must add this after </context-param>, and before the filters.

```
<login-config>
<auth-method>EXTERNAL</auth-method>
</login-config>
```

Modify standalone-full.xml, add a security domain:

Note You must search for *security–domains* and add the following contents below it.

```
<security-domain name="mySSO" cache-type="default">
      <authentication>
                     <login-module code="Client" flag="optional">
                     </login-module>
      </authentication>
</security-domain>
```

Note For Cluster, you should create **jboss-web.xml** and should modify the **web.xml** in the directory **C:\Install_dir\dist\RequestCenter.war**, for more information see Cisco Prime Service Catalog 11.1.1, section *Applying Patch or Customizations to the WildFly Cluster Setup.*

- You must search with keyword *security-domains* in the **domain.xml** (wildfly-8.2.0.Final\domain\configuration) and add the following contents below it.

```
<security-domain name="mySSO" cache-type="default">
      <authentication>
                     <login-module code="Client" flag="optional">
                     </login-module>
      </authentication>
</security-domain>
```

Configuring Directory LDAP Integration

Configuring directory integration involves using the Directories options of the Administration module. The basic process is to:

- **Enable directory integration**. Click the **Directory Integration** on the Administration module's Settings tab to enable directory integration.
- **Configure datasource information**. Use the Datasources area of the Administration module's Directories tab to configure datasources that connect to directory servers. Information such as the datasource name, description, protocol, server product, and authentication method is required.
- **Configure mapping**. Use the Mappings area of the Administration module's Directories tab to map application data to the directory server data. Mappings update the entire user/person's profile along with all related entities: addresses, contacts, locations, one or more group associations, one or more organizational unit (OU) associations, and one or more role associations.
- **Configure events**. Use the Events area of the Administration module's Directories tab to configure directory integration behavior. The Login and Person Lookup events can be configured to include operations such as Single Sign-On (SSO), End User Authentication (EUA), Import Person, Import Manager, and Person Search.
- If required, **configure custom code interfaces** for client customizations, including directory java class attribute mapping, directory server API, and Import Person, with its related entities.

Enabling Directory Integration

To enable directory integration:

Step 1 Log in using an account with administrative privileges and choose the **Administration** module.

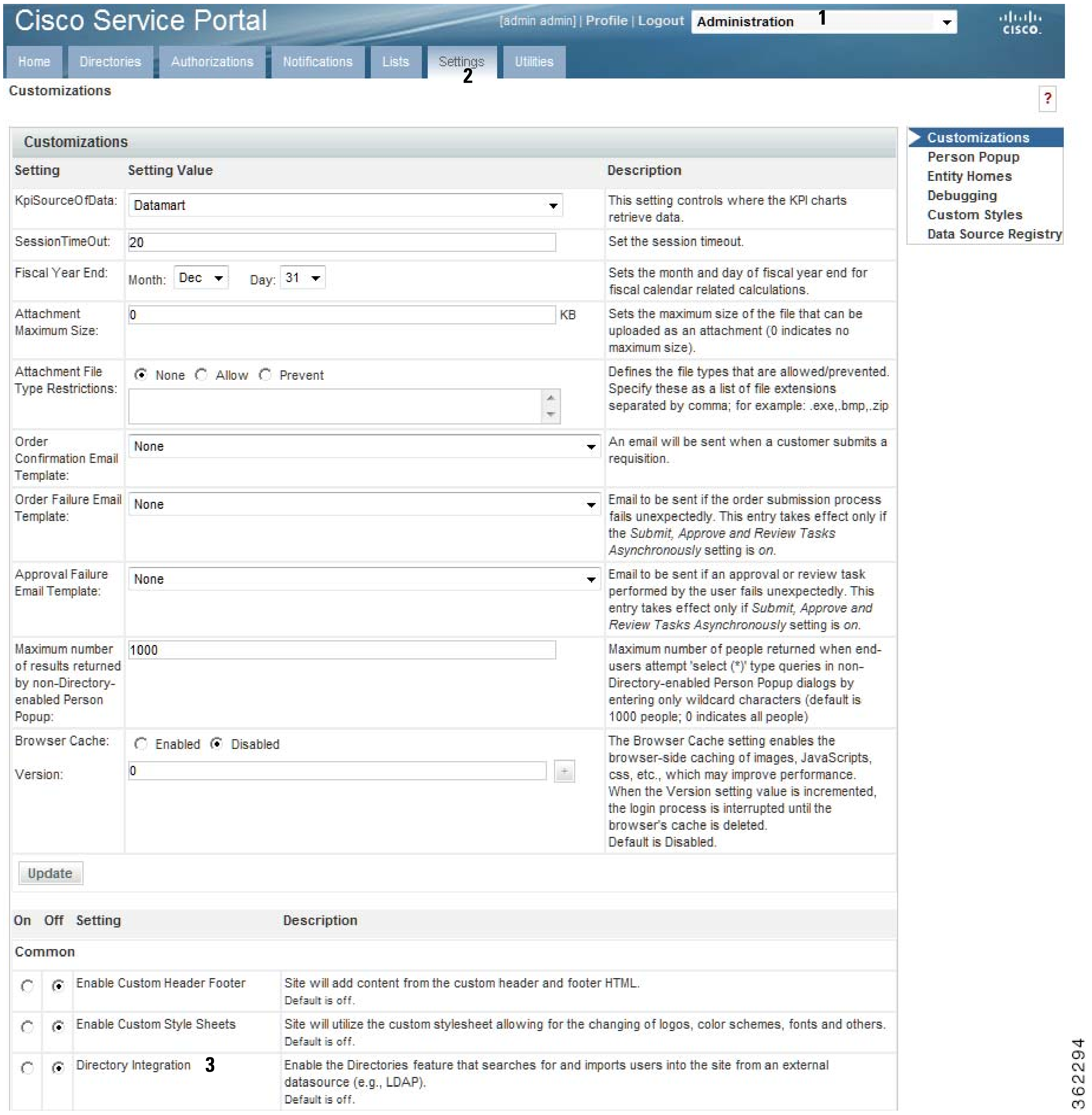
Step 2 Click the **Settings** tab.

Step 3 Next to Directory Integration, click **On**.

Step 4 On the bottom of the Customizations screen, click **Update**.

You have now enabled directory integration. (See Enabling Directory Integration.)

Figure 8-5 Enabling Directory Integration



Customizations

Setting	Setting Value	Description
KpiSourceOfData:	Datamart	This setting controls where the KPI charts retrieve data.
SessionTimeOut:	20	Set the session timeout.
Fiscal Year End:	Month: Dec Day: 31	Sets the month and day of fiscal year end for fiscal calendar related calculations.
Attachment Maximum Size:	0 KB	Sets the maximum size of the file that can be uploaded as an attachment (0 indicates no maximum size).
Attachment File Type Restrictions:	[✓ None] Allow Prevent	Defines the file types that are allowed/prevented. Specify these as a list of file extensions separated by comma; for example: .exe,.bmp,.zip
Order Confirmation Email Template:	None	An email will be sent when a customer submits a requisition.
Order Failure Email Template:	None	Email to be sent if the order submission process fails unexpectedly. This entry takes effect only if the *Submit, Approve and Review Tasks Asynchronously* setting is *on*.
Approval Failure Email Template:	None	Email to be sent if an approval or review task performed by the user fails unexpectedly. This entry takes effect only if *Submit, Approve and Review Tasks Asynchronously* setting is *on*.
Maximum number of results returned by non-Directory-enabled Person Popup:	1000	Maximum number of people returned when end-users attempt 'select (*)' type queries in non-Directory-enabled Person Popup dialogs by entering only wildcard characters (default is 1000 people; 0 indicates all people)
Browser Cache: Version:	Enabled [✓ Disabled] 0	The Browser Cache setting enables the browser-side caching of images, JavaScripts, css, etc., which may improve performance. When the Version setting value is incremented, the login process is interrupted until the browser's cache is deleted. Default is Disabled.

Update

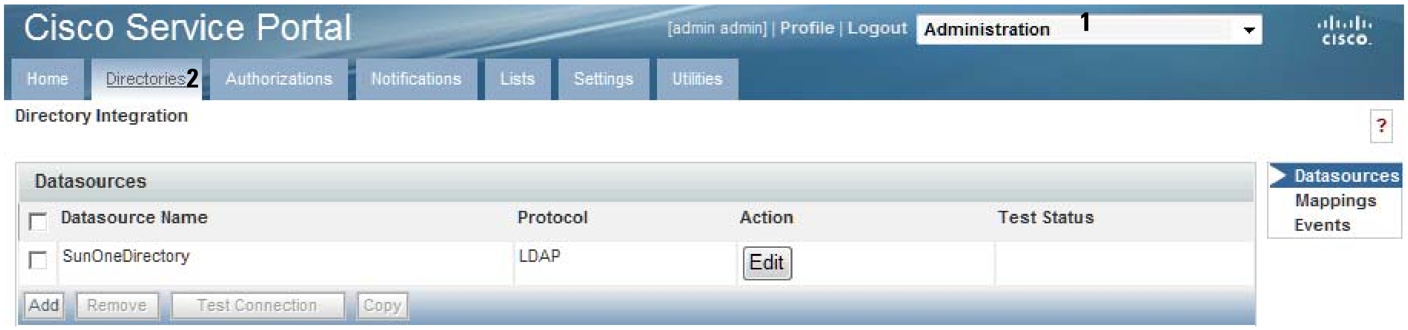
On	Off	Setting	Description
Common			
	✓	Enable Custom Header Footer	Site will add content from the custom header and footer HTML. Default is off.
	✓	Enable Custom Style Sheets	Site will utilize the custom stylesheet allowing for the changing of logos, color schemes, fonts and others. Default is off.
	✓	Directory Integration	Enable the Directories feature that searches for and imports users into the site from an external datasource (e.g., LDAP). Default is off.

1	Administration module	3	Directory Integration setting
2	Settings tab		

Configuring Directory Integration Settings

You use the Directories tab of the Administration module to configure many of the directory integration settings.

Figure 8-6 The Directory Integration Area



Datasources

Datasource Name	Protocol	Action	Test Status
SunOneDirectory	LDAP	Edit	

1	Administration module
2	Directories tab

To configure directory integration settings:

Step 1 Log in using an account with administrative privileges.

Step 2 From the drop-down menu, choose **Administration**.

Step 3 Click the **Directories** tab.

The Directory Integration page appears. These settings will be in effect once directory integration has been enabled.

Configuring Datasource Information

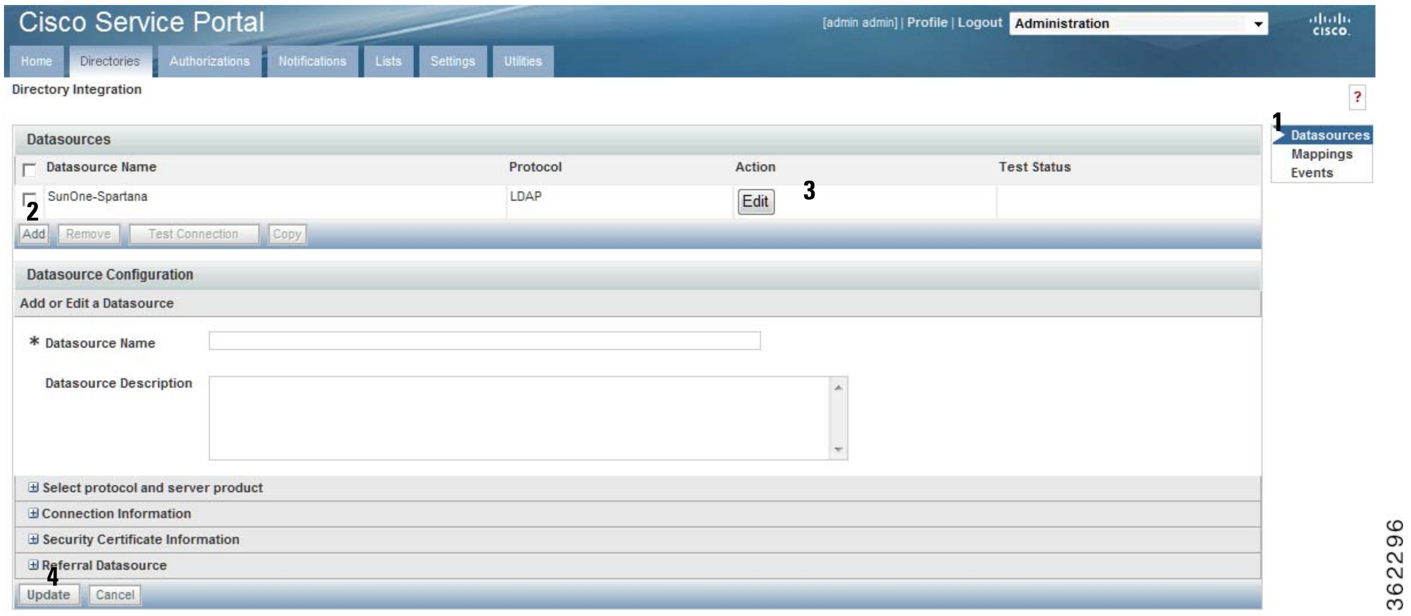
The following sections guide you through configuring datasource specific information. The tasks include:

- **Adding or editing a datasource** – You need to add a datasource to a new installation that does not yet have any datasources. If datasources exist, you may edit them.
- **Adding a server certificate for SSL connections** – You only need to do this if you choose SSL as the connection mechanism.
- **Adding referral datasources** – Only if desired.
- **Testing the connection** – You should always test the connection to prove connectivity.

Adding or Editing a Datasource

At least one datasource must be defined. To add a new datasource:

Figure 8-7 Adding or Editing a Datasource



1	Datasources option	3	Edit Datasource button
2	Add Datasource button	4	Update button

Step 1 Navigate to the Directory Integration page by choosing the **Administration** module and then clicking the **Directories** tab.

Step 2 In the page navigator, click the **Datasources** option, if not already selected.

Step 3 Click **Add**. To edit an existing datasource instead of adding a new datasource, click **Edit** next to the desired datasource in the list.

The Datasource Configuration area expands.

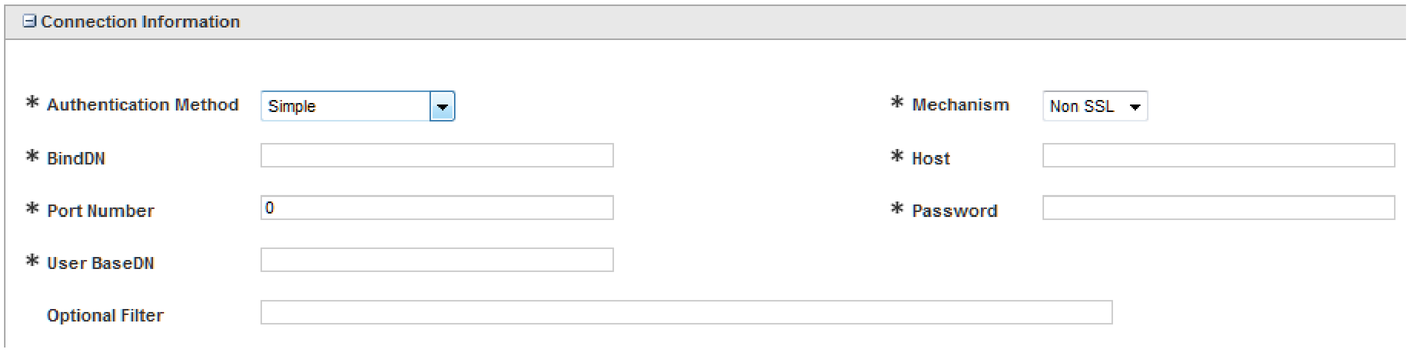
Step 4 Enter the Datasource Name, Datasource Description, and the desired settings. Click ⊞ to access all of the settings in the adjacent area. See the Datasource Worksheet for more information about these settings, or see the following sections.

Step 5 Click **Update**.

Configuring Connection Information

Specify the connection protocol and user credentials used to connect to the datasource.

Figure 8-8 ***Configuring Connection Information***



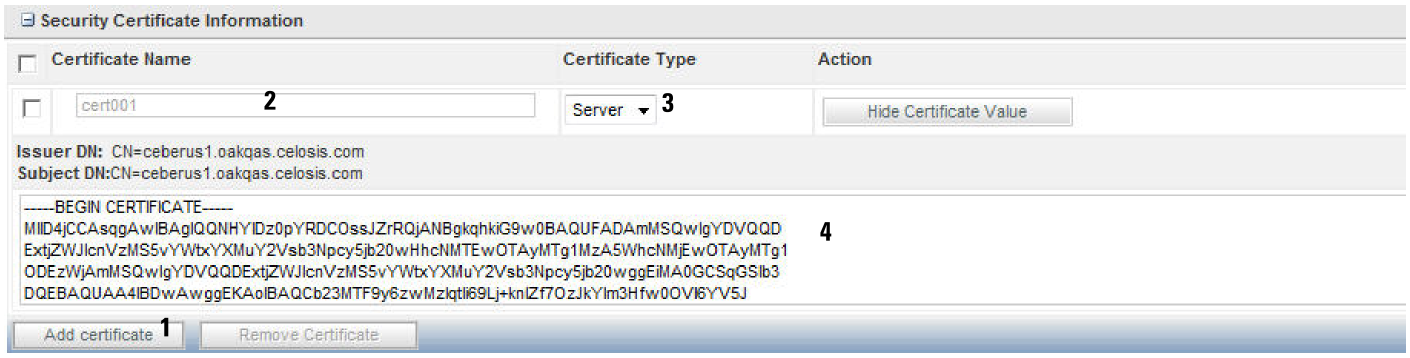
Connection Information

* Authentication Method	Simple	* Mechanism	Non SSL
* BindDN		* Host	
* Port Number	0	* Password	
* User BaseDN			
Optional Filter			

Configuring Certificates

If you chose SSL as the connection mechanism, you need to specify the certificates for the directory integration system.

Figure 8-9 ***Configuring Security Certificates***



Security Certificate Information

Certificate Name	Certificate Type	Action
cert001	Server	Hide Certificate Value

Issuer DN: CN=ceberus1.oakqas.celosis.com
Subject DN:CN=ceberus1.oakqas.celosis.com

```
-----BEGIN CERTIFICATE-----
MIID4jCCAsqgAwIBAgIQQNHYIDz0pYRDCOssJZrRQjANBgkqhkiG9w0BAQUFADAmMSQwIgYDVQQD
ExtjZWJlcnVzMS5vYWtxYXMuY2Vsb3Npcy5jb20wHhcNMTEwOTAyMTg1MzA5WhcNMjEwOTAyMTg1
ODEzWjAmMSQwIgYDVQQDExtjZWJlcnVzMS5vYWtxYXMuY2Vsb3Npcy5jb20wggEiMA0GCSqGSIb3
DQEBAQUAA4IBDwAwggEKAoIBAQCb23MTF9y6zwMzlqtli69Lj+knIZf7OzJkYIm3Hfw0OVl6YV5J
```

1	Add certificate button	**3**	Certificate Type drop-down menu
2	Certificate Name field	**4**	Certificate Value field

To configure certificates:

Step 1 Navigate to the Directory Integration page by choosing the **Administration** module and then clicking the **Directories** tab.

Step 2 In the page navigator, click the **Datasources** option, if not already selected.

Step 3 Next to the datasource to which you wish to add a certificate, click **Edit**.

Step 4 Click **Add Certificate**.

Step 5 Name the certificate. Do not use spaces or special characters in the certificate alias name.

Step 6 From the Certificate Type drop-down menu, choose the certificate type.

Step 7 Paste the certificate value (obtained from a vendor like VeriSign) into the certificate field.

Step 8 Click **Update**.

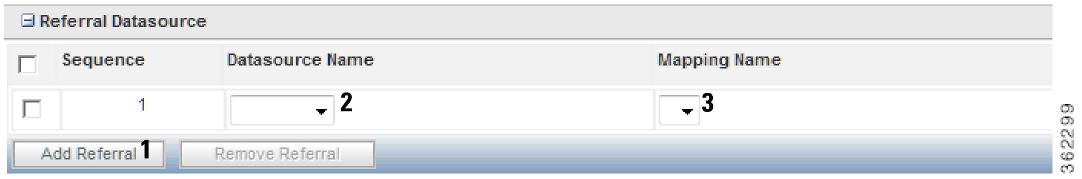
Configuring Referral Datasources

If you have multiple datasources configured, you can designate datasources as referral systems to a selected datasource. This way, whenever the system performs a search against the selected datasources, it will also search all referral datasources.

The referral datasources are searched in the order in which they are specified until a match is found. A match is said to be found when the search criteria returns one or more records.

Referral datasources are typically used when directory information is divided among multiple directories. For example, different company divisions may each maintain their own directory.

Figure 8-10 Configuring Referral Datasources



1	Add Referral button	**3**	Mapping Name drop-down menu
2	Datasource Name drop-down menu		

To configure referral datasources:

Step 1 Navigate to the Directory Integration page of the Administration module.

Step 2 In the page navigator, click the **Datasources** option, if not already selected.

Step 3 Next to the datasource for which to configure a referral datasource, click **Edit**.

Step 4 Click **Add Referral**.

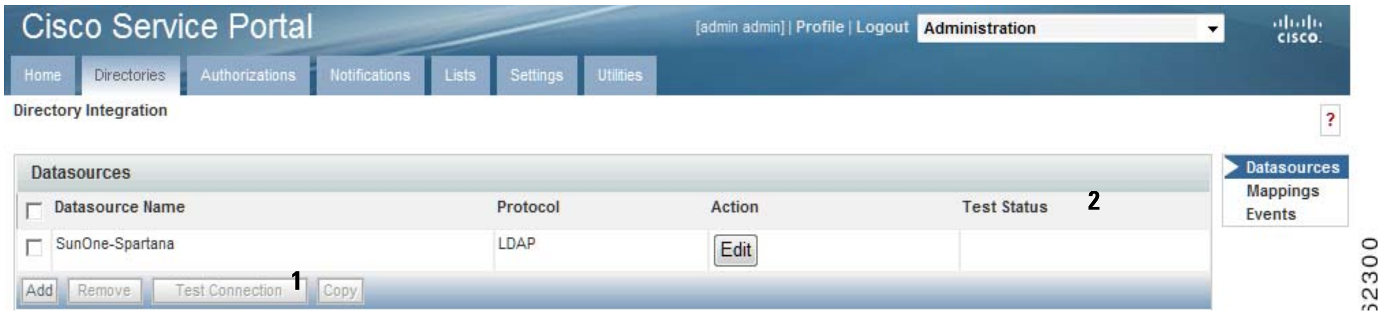
Step 5 The Referral Datasource area appears. From the Datasource Name drop-down menu choose a datasource name, and then from the Mapping Name drop-down menu choose a mapping name.

Step 6 Click **Update**.

Testing the Connection

If you have completed all the necessary configuration steps, then you are ready to test the directory integration connection.

Figure 8-11 Testing the Connection



1	Test Connection button	**2**	Test Status column

To test the connection:

Step 1 Navigate to the Directory Integration page in the Administration module.

Step 2 In the page navigator, click the **Datasources** option, if not already selected.

Step 3 Choose the datasource to test by checking the check box to the left of the datasource name.

Step 4 Click **Test Connection**.

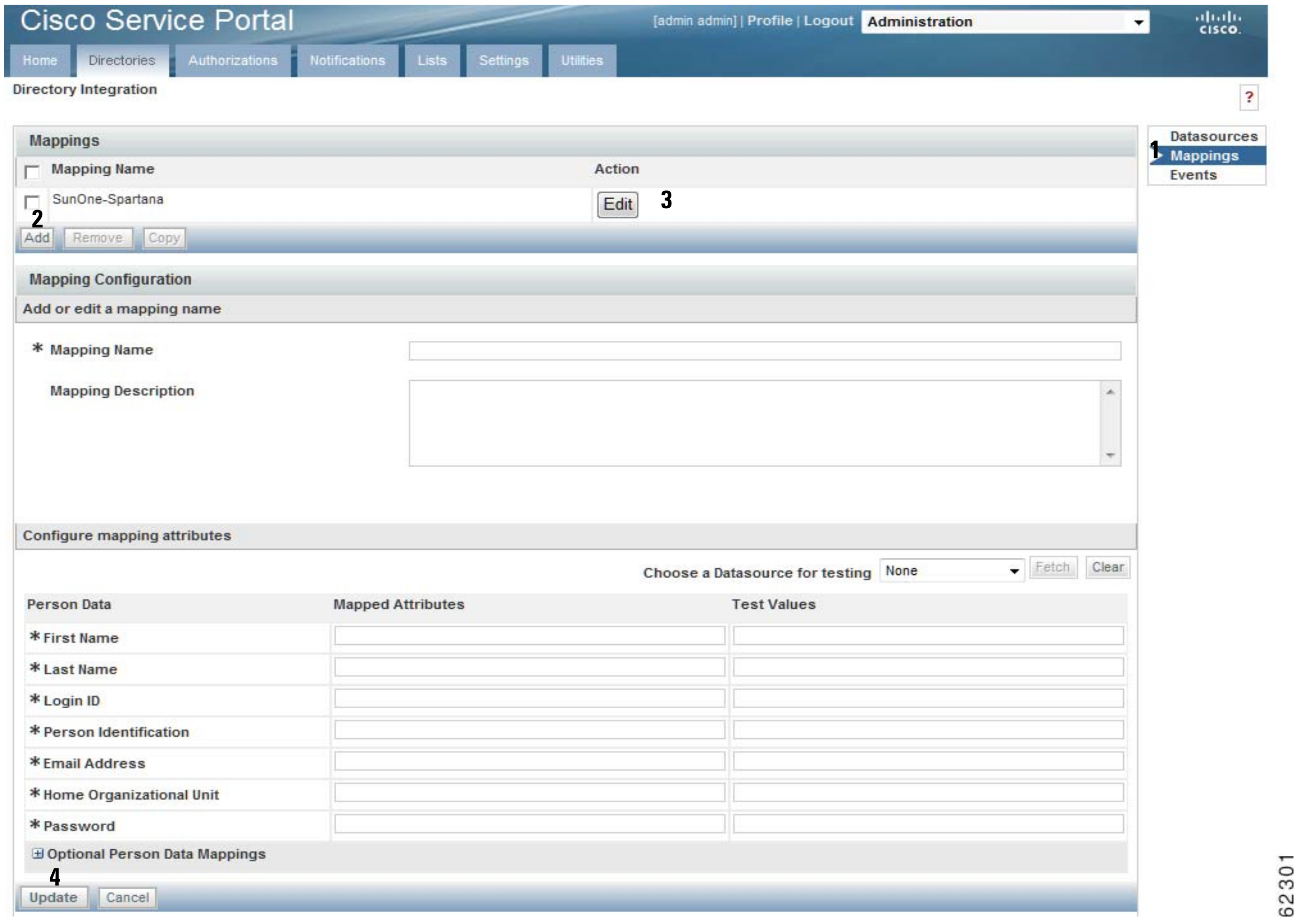
The Test Status column displays OK if the connection is successful, and ⚠ if it is unsuccessful.

Configuring Mappings

You use the Mappings area of the Administration module’s Directories tab to map Service Catalog data to directory server data.

To configure mapping, see Configuring Mapping and follow the procedure below.

Figure 8-12 Configuring Mapping



Mappings

	Mapping Name	Action
☐	SunOne-Spartana	Edit

Mapping Configuration

Add or edit a mapping name

* Mapping Name

Mapping Description

Configure mapping attributes

Choose a Datasource for testing: None

Person Data	Mapped Attributes	Test Values
*First Name		
*Last Name		
*Login ID		
*Person Identification		
*Email Address		
*Home Organizational Unit		
*Password		

⊞ Optional Person Data Mappings

1	Mappings options	3	Edit Mapping button
2	Add Mapping button	4	Update button

Step 1 Navigate to the Directory Integration page of the Administration module.

Step 2 In the page navigator, click the **Mappings** option.

Step 3 Click **Add** to add a new mapping, or click **Edit** next to the desired mapping in the list to edit an existing mapping.

The Mapping Configuration area expands.

Step 4 Configure the mapping name, description, and attributes, based on the requirements documented in the Mapping Worksheet. The mappings prefixed with an asterisk (*), shown in the Person Data section, are mandatory. You may also configure optional mappings by clicking the ⊞ button, to expand the Optional Person Data Mappings section.

Step 5 Click **Update**.

The mapping fields accept simple, composite, expression, and Java mapping types, as described below.

Mapping Types

This section describes accepted mapping types, illustrates a valid sample mapping, and explains with examples expression mapping. The following table describes the supported mapping types.

Table 8-12 Mapping Types

Mapping Type	Description
Simple	One directory attribute maps to the field. This is simple one-to-one mapping. For example: Person Field: First Name Directory Attribute: givenName
Composite	A combination of attributes maps to the field. # delimits each attribute name. The mapping may include literals. For example: Person Field: Email Directory Attributes: #givenName#_#sn#@#domain#.com
Expression	An expression uses regular expressions and pattern matching to derive the mapping. For more details see the Expression Mapping.
Java Class	Use Java mapping when simple, composite, or expression mapping does not offer the desired functionality. This involves writing a Java class and placing the compiled class file on the appropriate directory on the application server. For more details see the Java Class Mapping.

Simple and Composite Mappings

The following table illustrates sample simple and composite mappings for the mandatory fields.

Table 8-13 Sample Mapping

Person Data	Directory Value
First Name	givenName
Last Name	sn
Login ID	uid
Person Identification	uid
Email Address	#givenName#_#sn#@#company#.com
Home Organizational Unit	Ou
Password	Uid

Expression Mapping

Expression mapping allows you to conditionally assign a value to an attribute, based on which pattern (regular expression) the expression matches. The system expression mapping uses the Perl5 Regular Expression Language, to specify patterns to be matched, combined with syntax similar to that of the Java conditional operator. Syntax:

```
expr:<expression>=(<patternlist>)?(<valuelist>):<default>
```

where

expr	is a prefix to indicate that expression mapping is used.
<expression>	is the expression to match against.
<patternlist>	is a set of patterns, separated by a pipe (|).
<valuelist>	is a set of values, separated by a pipe (|), corresponding to the set of patterns. Each value designates the return value if the expression matches the corresponding pattern.
<default>	is the return value to use if no pattern in the <patternlist> matches the <expression>.

For example:

```
expr:<expression>=
(<pattern1>|<pattern2>…<patternn>)?(<value1> | <value2>  <valuen>):<default>
```

If <expression> matches <pattern1>, then return <value1>.

If <expression> matches <pattern2>, then return <value2>.

If <expression> does not match any pattern, then return <default>.

Each element (expression, pattern, or value) can contain a directory attribute name, delimited by the # symbol. For example, a pattern can be specified as “#givenName#_#sn#”, where both #givenName# and #sn# are attribute names:

In addition, parentheses can be used to group a series of pattern elements to a single element. When you match a pattern within parentheses, you can use back-references, in the form of $1, $2, and so on, to refer to the previously matched pattern.

Examples of Expression Data Mapping

A simple use of an expression applied to directory integration may be to translate one or more coded values in the directory to more user friendly descriptions or broader categories. For example, some services may need to differentiate between employees and contractors. The costCenter attribute is known to be “000000” for contractors. Therefore, the following expression could be applied to the “Employee Type” field:

```
expr:#costCenter#=(000000)?(Contractor):Employee
```

Another suse of an expression is to supply a default value for a field when the source attribute is blank. This may frequently be a “stop gap” measure, until directory data can be standardized. Or it could be standard; for example, if outside contractors are not assigned a department. The following expression could be applied to the “Home OU” field (a mandatory field for the mapping):

```
expr:#DeptLevel2#=(.+)?(#DeptLevel2#):Contractors
```

This expression uses the DeptLevel2 attribute if available, or defaults to the “Unknown” Business Unit for the user’s Home OU.

Similarly, the expression can be used to translate from a set of input values to a different set of return values. This is the equivalent of a case statement, or nested if/then construct. For example, the following expression could be applied to the “Locale ID” field, to assign a language for the user, based on his/her location:

```
expr:#country#=(United States | Germany)?(en_US | de_DE):en_US
```

If the user’s country is the United States, set the language to American English; if it is Germany, set the language to German. For any other country, set the language to American English.

Regular expressions can check the length of a source attribute and whether it is composed of alphabetic or numeric characters. For example, sometimes zip codes are stored as numeric data types, truncating leading zeroes. To restore a leading zero, an expression such as the following could be applied to the "Company Postal Code" field:

```
expr:#postalCode#=(^[1-9][0-9][0-9][0-9]$)?(0#postalCode#):#postalCode#
```

If the postalCode attribute consists of precisely four digits, add a leading zero to the value of the attribute. This converts zip code **1701** to **01701**, and leaves any source values which do not match the specified pattern unchanged.

A similar use of regular expressions might check that the format of an attribute value matches an expected pattern. Consider a use case in which a valid manager's user ID needs to consist of two letters followed by a series of numbers. Valid IDs would be, for example, fd1024 and ID3839. The following expression could be used:

```
expr:#manager#=(cn=([a-zA-Z][a-zA-Z][0-9]+),.*)?($1):None
```

Attributes can be used in the expression, pattern, or return value:

```
expr:#sn#, #givenname#=(Smith.*|Doe, John)?(All Smiths|Only John):Others

expr:#sn#, #givenname#=(Smith.*|Doe, John)?(#givenname#|Only John):Others
```

The last name and first name from directory records are combined into a string such as "Doe, Jane" before any attempt is made to match the patterns.

Embedded parentheses and back-references are useful for extracting a portion of the pattern. For example, the organization to which a person belongs is frequently embedded within a distinguished name (dn) attribute:

```
dn: cn=plee,ou=Corporate,dc=InfoSys,dc=com
```

The expression mapped to the "Home Organizational Unit" field might have the format:

```
expr:#dn#=((cn=[^,]+,ou=([a-zA-Z]+),dc=InfoSys,dc=com)?($1):Default
```

The returned value, "Corporate" is a back-reference value $1, which equals the pattern matched by the expression within the first set of parentheses, ([a-zA-Z]+).

Usage of back-referenced variables may be required to parse overloaded attributes which include the values for more than one field. For example, an attribute can include the business address of a person, including the building name, floor (level), and office.

```
location=Corporate Headquarters-Fifth Floor-Office #5F
```

The same pattern could be used to match the three elements in the expression, by using different back-referenced variables as the value:

Office Building	expr:#Location#=(([^-])+-([^-])+-(.*))?($1): Unknown
Building Level	expr:#Location#=(([^-])+-([^-])+-(.*))?($2): Unknown
Cubic Location	expr:#Location#=(([^-])+-([^-])+-(.*))?($3): Unknown

Java Class Mapping

You will need to be familiar with Java programming and have a Java development environment set up in order to implement a custom Java class to map directory data to fields.

Any custom mapping class must follow the guidelines given in "Using Custom Code in Directory Integration" section on page 8-36. The mapping class must implement an IEUIAttributeMapping interface.

The developer must follow the guidelines below to test and install the custom code module.

1. Install a Java IDE of choice, and set up a project for developing custom mapping code.
2. Edit the custom code file to fulfill your requirements.
3. Compile.
4. The custom Java class must be installed on the Service Catalog web archive (war), to be accessible to the Service Catalog service. Create a directory in RequestCenter.war/WEB-INF/classes to correspond to the package. Such directories are typically named:

   com/newscale/client/<clientname>, for example, com/newscale/client/aib.
5. Copy the CustomMapping.class file to the directory created in the previous step.
6. Restart the Service Catalog service.
7. Specify the fully qualified name of the class file as the Mapped Attribute for the field to be populated.
8. Test the custom code by using the Directories Test feature.
9. Save your source in an appropriate repository.

Testing Mappings

You can use the Mapping Test feature to test that your data mapping settings are configured correctly and pulling the correct values from the directory server.

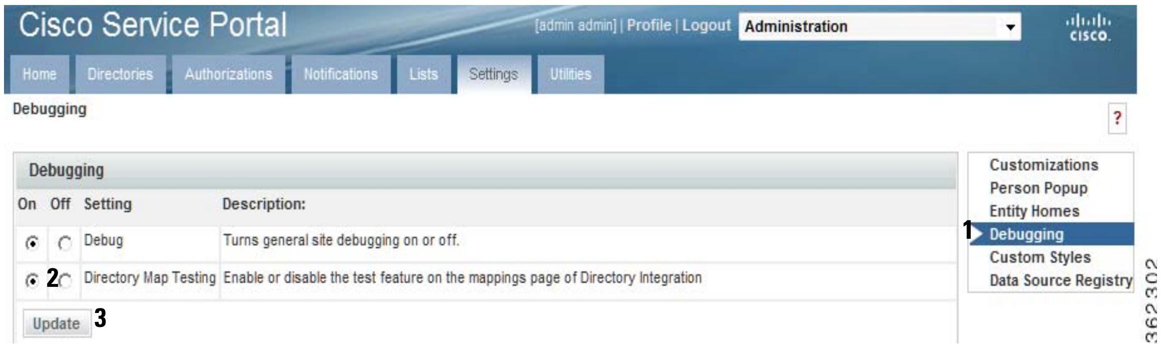
Using the Data Mapping Test feature involves:

- Enabling the Data Mapping Test Feature
- Using the Data Mapping Test Controls

Enabling the Directory Map Testing Feature

To enable the directory map testing feature, see Enabling Mapping Testing and follow the procedure below.

Figure 8-13 Enabling Mapping Testing



Debugging

On	Off	Setting	Description:
●	○	Debug	Turns general site debugging on or off.
●	○	Directory Map Testing	Enable or disable the test feature on the mappings page of Directory Integration

1	Debugging option	**3**	Update button
2	Directory Map Testing setting		

Step 1 Click the **Settings** tab of the Administration module to display the Settings page.

Step 2 In the page navigator, click the **Debugging** option.

The Debug Settings page appears.

Step 3 Next to the Directory Map Testing setting, click **On**.

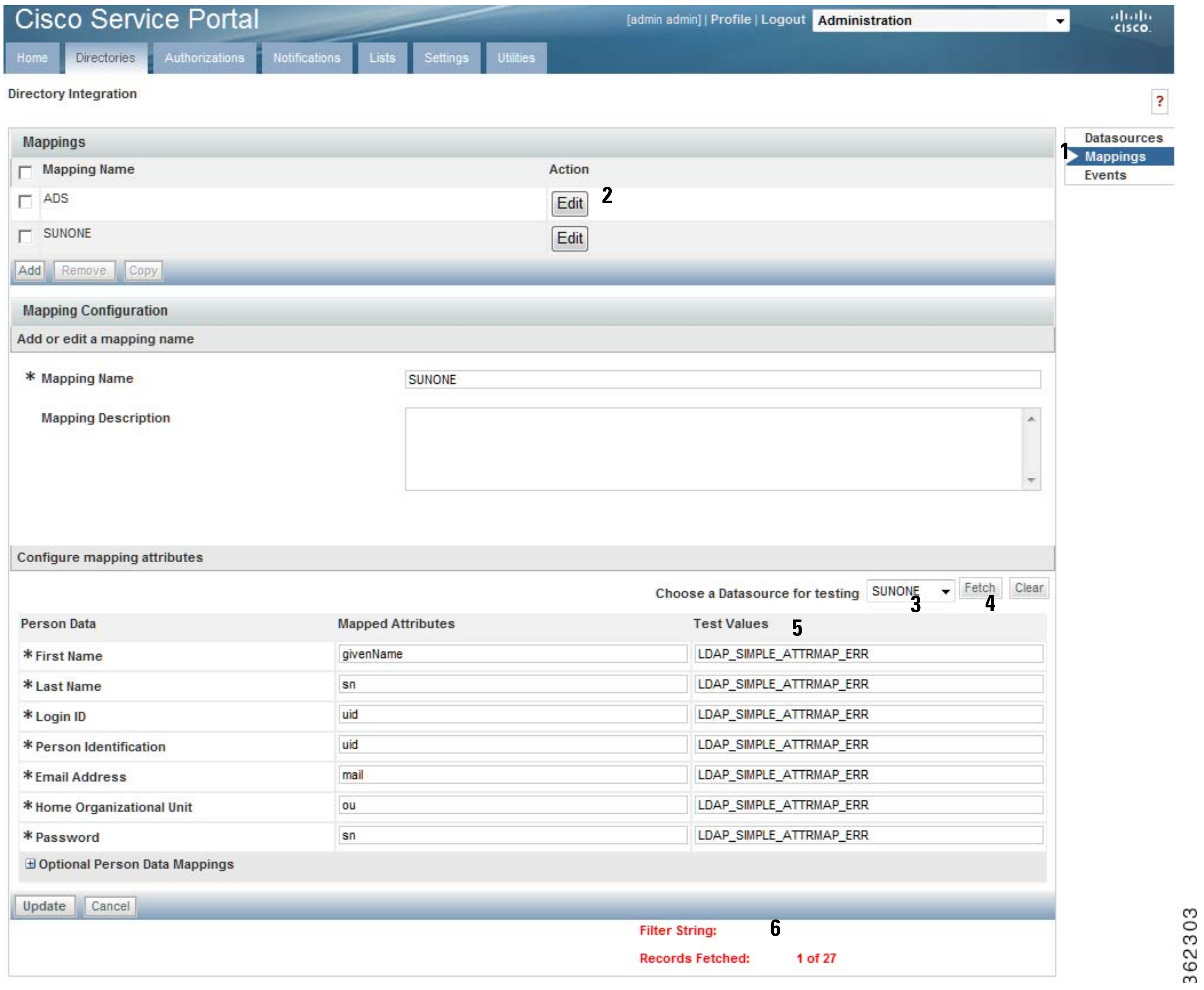
Step 4 Click **Update**.

The system enables the Data Mapping Test feature. Now when you access the Data Mapping tab, the following additional features appear as shown in Mapping Test Controls:

- The Choose a Datasource for Testing drop-down menu
- Fetch
- Clear
- Test Values

Using the Data Mapping Test Controls

Figure 8-14 Mapping Test Controls



Mappings

Mapping Name	Action
ADS	Edit
SUNONE	Edit

Mapping Configuration

Add or edit a mapping name

* Mapping Name: SUNONE

Mapping Description:

Configure mapping attributes

Choose a Datasource for testing: SUNONE

Person Data	Mapped Attributes	Test Values
*First Name	givenName	LDAP_SIMPLE_ATTRMAP_ERR
*Last Name	sn	LDAP_SIMPLE_ATTRMAP_ERR
*Login ID	uid	LDAP_SIMPLE_ATTRMAP_ERR
*Person Identification	uid	LDAP_SIMPLE_ATTRMAP_ERR
*Email Address	mail	LDAP_SIMPLE_ATTRMAP_ERR
*Home Organizational Unit	ou	LDAP_SIMPLE_ATTRMAP_ERR
*Password	sn	LDAP_SIMPLE_ATTRMAP_ERR

Filter String:

Records Fetched: 1 of 27

1	Mappings option	**4**	Fetch button
2	Edit button	**5**	Test Values column
3	Choose a Datasource for testing drop-down menu	**6**	Test summary area

To use the Data Mapping test controls:

Step 1 Click **Mappings**, if you are not already on the Mapping page.

Step 2 Next to the mapping you wish to test, click **Edit**.

Step 3 From the “Choose a Datasource for testing” drop-down menu, choose the desired datasource.

Step 4 In the Test Values column, enter test values. You can use simple, composite, Java, or expression mapping.

Step 5 Click **Fetch**.

Step 6 The test values appear in the Test Values column and a summary of the results appears at the bottom of the page.

Note Fetch returns values from only one datasource and does not search referrals. This is for convenience because it becomes difficult to debug with referrals search integrated.

Step 7 To the right of the Fetch button, click **Clear** and retry new values until you have configured the desired mappings.

Configuring Directory Integration Events

You use the Events area of the Administration module's Directories tab to configure directory integration behavior for the following events:

- Login
- Person Lookup for Order on Behalf
- Person Lookup for Service Form
- Person Lookup for Authorization Delegate

To configure events, see Configuring Events and follow the procedure below.

Step 1 Navigate to the Directory Integration page of the Administration module.

Step 2 In the Page Navigator, click **Events** to display the Events page.

Step 3 Next to the type of event to configure, click **Edit**.

The Event Configuration area appears.

Step 4 From the Event Status drop-down menu, choose **Enabled** to enable the event.

Step 5 Click **Add step** to add a step for the system to initiate when the selected event occurs.

Step 6 Choose an operation associated with the step you just added.

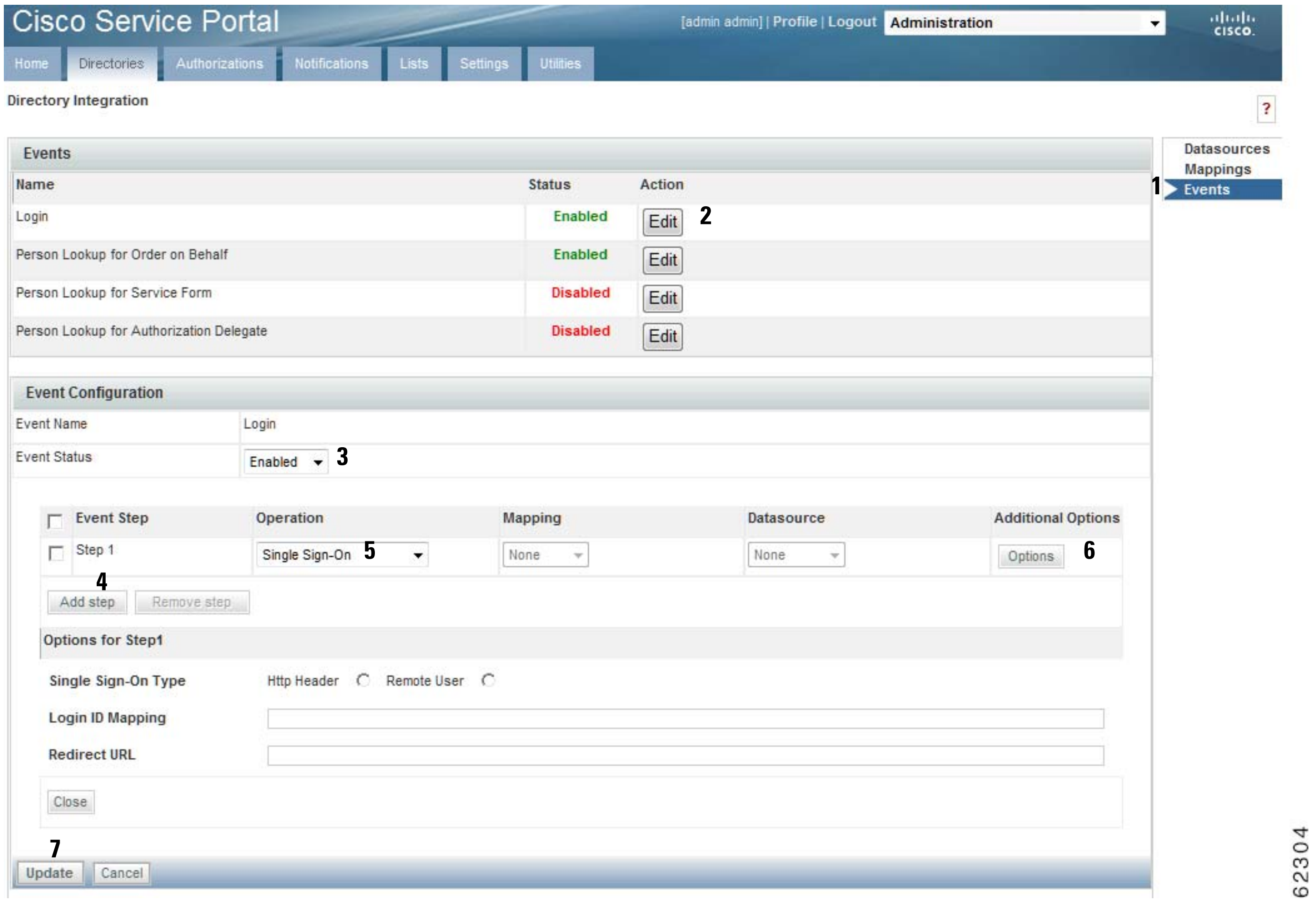
- All operations are available in this menu even though some operations, such as SSO and EUA, are not applicable for all event types.

Step 7 Click **Options** to configure the options associated with the operation you just chose. The Options area appears. The Options area will differ according to which operation is chosen. Details on the available operations and their options are given in the next section.

Step 8 Configure the associated options. See the relevant sections in this chapter on directory Events for a description of the operations available and options for configuring them.

Step 9 Click **Update** and repeat these steps for each step and operation you wish to add.

Figure 8-15 Configuring Events



Events

Name	Status	Action
Login	Enabled	Edit
Person Lookup for Order on Behalf	Enabled	Edit
Person Lookup for Service Form	Disabled	Edit
Person Lookup for Authorization Delegate	Disabled	Edit

Event Configuration

Event Name: Login

Event Status: Enabled

Event Step	Operation	Mapping	Datasource	Additional Options
Step 1	Single Sign-On	None	None	Options

Add step Remove step

Options for Step1

Single Sign-On Type: Http Header ○ Remote User ○

Login ID Mapping

Redirect URL

Close

1	Events option	5	Operation drop-down menu
2	Edit	6	Options
3	Event Status drop-down menu	7	Update
4	Add step		

Using Custom Code in Directory Integration

The directory integration framework is designed for flexibility and customization of the “Login” and “Person Lookup” events.

Standard operations for all events are available on the Administration module’s Directories tab. These include: SSO, External User Authentication, Import Person, Import Manager, and Person Search.

In cases where these standard operations do not fully satisfy a business scenario, the Directories tab also provides interfaces to execute custom Java code. This custom code should adhere to the interfaces described in this chapter, and you should develop any customized solutions using Service Catalog exposed APIs.

The following are valid use cases for scenarios in which you may wish to customize an event operation:

Table 8-14 UseCases

If…	**Then…**
The format of SSO headers input through the HttpServletRequest cannot be parsed …	Provide a custom code SSO operation to retrieve user credentials, in order to support the SSO integration with your vendor.
You wish to authenticate a user via a web service or database other than Service Catalog…	Provide a custom code External Authentication operation.
The main user repository in your company is a database other than an LDAP directory…	Provide custom code External Authentication and custom code Import Person operations.

The directory integration custom code framework also defines interfaces that can be implemented to provide complex retrieval logic for a specific field in the person/user profile from a record in an external datasource.

Public APIs and interfaces for directory integration include the:

- **Custom Code Operation Interfaces**, which are used to customize directory integration operations.
- **Custom Java Class Mapping Interface**, which is used to provide customized retrieval of a specific attribute in an external datasource from its record.
- **Directory Server API**, used to query/authenticate against an external datasource and retrieve records.
- **Import/Refresh Person API**, used to update person attributes in the Service Catalog database.

A typical custom code project will involve following types of activities:

- Identify the need for custom code.
- Configure the Directories tab in the Administration module to include the Datasource to be used by your custom code and, if relevant, the Mappings which your custom code will use.
- Develop the custom code. You will need to understand the public APIs and interfaces provided by Cisco for directory integration tasks.
- Build and deploy the custom code.
- Configure the Directories tab in the Administration module to use your custom code.

Directory Integration Operations below summarizes the directory integration operations in more detail.

Table 8-15 Directory Integration Operations

Operation	Purpose	Input	Output
Single Sign-On	Identifies the login name of the user	HttpServletRequest	Login Name
External Authentication	Authenticates a user against an external datasource	Login Name Password	Authenticity of User
Person Search	Retrieves the list of persons matching first name or last name	First Name and Last Name	List of Persons
Import Person	Imports a person into the Service Catalog database from an external datasource.	Login Name	Imported person information, including the managerID
Import Manager	Imports a manager or chain of managers into the Service Catalog database from an external datasource	Imported person information including manager information	Managers are imported into the system

Mixing and matching, or replacing, standard operations with custom code operations is also supported by the directory integration framework. Service Catalog supports various combinations of operations per event, as described in the table below, using your own customized code and Service Catalog public APIs, designed to help implement these interfaces.

It is important that custom code design and development engineers understand the directory integration framework, public APIs, and custom code interfaces, which are discussed in detail in this chapter.

Table 8-16 below portrays the relationship between methods, events, and operation types for custom code operations. Combinations not listed in Table 8-16 below are not supported.

Table 8-16 Custom Code Operations

Event	Operation Type	Interface	Method
Login	SSO	ISignOn	getCredentials
	EUA	ISignOn	authenticate
	Import Person	ISignOn	importPerson
	Import Manager	ISignOn	importManager
	Custom Code	ISignOn	performCustom
Person Search for: • Order On Behalf • Authorization Delegate • Service Form	Person Search	IPersonSearch	getCredentials
	Import Person	IPersonSearch	importPerson
	Import Manager	IPersonSearch	importManager
	Custom Code	IPersonSearch	performCustom

Custom Code Operation Interfaces

If you are providing a custom implementation of an operation configured within an event, you will need to implement a "custom code operation interface".

Custom code operation interfaces define callback methods that are invoked when a particular operation is triggered. Exactly which method is invoked depends on the operation type chosen in the operation. For more details see the Method, Event, and Operation Type for Custom code Operations table. All methods defined in the custom code operation interfaces follow the same pattern:

Parameters

In the following list, "**" must be replaced by the operation type, which is one of:

- IEUISignon
- IEUIPersonSearch

1. **OperationDTO: This object contains the information on how you have set the operation on the Directories tab of the Administration module. It includes mapping and datasource information.
2. **OperationContext: The Context object is used to share information across method invocations. The directory Integration framework makes information stored in one context object available to other context objects during the same HttpServletRequest invocation.
   a. Use setLocalContextObject and getLocalContextObject to set any custom information that does not fall as a part of results.
   b. Use get**Result to get a result object. Result objects contain all the information about what happened throughout the event request. Results contain information that is supported in a productized import. The LocalContext object is used to store objects that were unforeseen during the implementation of productized operations.
3. Request: This is the HttpServletRequest.
4. **ImportAPI: This object is used to import a person. More details can be found in the Javadocs.
5. **LDAPAPI: This API is used to make LDAP queries. More details can be found in the Javadocs.

Return

**Result. After performing the custom task the API must return a valid return type with results populated. Return the same result object retrieved from OperationContext after updating relevant properties. There may be unexpected behavior if a new instance of the result object is returned.

Table 8-17 below maps the expected input/return to the objects in the parameters of each of these callback methods:

Table 8-17 Input for Custom Code Callback Methods

Information	Object/Property
HttpServletRequest	Request
Login Name	• IEUISignOnOperationContext .IEUISignOnOperationResult.ssoLoginId • IEUIPersonSearchOperationContext .IEUIPersonSearchOperationResult.ssoLoginId
First Name and LastName	• First Name: IEUIPersonSearchOperationContext. firstNameSearchString • Last Name: IEUIPersonSearchOperationContext. lastNameSearchString

Table 8-17 Input for Custom Code Callback Methods

Information	Object/Property
List of Persons	IEUIPersonSearchOperationContext.EUIPersonSearchOperationResult.SearchPersonList. SearchPersonList is a collection with all elements of type IExtPersonDTO
Imported Person Information	• IEUISignOnOperationContext .IEUISignOnOperationResult.ImportedPersonExtDTO • IEUIPersonSearchOperationContext.EUIPersonSearchOperationResult.ImportedPersonExtDTO
Manager Id	IEUIPersonSearchOperationContext.EUIPersonSearchOperationResult.ImportedPersonExtDTO.PersonDTO.managerID

You must implement all methods to compile your implementation class. If you customize only limited operation types, you must provide an empty implementation of methods not relevant to the operation types.

For example, if you are only interested in a customized SSO, then provide a complete implementation of the getCredentials method. For all other methods, return null.

The system may pool an instance of an interface and may be concurrently accessed from multiple threads. Thus, it is recommended to keep the instance stateless.

There are two types of custom code operation interfaces:

- **ISignOn** is used for customizing the login.
- **IPersonSearch** is used for customizing the “Person Lookup” dialog box.

Custom Code Interface for Login Event – ISignOn

This is the interface that custom code should implement in order to customize login events: SSO, EUA, Import Person, Import Manager and custom code operations.

Customizing the SSO Operation

The primary purpose of an SSO custom code operation is to retrieve and return the Login Name from HttpHeader based Sign-On or from CGI Header (CGI variable REMOTE_USER) in the case of Remote NTML/IWA type of Sign-On.

As outlined in Table 8-16, you must provide a Java class that implements the ISignOn interface. Please provide a complete implementation of the getCredentials method in this interface, and read the documentation for the ISignOn interface for detailed specifications.

The following are some guidelines for implementing the getCredentials method. It is not required that all of these guidelines are implemented; There may be additional requirements, dependent on the customization, which are not covered by what is outlined below.

- Get IEUISignOnOperationResult from IEUISignOnOperationContext. This is the object that must be returned from this interface.
- Use the parameter request and process it to derive the login name of the person.
- Return LoginId back by calling IEUISignOnOperationResult.setSsoLoginId(<login id>), if using the in-product directory lookup functionality.

- Call IEUISignOnOperationResult.setSsoRedirectUrl("<any url or error page>"), which are used for redirecting the user on SSO failure.

SSO Operation Options received through IEUIEventSSOOperationDTO.getEventSsoDTO() may be null as SSO options are not accepted in the Administration module for custom code operations.

Customizing the EUA Operation for Login Event

The primary purpose of an EUA custom code operation is to authenticate a user against an external system.

As outlined in Table 8-16, you must provide a Java class that implements the ISignOn interface. Please provide a complete implementation of the authenticate method in this interface, and read the documentation for the ISignOn interface for detailed specifications.

The following are some guidelines for implementing an EUA operation. It is not required that all of these guidelines are implemented; There may be additional requirements, depending on the customization, that are not covered below.

- Get IEUISignOnOperationResult from IEUISignOnOperationContext. This is the object that must be returned from this interface.
- The EUIDatasourceDTO object from the IEUIEventEUAOperationDTO object contains the interface to the Datasource configured in the Administration module for this operation.
- Populate the LDAPConfigInfo object from the EUIUtil and pass EUIDatasourceDTO. This is needed to call LDAP API with the connection information to LDAP Server.
- Get the Login Name by calling IEUISignOnOperationResult.getSsoLoginId().
- Form a BindDN and set it into LDAPConfigInfo by calling setBindDN().
- Get the Password entered by the user in the Login page by calling IEUISignOnOperationResult.getEuaPassword().This function returns BASE64 encoded password. To convert this string into a plain password, perform the following steps programmatically:
  - Remove the prefix “!@^_” and suffix “_^@!” from the string.
  - Use Java’s Base64 decode method on the above resultant string.
- Set it into LDAPConfigInfo by calling setBindPassword().
- Authenticate the user against the Directory Server by passing the LDAPConfigInfo object ILDAPApi.authenticate() API.
- If the user has been authenticated, then call IEUISignOnOperationResult.setEuaAuthenticated(true).
- If the user authentication failed or any exception occurred, then call IEUISignOnOperationResult.setEuaAuthenticated(false).

EUA Operation Options received through IEUIEventEUAOperationDTO.getEventEuaDTO() will be empty as EUA options are not accepted in the Administration module for custom code operations.

Customizing the Import Person Operation for the Login Event

The primary purpose of the Import Person operation is to import/refresh a user from an external system, like a directory server or an external database, into the Service Catalog application.

As outlined in Table 8-16, you must provide a Java class that implements the ISignOn interface. Please provide a complete implementation of the importPerson method in this interface, and read the documentation for the ISignOn interface for detailed specifications.

The following are some guidelines for implementing an Import Person operation. It is not required that all of these guidelines are implemented; There may be additional requirements, dependent on the customization, which are not covered below.

- Get IEUISignOnOperationResult from IEUISignOnOperationContext. This is the object that must be returned from this interface.
- The EUIDatasourceDTO object from the IEUIEventImportPersonOperationDTO object contains the interface to the datasource configured in the Administration module for this operation.
- The EUIDataMappingDTO object from the IEUIEventImportPersonOperationDTO object contains the interface to the mapping configured in the Administration module for this operation.
- Using the Login Name retrieved from the IEUISignOnOperationResult.getSsoLoginId() method, query for the user on the external system either from an LDAP server or an external database and collect all information related to the Person profile, including organizational units, groups, and roles.
- Check to see if the user already exists in the Service Catalog database by calling ISignOnImportPersonAPI.getPersonByLoginName(<Login Id>). If the person already exists, this method returns the IPersonDTO object. If the person does not exist, the method throws a signOnImportPersonAPIException.
- If the person is not found, create an IPersonDTO object through the PersonFactory.createPersonDTO() method in preparation for importing the person.
- From the data fetched from the external system, create these DTOs using PersonFactory and populate them as well: IPersonDTO, ILoginInfo, IContactDTO, IAddressDTO, and IPersonExtensionDTO.
- Begin the database transaction by calling ISignOnImportPersonAPI.beginTransaction().
- Check to see if an organizational unit (OU) exists by calling ISignOnImportPersonAPI.getOrgUnitByName(<OU Name>). If it does, this method returns an IOrganizationalUnitDTO object. If the organizational unit does not exist, the method throws a signOnImportPersonAPIException.
- If an OU does not exist, it may be created by calling ISignOnImportPersonAPI.createOrgUnit(<IOrganizationalUnitDTO>).
- If the user already exists, call ISignOnImportPersonAPI.updatePerson(<IPersonDTO>). This updates a person’s basic profile, login information, preferences, Home OU and extensions.
- If the user already exists, link/update addresses/location and contacts by calling ISignOnImportPersonAPI.linkAddresses(<IAddressDTO collection>) and ISignOnImportPersonAPI.linkContact(<IContactDTO>.
- If the person is associated with one or more groups in the external system, first try getting all the existing groups by calling ISignOnImportPersonAPI.getGroupByName (<ou name>). If not, create all the new groups by calling ISignOnImportPersonAPI.createGroup(<IOrganizationalUnitDTO>).
- If the person is new, link all the lists of OUs and groups to the user by calling ISignOnImportPersonAPI.linkPersonToOrgUnit() and ISignOnImportPersonAPI.linkPersonToGroup().
- If the person already exists, any OUs and groups may be unlinked from the user by calling ISignOnImportPersonAPI.unlinkPersonToOrgUnit() and ISignOnImportPersonAPI.unlinkPersonToGroup().
- To find out the existing associations of OUs, including the home OU, and groups for a person, call the ISignOnImportPersonAPI.getOrgUnitsForPerson() and ISignOnImportPersonAPI.getGroupsForPerson() methods.

- To find out the existing associations to roles, call the ISignOnImportPersonAPI.getRolesForPerson() method.
- If the imported person needs to be associated with a role, first get the role using ISignOnImportPersonAPI.getRBACRoleByLogicName(<roleLogicName>).
- Link/unlink roles to a person by calling ISignOnImportPersonAPI.linkPersonToRole() or ISignOnImportPersonAPI.unlinkPersonToRole().
- If the person was imported/refreshed successfully, set the flag ImportPersonDone = true into IEUISignOnOperationResult.
- After successful import/refresh, also create an object of IExtUserDTO through PersonFactory.createExtUserDTO() and set IPersonDTO and HomeOUDTO (IOrganizationalUnitDTO) into IExtUserDTO, then return the IExtUserDTO of the imported person by calling IEUISignOnOperationResult.setImportedPersonExtDTO(<IExtUserDTO>).
- If the import/refresh operation failed, set the flag ImportPersonDone = false into IEUISignOnOperationResult.
- End/commit the database transaction by calling ISignOnImportPersonAPI.commitTransaction().
- If the transaction failed, roll back the transaction in the `exception` block by calling ISignOnImportPersonAPI.rollbackTransaction() and releasing the transaction in the `finally` block by calling ISignOnImportPersonAPI.releaseTransaction().

Import Person operation options through the IEUIEventImportPersonOperationDTO.getImportPersonDTO() method will be empty as Import Person options are not accepted in the Administration module for custom code operations.

Customizing the Import Manager Operation for the Login Event

The primary purpose of the Import Manager operation is to import/refresh the Supervisor chain of the person from an external system, like a directory server, into Service Catalog.

As outlined in Table 8-16, you must provide a java class that implements the ISignOn interface. Please provide a complete implementation of the importPerson method in this interface, and read the documentation for the ISignOn interface for detailed specifications.

The following are some guidelines for the Import Manager operation:

- Get IEUISignOnOperationResult from IEUISignOnOperationContext. This is the object that must be returned from this interface.
- Get the user imported/refreshed user ImportedPersonExtDTO from IEUISignOnOperationResult.
- Get the Person who was imported through the IEUISignOnOperationResult.getImportedPersonExtDTO() method. This will return a IExtUserDTO object, from this get IPersonDTO object.
- Import all managers as needed from the external system, create/update each manager in the same way as explained in Import Person example above.
- Link a manager to a person, assuming personDTO is a reference to IPersonDTO for the imported manager and managerDTO is a reference to the IPersonDTO returned after the manager is imported.
- Use personDTO.setManagerId(managerDTO.getId() to set the manager association for personDTO.
- Save the association by saving personDTO using one of the mechanisms explained in the Import Person Operation.

It is recommended that when importing the manager chain, you import the top level managers before persons. This avoids unnecessary updates for personDTO to update the link with the person's manager.

Import Manager Operation Options received through IEUIEventImportManagerOperationDTO. getImportManagerDTO() will be empty as Import Manager Options are not accepted in the Administration module for custom code operations.

Customizing Custom Operations for the Login Event

The primary purpose of the custom code operation is to perform any custom operation that is needed and not represented elsewhere in the application.

The following are some guidelines for the Custom Code operation:

- Get IEUISignOnOperationResult from IEUISignOnOperationContext. This is the object that must be returned from this interface.
- Get EUIDatasourceDTO from IEUIEventCustomOperationDTO. This object contains the datasource configured in the Administration module for this operation.
- Get EUIDataMappingDTO from IEUIEventCustomOperationDTO. This object contains the mapping configured in the Administration module for this operation.
- Perform any custom operation as needed.
- IEUISignOnOperationResult should be populated appropriately based on previous examples.

Custom Code Interface for Person Lookup – IPersonSearch

This is the interface that a custom code should implement in order to customize Person Search events: Person Search, Import Person, Import Manager and custom code operations.

The implementation class is configured in the **Administration module > Directories tab > Events**, and can be configured for searching a for person in the following places within the Service Catalog application:

- Person Search for Order On Behalf
- Person Search for Authorization Delegate
- Person Search for Service Form

Customizing the Person Search Operation

The primary purpose of the Person Search operation is to search for users from an external system, like a directory server.

As outlined in Custom Code Operations table, you must provide a Java class that implements the IPersonSearch interface. Please provide a complete implementation of the search method in this interface, and read the documentation for the ISignOn interface for detailed specifications.

The following are some guidelines for the Person Search operation:

- Get IEUISignOnOperationResult from IEUISignOnOperationContext. This is the object that must be returned from this interface.
- Since a custom Person Search operation can be configured using Person Search, we can add to, or manipulate, the search results from the previous operation in the Search Event by getting the list of persons already in the Search result by calling IEUISignOnOperationResult.getSearchPersonList().
- Search the users on an external system, either a directory server using the API methods in the interface ILDAPApi, or in an external database using the API in ISignOnImportPersonAPI for connecting to SQL datasources.
- For every person found on the external system, create IExtUserDTO.

- Populate IExtUserDTO with IPersonDTO, IOrganizationalUnitDTO (for Home OU) and ILoginInfoDTO.
- Optional – based on the person popup global setting, also populate collection IContactDTO, collection of IAddressDTO, IPersonExtensionDTO.
- Get the flag "All Users For Order On Behalf" using ISignOnImportPersonAPI getCustomParam("ShowAllUsersForOrderOnBehalf").
- To make the custom code consistent with the standard platform behavior, if the flag is Off, and any mandatory attributes are missing for the person, remove the entry. This will prevent any incomplete persons from being shown in the popup.
- To make the custom code consistent with the standard platform behavior, if the flag is On and the Person is missing any mandatory attributes, call IExtUserDTO.setResultHasError(true). This includes the incomplete person in the popup, but displays a red asterisk "*" instead of the radio button. The starred user cannot be chosen by the end user or imported.
- Return the list of all persons searched by calling IEUISignOnOperationResult. setSearchPersonList(<List of all IExtUserDTO>).

Person Search Operation Options received through the IEUIEventPersonSearchOperationDTO.getPersonSearchOperationDTO() method will be empty as Person Search Options are not accepted in the Administration module for custom code operations.

Customizing the Import Person Operation for Person Search Event

As outlined in Custom Code Operations table, you must provide a Java class that implements the IPersonSearch interface. Please provide a complete implementation of the importPerson method in this interface, and read the documentation for the IPersonSearch interface for detailed specifications.

Steps to customize this are similar to the Customizing the Import Person Operation for the Login Event.

Customizing the Import Manager Operation for Person Search Event

As outlined in Custom Code Operations, you must provide a Java class that implements the IPersonSearch interface. Please provide a complete implementation of the search method in this interface, and read the documentation for the IPersonSearch interface for detailed specifications.

Steps to customize this are similar to the Customizing the Import Manager Operation for the Login Event.

Customizing the Custom Operation for Person Search Event

As outlined in Custom Code Operations, you must provide a Java class that implements the IPersonSearch interface. Please provide a complete implementation of the performCustom method in this interface, and read the documentation for the IPersonSearch interface for detailed specifications.

Steps to customize this are similar to the Customizing Custom Operations for the Login Event.

Custom Java Class Mapping Interface

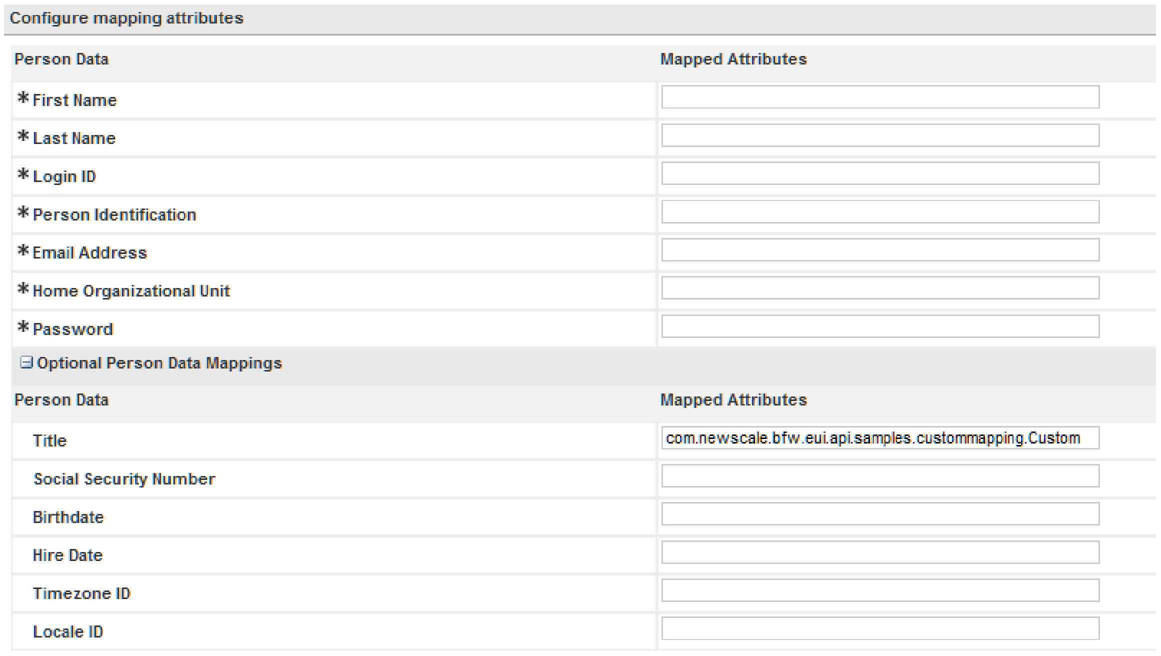
When simple, composite, or regular expression attribute mappings do not suffice, a custom Java class can be used in a directory integration attribute mapping.

Custom Java Class for Attribute Mapping – IEUIAttributeMapping

This is the interface that a custom code should implement in order to customize directory attribute mappings. The primary purpose of custom mapping class is to customize the attribute value fetched from the directory server.

The implementation class has to be configured in the **Administration module > Directories tab > Mappings**, and can be configured for any attribute in the mapping.

Figure 8-16 Custom Java Class for Attribute Mapping



Configure mapping attributes

Person Data	Mapped Attributes
* First Name	
* Last Name	
* Login ID	
* Person Identification	
* Email Address	
* Home Organizational Unit	
* Password	

⊟ Optional Person Data Mappings

Person Data	Mapped Attributes
Title	com.newscale.bfw.eui.api.samples.custommapping.Custom
Social Security Number	
Birthdate	
Hire Date	
Timezone ID	
Locale ID	

The following are some guidelines for using a custom Java class mapping class:

- The mapping class should only be used for simple logic to be applied to the value retrieved from the directory.
- For performance reasons, the mapping class should not be used to perform a call to a directory server using the Directory Server API or to execute any database operations. The Person Search or Login interfaces should be used for these use cases.
- Implement IEUIAttributeMapping.getAttributeValue() for returning a single value for the mapped attribute. This method should not be implemented for the OU List, Group List, or Role List mapping fields.
- Implement IEUIAttributeMapping.getAttributeValueArray() for returning multiple values for the mapped attribute. This method should only be implemented for the OU List, Group List, and Role List mapping fields.

Directory Server API

This is an API wrapper that Cisco provides for integrating with the directory server (LDAP) connection facility built into the product.

Authentication to, and querying, the directory server are the only features this API provides. This API supports all directory servers supported by Service Catalog.

Typically, the Directory Server API works from the directory integration datasource and mapping configurations, and eliminates the need for hand-coding connection information, filters, and the attributes for querying.

Generally, to use the LDAP API, you also need the LDAPConfigInfo object. Use EUIUtil.get LDAPConfigInfo() from any datasource and mapping for this purpose.

The javadoc for LDAP API can be located in the javadocs folder of the product package.

Getting an Instance of ILDAPApi – API Implementation

An instance of ILDAPApi does not need to be created. It is available in all method arguments of both custom code API interfaces (ISignOn and IPersonSearch).

Directory Integration Utility (EUIUtil) Class

The directory integration utility class (EUIUtil) converts the datasource and mapping configured in the Administration module into a format that the Directory Server API can use as input for authentication, search, and query functions.

LDAP Configuration Info (LDAPConfigInfo) Class

An object of LDAPConfigInfo class encapsulates all the following configuration options that must be passed to the directory server API:

- Authentication information
- Connection information
- Query attributes
- Search filter

For more advanced users, if there is a need to override any configuration, LDAPConfigInfo provides getters and setters for all configurations. For further details on these methods, see the Javadoc for this class.

Main interface of the API – ILDAPApi

The ILDAPApi is the main interface that provides two basic operations on the directory server:

- Authenticate
- Search/Query

The ILDAPApi interface provides methods to interact with LDAP consistently throughout Service Catalog.

LDAPEntryBean

After querying/searching the directory server using the ILDAPApi.query(…) method, the results are returned as a collection of LDAPEntryBean.

Import/Refresh Person API

This API can be used to import/refresh Person profile, create OUs or groups and also to link or unlink a person to an OU, group, or role. This API also supports transaction management for importing a person, and connectivity to SQL datasources. This API includes a method to read from the CnfParams table.

Import/Refresh Person API Interface – ISignOnImportPersonAPI

The Import/Refresh Person API interface provides methods for the following:

- Get a Person object by PersonID or LoginName. This returns the Person with login information, preferences, home OU, address, contact, location, and extensions.
- Create a Person with login information, preferences, home OU, address, contact, location, and extensions.
- Update a Person with login, preferences, home OU, and extensions.
- Get OU by OrganizationalUnitID, Name. This does not return the members of the OU.
- Get all the OUs for a given Person. This does not return the members of the OU.
- Create an OU.
- Link/unlink a Person with an OU.
- Get Group by GroupID, Name. This does not return all the members of the Group.
- Get all the groups for a given person.
- Create a group.
- Link/unlink a person with a group.
- Get a user-defined role by name.
- Get LogicName object for a system-defined role.
- Get system-defined role by LogicName object.
- Get all the roles for a given person.
- Link/unlink a person with a role.
- Link/update address or location for a person.
- Add/update/delete a contact for a person.
- Begin transaction, commit transaction and release transaction resources for Import Person.
- Get a connection to a SQL datasource.
- Rollback the transaction on the SQL datasource connection.
- Return the connection to the SQL datasource back to the connection pool.
- Get parameter values from the CnfParams table.

For further details see the Java documentation.

Customizing Java Class to Connect to a SQL Datasource

To customize the Java class to connect to a SQL datasource:

Step 1 Get a connection to a SQL datasource database from ISignOnImportPersonAPI by passing the DatasourceName. The DatasourceName should be prefixed with the JNDI prefix, as defined by the "DatasourceJNDIPrefix" property in newscale.properties file.

Step 2 Use the above connection to execute any query using a JDBC statement.

Step 3 Commit the connection object directly at the end of the **try** block.

Step 4 Call ISignOnImportPersonAPI to roll back the connection when there are any failures/exceptions.

Step 5 In the final block, close the statement directly and call ISignOnImportPersonAPI to release the connection and return it to the connection pool.

Best Practices

Compiling Custom Code Java Files

The following are steps to compile and deploy custom code:

Step 1 Copy the build.xml file given in the Sample build.xml File and paste it to any folder; for example, C:\CustomCode.

Step 2 Edit the build.xml file to change the property "rcwar.dir" to point to the full path where the RequestCenter.war is available.

Step 3 Edit the build.xml to change the property "javax.servlet.dir" to point to the full path where the servlet-api.jar is available. This is specific to the application server.

Step 4 Create a subfolder for the custom code java files; for example, C:\CustomCode\src.

Step 5 Create a custom code with a package name like "com.newscale.SignOnCustomCode" and place the SignOnCustomCode.java file in the following directory:
C:\CustomCode\src\com\newscale\SignOnCustomCode.java

Step 6 Run "ant" from a command line in the C:\CusomCode folder.

Step 7 The ant build file will compile all the java files under the "src" subfolder and place the class files in the "out" subfolder.

Step 8 The ant build file will also deploy the class files to the "RequestCenter.war\WEB-INF\classes" folder.

Step 9 Restart the application server.

Coding Guidelines

Package Names

- We recommend that the package name should be: com.newscale.[yourcompanyname].*.
- Use the key name “com.yourcompanyname.*” to store any ContextLocalAttributes. This eliminates clashes with the internal namespaces.

Logging

- Use the Logger to log messages to the server logs instead of using System.out.println.
- For debug logs, always begin by checking whether debugging is enabled. This is essential for performance.
- Always log the error in the exception block before propagating the exception back to the caller.

Exception Handling

- When EUIException is caught, throw it back as is.
- Wrap all other exceptions as EUIException and throw it back.

Configuring Custom Code in the Administration Module

After you have developed, compiled, and deployed the custom code, the Administration module must be configured to use the code. Configuration involves specifying when (in which event), in which operation and in what sequence (step) to invoke the custom code.

Step 1: Configure Global Settings

Ensure that the Directory Integration has been enabled by turning on this setting in the Administration module’s Settings tab. Instructions for turning on Directory Integration are given in the Enabling Directory Integration.

Step 2: Configure Datasources

Most operations, customized or not, require a datasource and mapping, so these two areas of the Directory Administration must be configured first.

Datasources are the external servers, such as LDAP, where your data is currently stored, and which Service Catalog must access. The only custom operation which does not require a datasource is SSO.

See the Defining Datasources and the Configuring Datasource Information for more information on configuring datasources.

Step 3: Configure Attribute Mappings

Once you have set up the external datasource, you must map the person-related data available in Service Catalog to the data in the LDAP directory (or other external datasource). These mappings tell Service Catalog where to look and what to get during an event and sequence of operations.

To configure a mapping follow the guidelines and instructions in the Defining Mappings and the Configuring Mappings.

Step 4: Configure Events/Customized Events

Customizing the Single Sign-On (SSO) and authentication operations for any event other than Login is considered an illegal action. There is no other time when these operations are necessary. Once a user is signed into and authenticated in the application from the external LDAP server, the process does not need to be replicated.

All events requiring connection to external datasources are configured here. When invoking the Custom Code APIs described in this guide, it is important to think through the sequence of operations for each event so that the custom operation does not occur out of order and fail.

Step 1 From the Navigation Pane, click **Events**.

Step 2 For the event you wish to customize, click **Edit**.

Step 3 If the event is disabled, use the drop-down menu to choose **Enabled**.

Step 4 Click **Add step** to add an operation. You can add as many steps are as necessary now, or complete the details of each step before adding and configuring the next.

Step 5 Choose the **Operation** from the drop-down menu.

- To simply invoke the code for SSO; for example, you can choose SSO from the menu. To *customize* the code for SSO, choose Custom Code, and then, in the next step, choose which operation you want to customize.
- To configure a customized operation, choose **Custom Code**.

Step 6 Choose your **mapping** and **datasource** from the drop-down menus.

Step 7 Under the "Additional Options" heading, click **Options**.

Step 8 Configure the options for that step:

- For Custom Code Operation Type, use the drop-down menu to choose the operation you wish to customize.
- For Java Class, enter the entire package name for that operation, followed by the class name; for example, com.newscale.bfw.eui.api.samples.operations.*CustomCodeTester*.
- In the above example, the Java class name is in *italics*. Both of these may be found in and copied from the code itself.

Step 9 Click **Close** to close the additional options for the step.

Step 10 Continue adding and configuring steps, as necessary.

Step 11 Click **Update** to save all steps for that event.

Using Custom Code as an Operation Type

In the steps above, if you choose Custom Code as the operation and Custom Code again for the operation type, you are then calling an undefined Custom Code, which you must design.

In the Custom Code test example provided by Cisco, you can use the Java Class “performCustom” to define your own custom code.

Deploying Custom Code

All custom code must be packaged as a customization to the Service Catalog installer. This allows the customizations to be reapplied if the installation needs to be upgraded or to install a new site.

Instructions for packaging and deploying custom code are dependent on the application server which hosts Service Catalog. See the *Cisco Prime Service Catalog 12.1 Integration Guide* and *Cisco Prime Service Catalog Administration and Operations Guide* for further information about configuring custom code.

Sample View/Usage of the API

The solution here satisfies these use cases:

- Create an event class that searches for a person using data collected from a container-managed SQL datasource.
- Create an event class that imports a person using data collected from a container-managed SQL datasource.
- Create an event class that modifies a person using data collected from a container-managed SQL datasource.
- Create an event class that can receive configuration parameters from the UI. The mappings interface is used in this example to pass the configuration parameters to the class.

It also creates the home OU for the person as a business unit, if it doesn’t already exist in Service Catalog.

Note The solution requires a datasource to be configured on the application server. The following sections illustrate configuration and usage of the EUIPersonSearchSQL class.

SQL Datasource

Any SQL table or tables that contain data for the mandatory fields in a Person profile (or from which values for those fields can be derived) could be used as a datasource. Here is the table definition used in this example:

```
CREATE TABLE [psgextusers] (
  [login]     [nvarchar] (100) COLLATE Latin1_General_CI_AI NOT NULL,
  [firstname] [nvarchar] (100) COLLATE Latin1_General_CI_AI NULL,
  [lastname]  [nvarchar] (100) COLLATE Latin1_General_CI_AI NULL,
  [password]  [nvarchar] (100) COLLATE Latin1_General_CI_AI NULL,
  [email]     [nvarchar] (100) COLLATE Latin1_General_CI_AI NULL,
  [homeOU]    [nvarchar] (100) COLLATE Latin1_General_CI_AI NULL,
  CONSTRAINT [PK_extuser] PRIMARY KEY CLUSTERED
  (
     [login]
  )  ON [PRIMARY]
) ON [PRIMARY]
GO
```

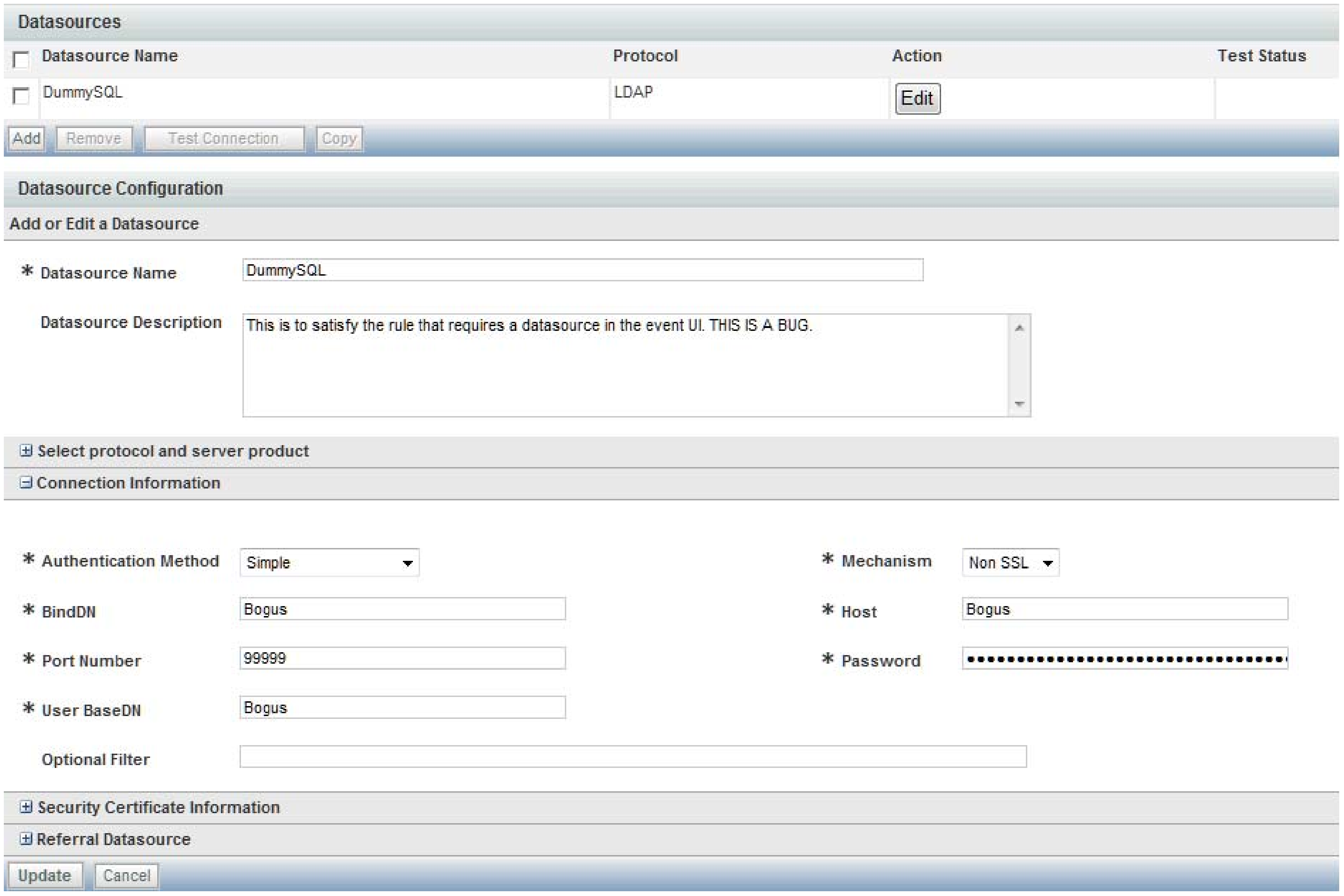
The following is some sample data to go with the above table definition:

```
INSERT INTO [RequestCenter].[dbo].[psgextusers]([login], [firstname], [lastname],
[password], [email], [homeOU])VALUES('Moe', 'Moe', 'Howard', 'Moe', 'moe@stooge.com',
'Nyuk Nyuk Nyuk')
INSERT INTO [RequestCenter].[dbo].[psgextusers]([login], [firstname], [lastname],
[password], [email], [homeOU])VALUES('Larry', 'Larry', 'Fine', 'Larry',
'larry@stooge.com', 'Nyuk Nyuk Nyuk')
INSERT INTO [RequestCenter].[dbo].[psgextusers]([login], [firstname], [lastname],
[password], [email], [homeOU])VALUES('Curly', 'Curly', 'Howard', 'Curly',
'curly@stooge.com', 'Nyuk Nyuk Nyuk')
INSERT INTO [RequestCenter].[dbo].[psgextusers]([login], [firstname], [lastname],
[password], [email], [homeOU])VALUES('Shemp', 'Shemp', 'Howard', 'Shemp',
'shemp@stooge.com', 'Nyuk Nyuk Nyuk')
```

Datasource Definition

To use the Directory Integration interface you have to have an LDAP datasource configured. LDAP is the only UI supported datasource. You can create maps without a datasource, but you cannot test them without an LDAP datasource.

Figure 8-17 Sample Datasource Configuration



Datasources

	Datasource Name	Protocol	Action	Test Status
☐	DummySQL	LDAP	Edit	

Datasource Configuration

Add or Edit a Datasource

* Datasource Name	DummySQL
Datasource Description	This is to satisfy the rule that requires a datasource in the event UI. THIS IS A BUG.

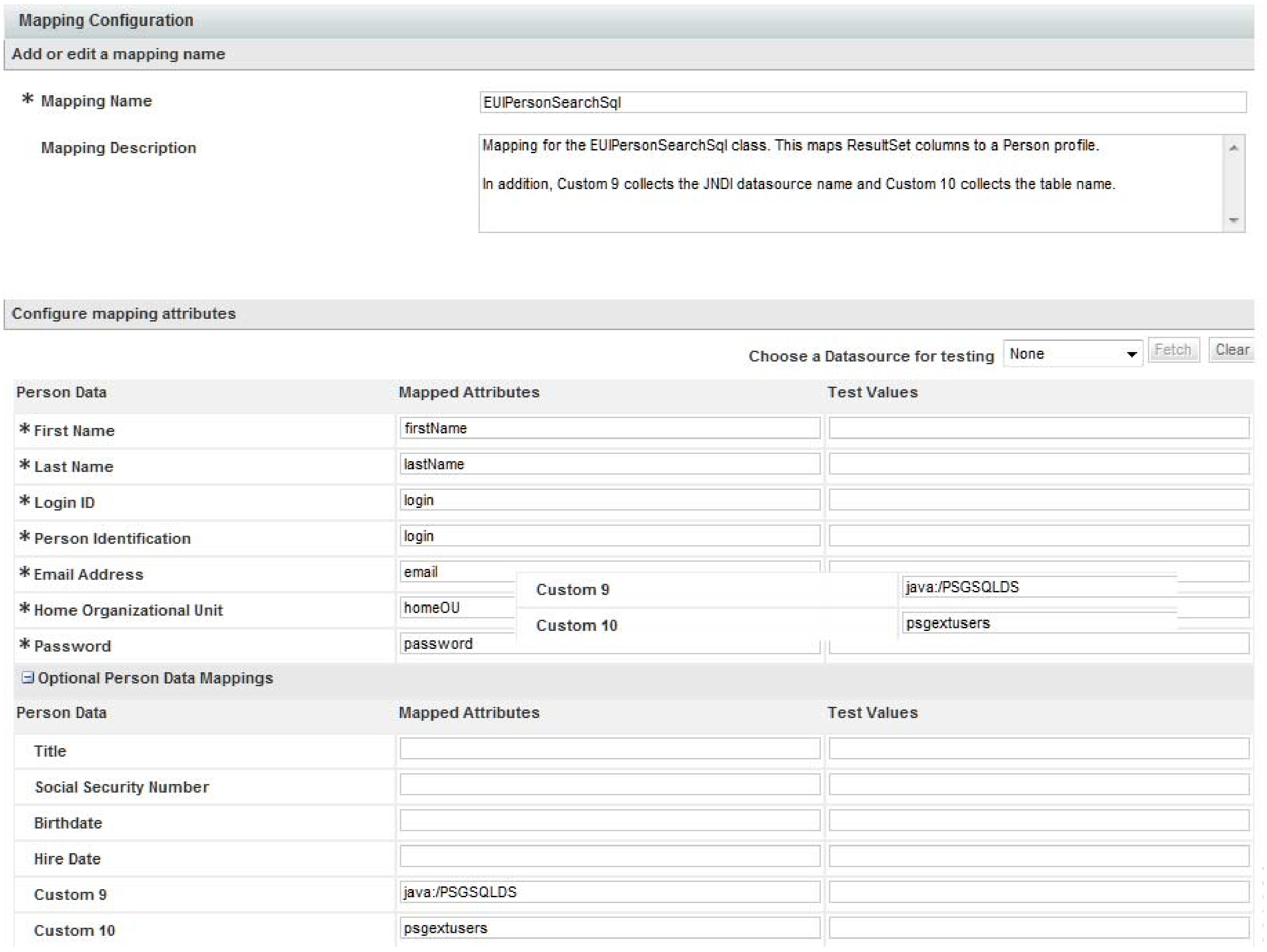
* Authentication Method	Simple	* Mechanism	Non SSL
* BindDN	Bogus	* Host	Bogus
* Port Number	99999	* Password	••••••••••••••••••••••••••••••••••
* User BaseDN	Bogus		
Optional Filter			

Configuring a container-managed datasource depends on the container. Detailed instructions on configuring datasources are given in the *Cisco Prime Service Catalog Installation and Upgrade Guide*.

Sample Mapping

A mapping must be created for the EUIPersonSearchSQL class.

Figure 8-18 Sample Mapping Configuration



Mapping Configuration

Add or edit a mapping name

* Mapping Name	EUIPersonSearchSql
Mapping Description	Mapping for the EUIPersonSearchSql class. This maps ResultSet columns to a Person profile. In addition, Custom 9 collects the JNDI datasource name and Custom 10 collects the table name.

Configure mapping attributes

Choose a Datasource for testing: None

Person Data	Mapped Attributes	Test Values
* First Name	firstName	
* Last Name	lastName	
* Login ID	login	
* Person Identification	login	
* Email Address	email	
* Home Organizational Unit	homeOU	
* Password	password	

Custom 9	java:/PSGSQLDS
Custom 10	psgextusers

Optional Person Data Mappings

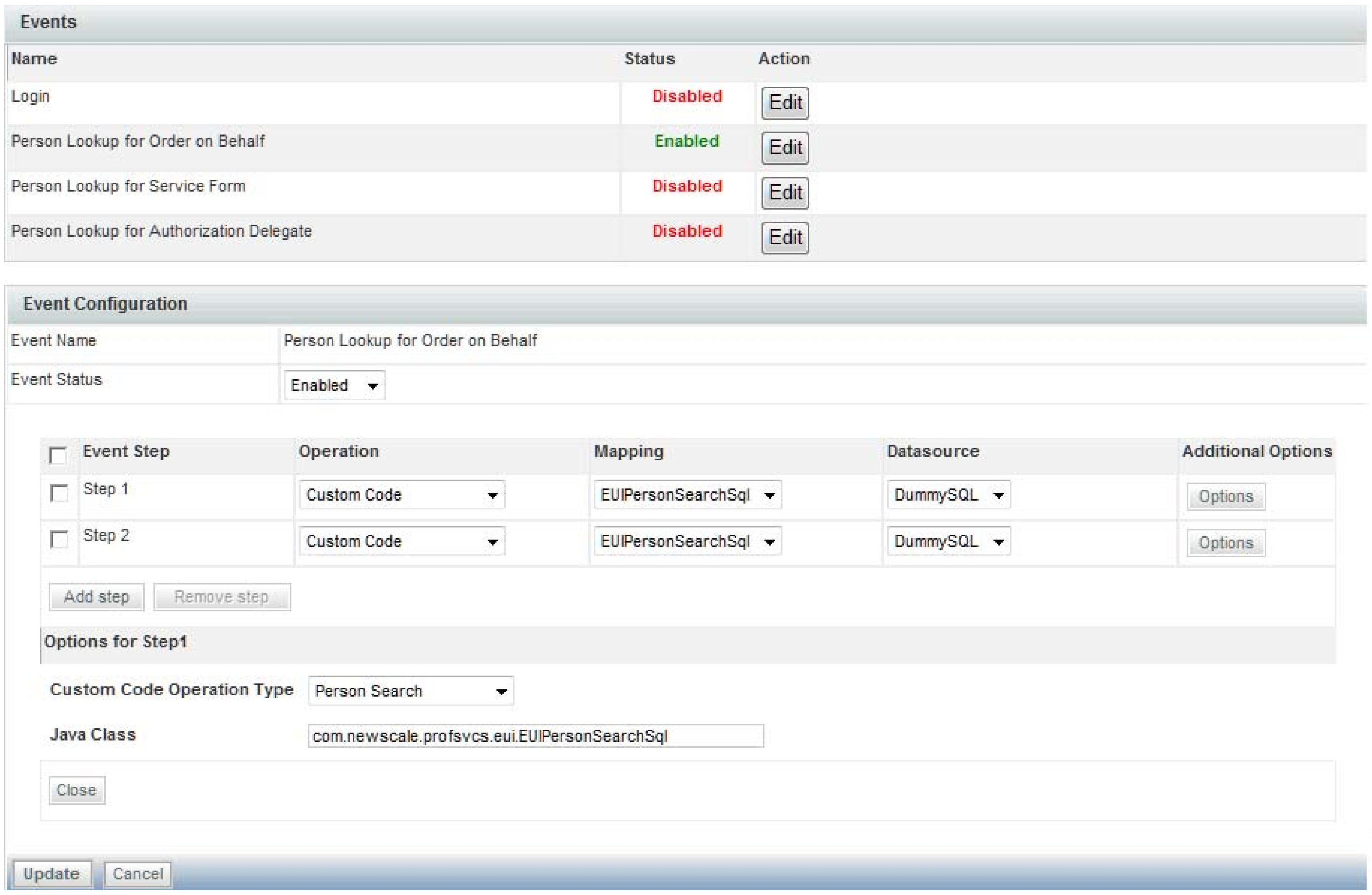
Person Data	Mapped Attributes	Test Values
Title		
Social Security Number		
Birthdate		
Hire Date		
Custom 9	java:/PSGSQLDS	
Custom 10	psgextusers	

This mapping includes references to the JNDI as Custom 9 and the table name for Custom 10. Using a mapping like this, it is possible to do a simple query such as “select * from tablename” and use the metadata functionality in JDBC to select the column based on the mapping.

Sample Event Configuration

The “Person Lookup for Order on Behalf” event has two steps: The first must perform a “Person Search” operation. The name of the class is given as the mapping. The complete package specification is given as the Java class.

Figure 8-19 Custom Person Search Operation



Events

Name	Status	Action
Login	Disabled	Edit
Person Lookup for Order on Behalf	Enabled	Edit
Person Lookup for Service Form	Disabled	Edit
Person Lookup for Authorization Delegate	Disabled	Edit

Event Configuration

Event Name	Person Lookup for Order on Behalf
Event Status	Enabled

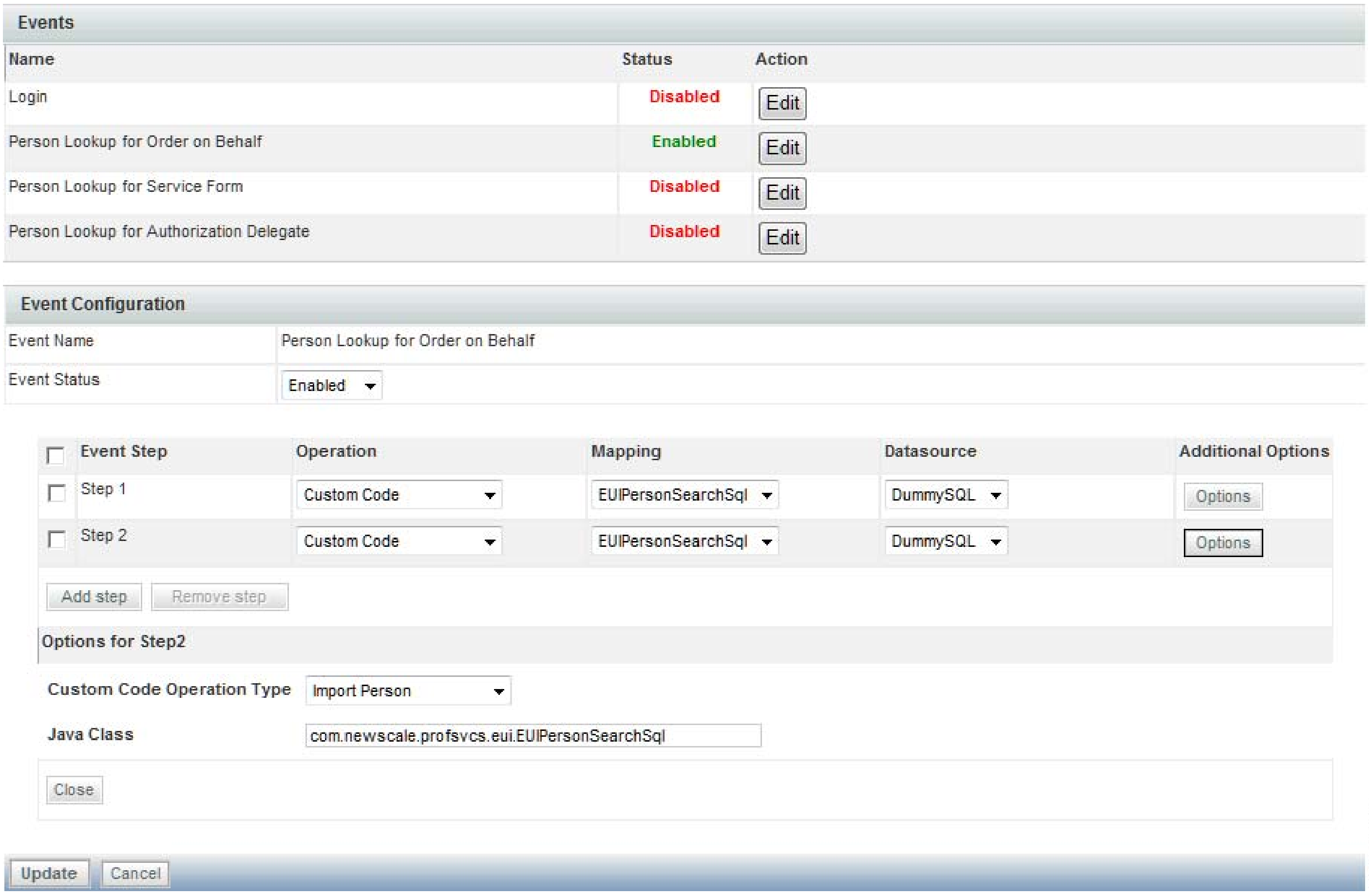
Event Step	Operation	Mapping	Datasource	Additional Options
Step 1	Custom Code	EUIPersonSearchSql	DummySQL	Options
Step 2	Custom Code	EUIPersonSearchSql	DummySQL	Options

Options for Step1

Custom Code Operation Type	Person Search
Java Class	com.newscale.profsvcs.eui.EUIPersonSearchSql

The second step in the "Person Lookup for Order on Behalf" event is to import the selected person ("Import Person"). This configuration uses the same Java class, but a different Custom Code Operation Type. The Custom Code Operation Types in the drop-down menu correspond to the methods that are called in the interface class.

Figure 8-20 Event Step 2 – Custom Import Person Operation



Events

Name	Status	Action
Login	Disabled	Edit
Person Lookup for Order on Behalf	Enabled	Edit
Person Lookup for Service Form	Disabled	Edit
Person Lookup for Authorization Delegate	Disabled	Edit

Event Configuration

Event Name	Person Lookup for Order on Behalf
Event Status	Enabled

Event Step	Operation	Mapping	Datasource	Additional Options
Step 1	Custom Code	EUIPersonSearchSql	DummySQL	Options
Step 2	Custom Code	EUIPersonSearchSql	DummySQL	Options

Options for Step2

Custom Code Operation Type	Import Person
Java Class	com.newscale.profsvcs.eui.EUIPersonSearchSql

Sample Code for SQL-Based Person Lookup

The following is the source for the custom class:

```
package com.newscale.profsvcs.eui;

import com.newscale.api.person.*;
import com.newscale.bfw.eui.EUIException;
import com.newscale.bfw.eui.api.*;
import com.newscale.bfw.ldap.ILDAPApi;
import com.newscale.bfw.logging.ILogUtil;
import com.newscale.bfw.logging.LogUtilFactory;
import com.newscale.comps.extuserintegration.session.*;

import javax.servlet.http.HttpServletRequest;
import java.sql.Connection;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.sql.Statement;
import java.util.*;

/**
 * Person Search to an external SQL datasource
 *
 * @author Lee Weisz
 * @version $Revision$
 */
public class EUIPersonSearchSql implements IPersonSearch {
  /**
   * Logger instance
   */
  private ILogUtil log = LogUtilFactory.getLogUtil(EUIPersonSearchSql.class);

  /**
   * Implement Person Search Operation and fetch users from an external system
   *
   * @param euiOperationDTO       .
   * @param euiPersonSearchOperationContext
   *
   * @param request               .
   * @param signOnImportPersonAPI
   * @param ldapApi
   * @return .
   * @throws EUIException .
   */
  public IEUIPersonSearchOperationResult search(IEUIEventPersonSearchOperationDTO 
euiOperationDTO,
                                                IEUIPersonSearchOperationContext 
euiPersonSearchOperationContext,
                                                HttpServletRequest request,
                                                ISignOnImportPersonAPI 
signOnImportPersonAPI, ILDAPApi ldapApi)
      throws EUIException {

    log.debug("search: Entering search method...");
    IEUIPersonSearchOperationResult euiOperationResult = euiPersonSearchOperationContext
        .getEUIPersonSearchOperationResult();

    // Check if there is any SearchPerson List already available, if so we
    // can append to the existing List

    // Typically if there is a productized Person Search Operation is
    // configured before the custom code, this list would be populated

    // TODO Why is this an ArrayList? Can't it be a List?
    ArrayList personList = euiOperationResult.getSearchPersonList();

    if (null == personList) {
      personList = new ArrayList();
    }

    // Get the search criteria from the dialog box
    String searchFirstName = euiPersonSearchOperationContext.getFirstNameSearchString();
    String searchLastName = euiPersonSearchOperationContext.getLastNameSearchString();

    log.debug("search: Looking for " + searchFirstName + " " + searchLastName);

    EUIDataMappingDTO dataMappingDTO = euiOperationDTO.getEuiMappingDTO();
    Map attributeMap = dataMappingDTO.getAllAttributeMap();

    // What's in this map?
    if (log.isDebugEnabled()) {
      Set ks = attributeMap.keySet();
      for (Iterator it = ks.iterator(); it.hasNext();) {
        Object key = it.next();
        log.debug("search: " + key + " is " + attributeMap.get(key));
      }
    }

    // Use the map to map the columns to Person fields
    String firstNameColumn = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_FIRSTNAME);
    String lastNameColumn  = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_LASTNAME);
    String loginColumn     = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_LOGINID);

    // Use the custom9 mapping to hold the datasource value and custom10 to
    // hold the tablename. Since we control the import as well, it won't show up
    // in the imported Person's profile
    String ds = (String) attributeMap.get("custom9");
    String sourceTable = (String) attributeMap.get("custom10");


    StringBuffer searchSQL;
    searchSQL = new StringBuffer().append("select ")
        .append(firstNameColumn).append(", ")
        .append(lastNameColumn).append(", ")
        .append(loginColumn).append(" from ")
        .append(sourceTable);

    if (searchFirstName != null && searchFirstName.trim().length() > 0 ||
        searchLastName != null && searchLastName.trim().length() > 0) {
      searchSQL.append(" where ");

      if (searchFirstName != null && searchFirstName.trim().length() > 0) {
        searchSQL.append(firstNameColumn).append(" like
'").append(searchFirstName.trim()).append("%'");
      }

      if (searchFirstName != null && searchFirstName.trim().length() > 0 &&
          searchLastName != null && searchLastName.trim().length() > 0) {
        searchSQL.append(" and ");
      }

      if (searchLastName != null && searchLastName.trim().length() > 0) {
        searchSQL.append(lastNameColumn).append(" like
'").append(searchLastName.trim()).append("%'");
      }
    }

    log.debug("search: " + searchSQL.toString());

    Connection conn = null;
    Statement s = null;

    // get a connection to the external db
    try {
      conn = signOnImportPersonAPI.getExternalDBConnection(ds);

      s = conn.createStatement();
      ResultSet rs = s.executeQuery(searchSQL.toString());

      while (rs.next()) {
        String fname = rs.getString(firstNameColumn);
        String lname = rs.getString(lastNameColumn);
        String login = rs.getString(loginColumn);

        IExtUserDTO extUserDTO = PersonFactory.createExtUserDTO();
        IPersonDTO personDTO = PersonFactory.createPersonDTO();
        personDTO.setFirstName(fname);
        personDTO.setLastName(lname);
        personDTO.setPersonIdentification(login);

        // Make the IPersonDTO into an IExtPersonDTO
        extUserDTO.setPersonDTO(personDTO);
        // Add IExtUserDTO to the collection of searched persons
        personList.add(extUserDTO);
      }
    } catch (SQLException e) {
      log.error("search: " + searchSQL.toString(), e);
    } catch (SignOnImportPersonAPIException e) {
      log.error("search: Cannot get a connection to " + ds, e);
    } finally {
      try {
        s.close();
      } catch (SQLException e) {
        e.printStackTrace();
      }
      try {
        conn.close();
      } catch (SQLException e) {
        e.printStackTrace();
      }
    }

    // Set the list of Persons Searched into the Result to be returned
    euiOperationResult.setSearchPersonList(personList);

    log.debug("search: Leaving search method...");
    return euiOperationResult;
  }

  /**
   * Implement the Import Person Operation to Import a user from External
   * system
   *
   * @param euiOperationDTO       .
   * @param euiPersonSearchOperationContext
   *                              .
   * @param request               .
   * @param signOnImportPersonAPI
   * @param ldapApi
   * @return .
   * @throws EUIException .
   */
  public IEUIPersonSearchOperationResult importPerson(IEUIEventImportPersonOperationDTO 
euiOperationDTO,
                                                      IEUIPersonSearchOperationContext 
euiPersonSearchOperationContext,
                                                      HttpServletRequest request,
                                                      ISignOnImportPersonAPI 
signOnImportPersonAPI, ILDAPApi ldapApi)
      throws EUIException {

    log.debug("importPerson: Entering importPerson method...");

    /* Potentially useful stuff on the request...
      Name : isOOB          Value : true/false
      Name : customerid     Value : personDTO.setPersonIdentification() from search
      Name : customerId     Value : personDTO.setPersonIdentification() from search
      Name : lDAPCustomerId Value : personDTO.setPersonIdentification() from search
    */
    // What's on this request?
    if (log.isDebugEnabled()) {
      log.debug("importPerson: Parameters collected from the search window...");
      Enumeration paramNames = request.getParameterNames();

      if (paramNames.hasMoreElements()) {
        while (paramNames.hasMoreElements()) {
          String paramName = (String) paramNames.nextElement();
          String paramValues[] = request.getParameterValues(paramName);
          if (paramValues != null) {
            log.debug("importPerson: Name : " + paramName);
            for (int i = 0; i < paramValues.length; i++) {
              log.debug("importPerson: Value : " + paramValues[i]);
            }
          }
        }
      }
    }

    boolean refreshPerson = true;
    String login = request.getParameter("customerId");

    // Defaults
    String homeOU    = "";
    String firstName = "";
    String lastName  = "";
    String email     = "";
    String password  = "password";

    // Get the UI mapping
    EUIDataMappingDTO dataMappingDTO = euiOperationDTO.getEuiMappingDTO();
    Map attributeMap = dataMappingDTO.getAllAttributeMap();

    // Use the map to map the columns to Person fields
    String firstNameColumn = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_FIRSTNAME);
    String lastNameColumn  = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_LASTNAME);
    String loginColumn     = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_LOGINID);
    String passwordColumn  = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_PASSWORD);
    String emailColumn     = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_EMAILADDRESS);
    String homeOUColumn    = (String)
attributeMap.get(EUIAPIConstants.EUIMAPFIELDTYPE.ATTR_HOMEORGANIZATIONALUNIT);

    // Use the custom9 mapping to hold the datasource value and custom10 to
    // hold the tablename. Since we control the import as well, it won't show up
    // in the imported Person's profile unless we screw up somehow and put it there...
    String ds = (String) attributeMap.get("custom9");
    String sourceTable = (String) attributeMap.get("custom10");

    StringBuffer importSQL;
    importSQL = new StringBuffer().append("select ")
        .append(firstNameColumn).append(", ")
        .append(lastNameColumn).append(", ")
        .append(loginColumn).append(", ")
        .append(passwordColumn).append(", ")
        .append(emailColumn).append(", ")
        .append(homeOUColumn)
        .append(" from ").append(sourceTable).append(" where ")
        .append(loginColumn).append("='").append(login).append("'");
    log.debug("import: " + importSQL.toString());

    Connection conn = null;
    Statement s = null;

    try {
      // get a connection to the external db
      conn = signOnImportPersonAPI.getExternalDBConnection(ds);
      s = conn.createStatement();
      ResultSet rs = s.executeQuery(importSQL.toString());

      while (rs.next()) {
        homeOU = rs.getString(homeOUColumn);
        firstName = rs.getString(firstNameColumn);
        lastName = rs.getString(lastNameColumn);
        email = rs.getString(emailColumn);
        password = rs.getString(passwordColumn);
      }
    } catch (SQLException e) {
      log.error("import: " + importSQL.toString(), e);
    } catch (SignOnImportPersonAPIException e) {
      log.error("import: Cannot get a connection to " + ds, e);
    } finally {
      try {
        s.close();
      } catch (SQLException e) {
        log.error("import: ", e);
      }
      try {
        conn.close();
      } catch (SQLException e) {
        log.error("import: ", e);
      }
    }

    log.debug("import : Got " + login + "," + firstName + "," + lastName + "," + email +
"," + password + "," + homeOU);

    IPersonDTO personDTO = PersonFactory.createPersonDTO();
    try {
      // Get or Create the Person
      // This API throws an exception if the Person is not found in Service Catalog
      try {
        personDTO = signOnImportPersonAPI.getPersonByLoginName(login);
        log.info("importPerson: " + login + " exists in Request Center");
      } catch (SignOnImportPersonAPIException impEx) {
        log.info("importPerson: Creating new Person for " + login);
        refreshPerson = false;
        personDTO.setLogin(login);
      }

      // Get or Create the Home OU that the Person should be associated with
      // This API throws an exception if the OU is not found in Service Catalog
      IOrganizationalUnitDTO homeOUDTO;
      try {
        homeOUDTO = signOnImportPersonAPI.getOrgUnitByName(homeOU);
        log.info("importPerson: " + homeOU + " exists in Request Center");
      } catch (SignOnImportPersonAPIException impEx) {
        log.info("importPerson: Creating new OU " + homeOU + " for " + login);
        homeOUDTO = PersonFactory.createOrganizationalUnitDTO();
        homeOUDTO.setName(homeOU);
        homeOUDTO.setBillable(false);
        homeOUDTO.setOrganizationalUnitTypeId(2); // business unit.
        homeOUDTO.setRecordStateId(1); // active
```

```
          homeOUDTO.setLocaleId(EUIAPIConstants.LOCALEID.USEN);
          try {
            homeOUDTO = signOnImportPersonAPI.createOrgUnit(homeOUDTO);
          } catch (SignOnImportPersonAPIException crEx) {
            log.error("importPerson: Can't create " + homeOU + " for " + login);
            throw crEx;
          }
        }
        personDTO.setHomeOrganizationalUnitId(homeOUDTO.getId());

        // Populate the Login Object...
        // Modify the login information only if this is a new Person
        if (!refreshPerson) {
          ILoginInfoDTO loginInfoDTO = PersonFactory.createLoginInfoDTO();

          loginInfoDTO.setLoginname(personDTO.getLogin());
          loginInfoDTO.setPrivateKey(personDTO.getLogin());
          // Set the un-encrypted password
          loginInfoDTO.setPassword(password);

          // Set ILoginInfoDTO to IPersonDTO
          personDTO.setILoginInfoDTO(loginInfoDTO);
        }

        // Populate the rest of the essential fields
  // Presumably, any expression on the mapping will have already been executed
  // and the result is what's returned in the personDTO
        personDTO.setFirstName(firstName);
        personDTO.setLastName(lastName);
        personDTO.setEmail(email);

        // Set the active status
        // TODO These methods are bogus...
  //    personDTO.setIsInactive(false);
  //    personDTO.setIsActive(true);
        // TODO What do these numbers mean? Is there a constants library to convert these
  codes into something meaningful?
        personDTO.setRecordStateId(1);

        // Upsert the Person
        signOnImportPersonAPI.beginTransaction();
        if (refreshPerson) {
          // Update the existing Person
          // This method updates only Basic Info, LoginInfo, Preferences, Home OU and Person
  Extension
          signOnImportPersonAPI.updatePerson(personDTO);
        } else {
          // Create the Person
          // This creates a Person with Basic Info, LoginInfo, Preferences, Home OU and
  Person Extension
          personDTO = signOnImportPersonAPI.createPerson(personDTO);
          // From here on out it's a refresh
          refreshPerson = true;
        }
        signOnImportPersonAPI.commitTransaction();
      } catch (Exception e) {
        log.error("importPerson: Exception during Import Person", e);
        try {
          // Rollback Transaction
          signOnImportPersonAPI.rollbackTransaction();
        } catch (SignOnImportPersonAPIException se) {
          log.error("importPerson: Error while Rolling back transaction", se);
        }
      } finally {
```

```
      // Release Transaction
      signOnImportPersonAPI.releaseTransaction();
    }

    IExtUserDTO extUserDTO = PersonFactory.createExtUserDTO();
    extUserDTO.setPersonDTO(personDTO);

    IEUIPersonSearchOperationResult psor =
euiPersonSearchOperationContext.getEUIPersonSearchOperationResult();
    psor.setImportedPersonExtDTO(extUserDTO);

    log.debug("importPerson: Leaving importPerson method...");

    return psor;
  }

  /**
   * Implement Import Manager Operation and Import all the Supervisors chain
   * of the Person being imported
   *
   * @param euiOperationDTO       .
   * @param euiPersonSearchOperationContext
   *                              .
   * @param request               .
   * @param signOnImportPersonAPI
   * @param ldapApi
   * @return .
   * @throws EUIException .
   */
  public IEUIPersonSearchOperationResult importManager(IEUIEventImportManagerOperationDTO
euiOperationDTO,
                                                       IEUIPersonSearchOperationContext
euiPersonSearchOperationContext,
                                                       HttpServletRequest request,
                                                       ISignOnImportPersonAPI
signOnImportPersonAPI, ILDAPApi ldapApi)
      throws EUIException {
    return null;
  }

  /**
   * Implement any Custom Operation
   *
   * @param euiOperationDTO       .
   * @param euiPersonSearchOperationContext
   *
   * @param request               .
   * @param signOnImportPersonAPI
   * @param ldapApi
   * @return .
   * @throws EUIException .
   */
  public IEUIPersonSearchOperationResult performCustom(IEUIEventCustomOperationDTO
euiOperationDTO,
                                                       IEUIPersonSearchOperationContext
euiPersonSearchOperationContext,
                                                       HttpServletRequest request,
                                                       ISignOnImportPersonAPI
signOnImportPersonAPI, ILDAPApi ldapApi)
      throws EUIException {
    return null;
  }
}
```

Supported Time Zones

The supported time zone values when mapping time zones are listed below.

Table 8-18 Supported Time Zones

Time Zone Name	GMT Equivalent
Etc/GMT+12	(GMT-12:00) International Date Line West
Pacific/Apia	(GMT-11:00) Samoa
US/Hawaii	(GMT-10:00) Hawaii
US/Aleutian	(GMT-10:00) Hawaii Aleutian Daylight Time
US/Alaska	(GMT-09:00) Alaska
America/Tijuana	(GMT-08:00) Pacific Time (US and Canada); Tijuana
America/Chihuahua	(GMT-07:00) Chihuahua, La Paz, Mazatlan
US/Arizona	(GMT-07:00) Arizona
Canada/Mountain	(GMT-07:00) Mountain Time (US and Canada)
Canada/Saskatchewan	(GMT-06:00) Saskatchewan
US/Central	(GMT-06:00) Central America
Canada/Central	(GMT-06:00) Central Time (US and Canada)
America/Mexico_City	(GMT-06:00) Guadalajara, Mexico City, Monterrey
America/Bogota	(GMT-05:00) Bogota, Lima, Quito
Canada/Eastern	(GMT-05:00) Eastern Daylight Time (US and Canada)
America/Jamaica	(GMT-05:00) Eastern Time (US and Canada)
US/East-Indiana	(GMT-05:00) Indiana (East)
America/Antigua	(GMT-04:00) Atlantic Time (Canada)
Canada/Atlantic	(GMT-04:00) Atlantic Daylight Time (Canada)
America/Manaus	(GMT-04:00) Manaus
America/Santiago	(GMT-04:00) Santiago
America/Caracas	(GMT-04:30) Caracas
America/La_Paz	(GMT-04:00) La Paz (Bolivia)
America/Sao_Paulo	(GMT-03:00) Brasilia
America/Godthab	(GMT-03:00) Greenland
America/Argentina/Buenos_Aires	(GMT-03:00) Buenos Aires
America/Guyana	(GMT-04:00) Georgetown
America/St_Johns	(GMT-03:30) Newfoundland and Labrador
Atlantic/South_Georgia	(GMT-02:00) Mid-Atlantic
Atlantic/Azores	(GMT-01:00) Azores
Atlantic/Cape_Verde	(GMT-01:00) Cape Verde Islands
Etc/Greenwich	(GMT) Greenwich Mean Time: Dublin, Edinburgh,
Africa/Casablanca	(GMT) Casablanca, Monrovia
Europe/Sarajevo	(GMT+01:00) Sarajevo, Skopje, Warsaw, Zagreb
Europe/Brussels	(GMT+01:00) Brussels, Copenhagen, Madrid, Paris
Africa/Brazzaville	(GMT+01:00) West Central Africa
Europe/Amsterdam	(GMT+01:00) Amsterdam, Berlin, Bern, Rome,

Table 8-18 Supported Time Zones

Time Zone Name	GMT Equivalent
Europe/Belgrade	(GMT+01:00) Belgrade, Bratislava, Budapest,
Africa/Cairo	(GMT+02:00) Cairo
Europe/Helsinki	(GMT+02:00) Helsinki, Kiev, Riga, Sofia, Tallinn,
Europe/Minsk	(GMT+02:00) Minsk
Europe/Athens	(GMT+02:00) Athens, Bucharest, Istanbul
Asia/Jerusalem	(GMT+02:00) Jerusalem
Africa/Windhoek	(GMT+02:00) Windhoek
Africa/Harare	(GMT+02:00) Harare, Pretoria
Asia/Baghdad	(GMT+03:00) Baghdad
Africa/Nairob	(GMT+03:00) Nairobi
Europe/Moscow	(GMT+03:00) Moscow, St. Petersburg, Volgograd
Asia/Kuwait	(GMT+03:00) Kuwait, Riyadh
Asia/Tehran	(GMT+03:30) Tehran
Asia/Baku	(GMT+04:00) Baku
Asia/Muscat	(GMT+04:00) Abu Dhabi, Muscat
Asia/Yerevan	(GMT+04:00) Yerevan
Asia/Tbilisi	(GMT+04:00) Tbilisi
Asia/Kabul	(GMT+04:30) Kabul
Asia/Karachi	(GMT+05:00) Islamabad, Karachi, Tashkent
Asia/Yekaterinburg	(GMT+05:00) Ekaterinburg
Asia/Kolkata	(GMT+05:30) Chennai, Kolkata, Mumbai, New Delhi
Asia/Kathmandu	(GMT+05:45) Kathmandu
Asia/Dhaka	(GMT+06:00) Astana, Dhaka
Asia/Novosibirsk	(GMT+07:00) Novosibirsk
Asia/Colombo	(GMT+05:30) Sri Jayawardenepura
Asia/Rangoon	(GMT+06:30) Yangon (Rangoon)
Asia/Bangkok	(GMT+07:00) Bangkok, Hanoi, Jakarta
Asia/Krasnoyarsk	(GMT+08:00) Krasnoyarsk
Asia/Irkutsk	(GMT+09:00) Irkutsk
Asia/Kuala_Lumpur	(GMT+08:00) Kuala Lumpur, Singapore
Asia/Taipei	(GMT+08:00) Taipei
Australia/Perth	(GMT+08:00) Perth
Asia/Chongqing	(GMT+08:00) Beijing, Chongqing, Hong Kong SAR,
Asia/Seoul	(GMT+09:00) Seoul
Asia/Tokyo	(GMT+09:00) Osaka, Sapporo, Tokyo
Asia/Yakutsk	(GMT+09:00) Yakutsk
Australia/Darwin	(GMT+09:30) Darwin
Australia/Adelaide	(GMT+09:30) Adelaide
Australia/Hobart	(GMT+10:00) Hobart
Australia/Canberra	(GMT+10:00) Canberra, Melbourne, Sydney

Table 8-18 Supported Time Zones

Time Zone Name	GMT Equivalent
Australia/Brisbane	(GMT+10:00) Brisbane
Asia/Vladivostok	(GMT+10:00) Vladivostok
Pacific/Guam	(GMT+10:00) Guam, Port Moresby
Pacific/Guadalcanal	(GMT+11:00) Solomon Islands, New Caledonia
Pacific/Auckland	(GMT+12:00) Auckland, Wellington
Pacific/Fiji	(GMT+12:00) Fiji Islands
Pacific/Tongatapu	(GMT+13:00) Nuku alofa

Sample build.xml File

```
<?xml version="1.0" ?>
<project name="Sample Project" default="all" basedir=".">
- <!-- Main target -->
  <target name="all" depends="init,build,deploy" />
  <!- Set the following properties to point to appropriate folders -->
  <property name="rcwar.dir" value="<apps server path where Request Center application WAR
file is deployed>" />
  <property name=" javax.servlet.dir" value="<path where
jboss-servlet-api_3.0_spec-1.0.0.Final.jar is available in the app server>" />
  <property name="rcwar_webinf_classes.dir"value="${rcwar.dir}/WEB-INF/classes" />
  <target name="init">
    <property name="dirs.base" value="${basedir}" />
    <mkdir dir="${dirs.base}/out" />
    <property name="src" value="${dirs.base}/src" />
    <property name="out" value="${dirs.base}/out" />
  </target>
  <path id="classpath">
    <fileset dir="${rcwar.dir}" includes="*.jar" />
    <fileset dir="${javax.servlet.dir}"
includes="jboss-servlet-api_3.0_spec-1.0.0.Final.jar" />
    <pathelement path="${rcwar_webinf_classes.dir}" />
  </path>
- <!-- Compile Java Files -->
  <target name="build" depends="init">
    <javac srcdir="${src}" destdir="${out}" debug="true" includes="**/*.java"
classpathref="classpath" deprecation="true" fork="true" memoryinitialsize="256M"
memorymaximumsize="512M" />
  </target>
  <target name="deploy" depends="init">
    <copy todir="${rcwar_webinf_classes.dir}">
      <fileset dir="${out}">
        <include name="**/*.class" />
      </fileset>
    </copy>
  </target>
</project>
```