# HP OpenView Select Identity

For the Red Hat Enterprise Linux and
Microsoft Windows 2003 Operating Systems

Software Version: 4.0

# Connector Developer Guide

March 2006

invent

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# Preface

Welcome to the *HP OpenView Select Identity Connector Developer Guide*. This guide provides detailed information about how to develop a connector, which is a “plug-in” that enables OVSI to provision users and entitlements in third-party systems.

OVSI automates the process of provisioning and managing user accounts and access privileges across platforms, applications, and corporate boundaries. Key features of the OVSI system include the following:

Centralized Management – Provides a single point of control for the management of users and entitlements

Provisioning – Automates the creation, update, and deletion of accounts and entitlements on information systems across the enterprise

Administrative Delegation – Enables administrative rights to be distributed to multiple tiers of functional departments, customers, and partners

User Self-service – Enables end users to initiate access to Services, change passwords, set password hints, and update general identity information through a simple web-based client

Approval Workflow – Automates approval processes required to grant access privileges to users

Password and Profile Management – Manages and distributes password and user profile information across and between enterprise information systems

Audit and Reporting – Provides standardized reporting on actions and account activity

## About This Guide

The *HP OpenView Select Identity Connector Developer Guide* is designed to help you understand the architecture of connectors, including the J2EE Connector Architecture (JCA) and the OVSI architecture. It also details how to build a connector, from generating the skeleton code base to building the source files and installing the connector. The following chapters and appendices are included:

Chapter 1, Select Identity Connectors — Provides an introduction to the types of connectors supported by OVSI, the JCA, and the phases of connector development.

Chapter 2, Functional Requirements and Development Phases — Provides a high-level outline of the requirements to implement a connector.

Chapter 3, Connector SDK — Describes how to use the SDK (Software Development Kit) to quickly develop connectors for OVSI.

Chapter 4, Implementing a Select Identity Connector — Describes how to build a connector, including the connector interface methods to be implemented, and the requirements of the agent.

Chapter 5, Connector Tester Tool — Describes how to use the connector Tester Tool to certify the connector before it is deployed in OVSI.

Chapter 6, Installation and Deployment — Describes how to install and deploy a connector that has been built.

Chapter 7, HP Openview Select Identity Web Service — Describes the OVSI Web Service, which enables you to programmatically provision users in OVSI.

Chapter 8, Connector Migration — Provides detailed information on migrating OVSI 3.3.x connectors to OVSI 4.0.

Appendix A, Connector Template — Provides an overview of the dummy connector files, which are provided as examples for building your own connector.

## Audience

This document is intended for Java programmers. It is strongly suggested that the developer be familiar with the target resource for which the connector is being built. Familiarity with the Java environment (development tools, build tools, and so on) is a must for understanding this guide and successfully building a connector.

## Typographical Conventions

This guide uses the following typographical conventions:

| **Convension** | **Description** |
|---|---|
| **Bold** | Used for fuser interface elements (menus, buttons, and so on), new terms, and URLs. |
| *Italics* | Used for variables, book titles, and emphasis. |
| `Monospace` | Used for code examples, directory and file names, commands, and user input. |

## Product Documentation

The OVSI product documentation includes the following:

- Release notes are provided in the top-level directory of the HP OpenView Select Identity CD. This document provides important information about new features included in this release, known defects and limitations, and special usage information that you should be familiar with before using the product.
- For installation and configuration information, refer to the *HP OpenView Select Identity Installation Guide*. All installation prerequisites, system requirements, and procedures are explained in detail in this guide. Specific product configuration and logging settings are included. This guide also includes uninstall and troubleshooting information.
- Detailed procedures for deployment and system management are documented in the *HP OpenView Select Identity Administrator Guide* and OVSI online help system. This guide provides detailed concepts and procedures for deploying and configuring the OVSI system. In the online help system, tasks are grouped by the administrative functions that govern them.
- The *HP OpenView Select Identity My Identity User Guide* provides detailed information for end-users about the My Identity function, which allows users to manage their identity information.
- The *HP OpenView Select Identity Workflow Studio Guide* provides detailed information about using Workflow Studio to create workflow templates. It also describes how to create reports that enable managers and approvers to check the status of account activities.
- An *HP OpenView Connector Installation and Configuration Guide* is provided for each resource connector. These are located on the Select Identity Connector CD.
- The *HP OpenView Select Identity Attribute Mapping Utility User Guide* describes how to access the Attribute Mapping Utility, provides an overview to the utility's user interface, and describes how to define user and entitlements mappings. This guide is provided on the Select Identity Connector CD and is for use with the SQL and SQL Admin connectors only.
- The *HP OpenView Select Identity External Call Developer Guide* provides detailed information about creating calls to third-party applications. These calls can then be deployed in OVSI to constrain attribute values or facilitate workflow processes. In addition, JavaDoc is provided for this API. To view this help, extract the `javadoc.jar` file in the `docs/api_help/external_calls/Javadoc` directory on the HP OpenView Select Identity CD.
- If you need to develop connectors, which enable you to connect to external systems for provisioning, refer to the *HP OpenView Select Identity Connector Developer Guide*. This document provides an overview of the Connector API and the steps required to build a connector. This guide also describes the Web Service, which enables you to

programmatically provision users in OVSI, providing an overview of the operations you can perform through use of the Web Service, including SPML examples for each operation. The audience of this guide is developers familiar with Java.

JavaDoc is also provided for the Connector API. To view this help, extract the `javadoc.jar` file in the `docs/api_help/connectors/Javadoc` directory on the HP OpenView Select Identity CD. Also, an independent, web-based help system is available for the Web Service API. To view this help, double-click the `index.htm` file in the `docs/api_help/web_service/help` directory on the HP OpenView Select Identity CD.

# Contents

# 1 Select Identity Connectors

HP OpenView Select Identity (Select Identity) lets you connect to enterprise applications and resources to configure and manage users, groups, and entitlements. Access to resources from Select Identity occurs via **connectors**. Connectors are plug-in modules that are implemented as resource adapters, and are based on the J2EE Connector Architecture (JCA) framework.

Connectors synchronize the provisioning information between Select Identity and the resources that store identity information. That is, connectors replicate the changes performed in Select Identity to the resources and from the resources to Select Identity.

This chapter provides the high-level knowledge required to develop and implement connectors. Topics in this chapter include conceptual information about the framework, diagrams outlining the API and connector architectures, and descriptions of API classes and interfaces.

## Connector Types

Select Identity connectors can be unidirectional or bi-directional (duplex).

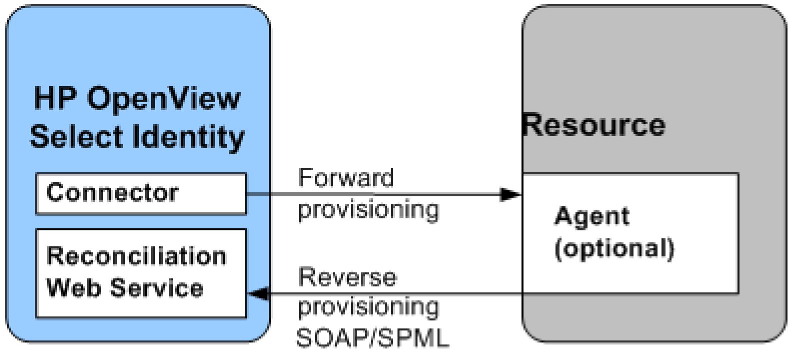
- Unidirectional connectors support only forward provisioning operations from Select Identity to the resource.
- Bidirectional connectors support reconciliation or reverse synchronization from the resource to the Select Identity server.

The connectors can also be classified as agent-less or agent-based connectors.

- Agent-less connectors interact with the resources directly through APIs or the remote protocols supported by the resource.
- Agent-based connectors make use of agents to communicate with the resource. Agents may be required based on various factors. For example, the resource does not provide remote APIs or resource-specific logic to be developed to reconcile the changes in the resource to OVSI.

The following diagram illustrates the flow of data between an OVSI agent-based connector and an agent:

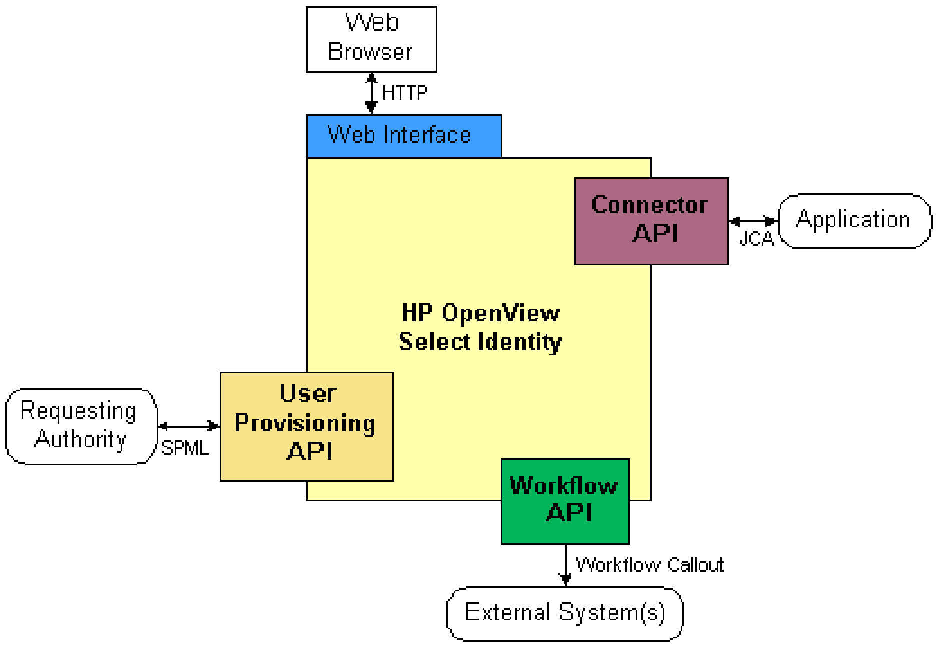
**Figure 1 Data Flow Between Agent-Based Connector and Agent**


HP OpenView Select Identity
Connector
Reconciliation Web Service
Forward provisioning
Reverse provisioning SOAP/SPML
Resource
Agent (optional)

## OVSI API Architecture

The following diagram illustrates the OVSI API architecture, showing the relationship of the Connector API to OVSI and the other APIs.

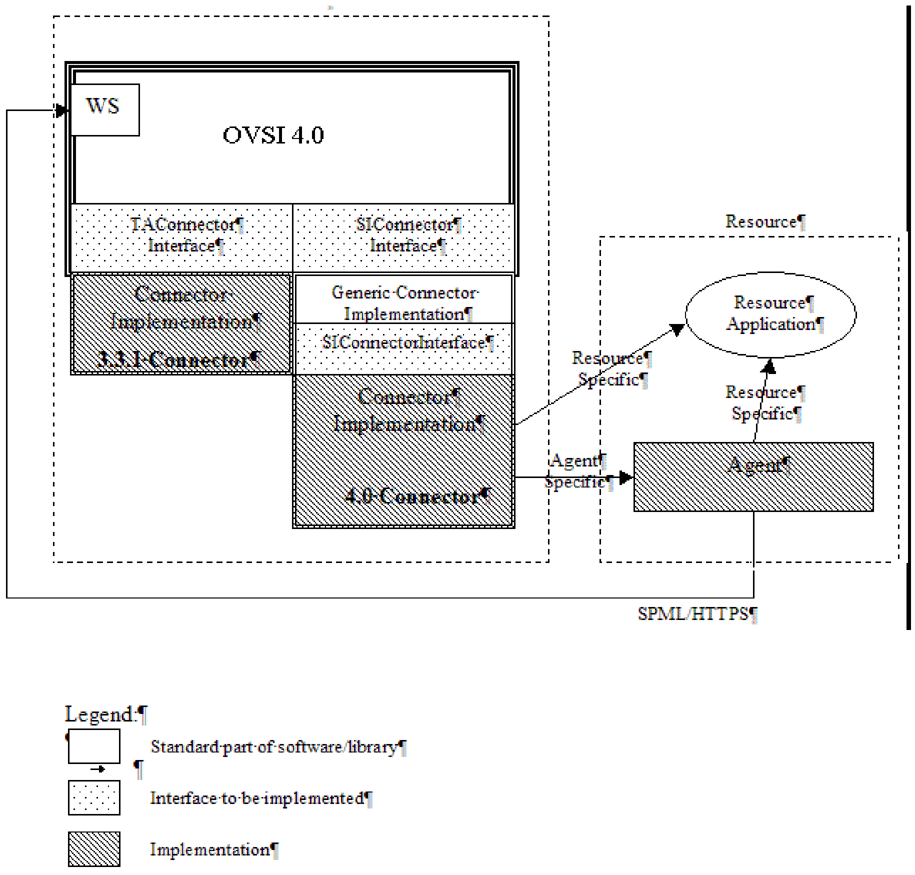
**Figure 2 OVSI API Architecture**



## OVSI Connector Architecture

The following diagram illustrates a high-level architecture of an OVSI connector:

**Figure 3 High-Level Architecture of an OVSI Connector**



The OVSI connector is J2EE Connector Architecture (JCA) compliant and is to be deployed as a RAR (Resource Archive) module on the OVSI server. The connector runs as a plug-in RAR module on the same application server as OVSI.

All developed connectors must implement the SIConnector interface and other JCA related interfaces. To simplify the development of the connector from the intricacies of JCA details, a Generic Connector implementation is provided which implements the required SIConnector and JCA interfaces. This generic connector implementation only requires the connector developers to provide the implementation of the SIConnectorInterface. For more details, see OVSI Connector API Interfaces and Classes on page 21.

In other words, there are two ways to develop a connector:

- Option 1: Implement the SIConnector interface and all JCA-related interfaces.
- Option 2: Use the Generic Connector implementation (which also provides a generic implementation for the SIConnector interface and JCA interface specification) and implement only the SIConnectorInterface interface.

As the picture shows above, it is also possible to use existing 3.3.x connectors with OVSI 4.0.

For a general overview of JCA, refer to the following web page:

http://java.sun.com/j2ee/white/connector.html

➤ OVSI implements only the Connector Management portion of the JCA specification.

## OVSI Connector API Interfaces and Classes

The following interfaces and classes are provided by the Connector API. Online help (Javadoc) is provided for this API on the HP OpenView Select Identity CD, in the `docs/api_help/connectors/Javadoc` directory:

- **SIConnector**

  Provides the top-level interface that maps identity information to a resource type. This interface is an extension of the JCA CCI Connection interface. This is the main interface to implement to build an OVSI connector to any resource.

- **SIConnectorFactory**

  Factory to create instances of connection handles for resources. The connection handle is an implementation of SIConnector.

- **SIUserModel**

  The interface that contains user information that is being provisioned into a resource.

- **SIJCAUserModel**

  Implementation of the SIUserModel interface. All user attribute information passed from OVSI to connectors is passed in an instance of this class.

- **EntitlementModel**

  Interface that contains the identity of an entitlement in the resource. Represents all types of entitlements on a resource including groups, roles, privileges, access control lists (ACLs), responsibilities, and any generic entitlement.

- **JCAEntitlementModel**

  Implementation of the EntitlementModel. Entitlement information passed from OVSI to connectors is passed in an instance of this class.

- **SIChangeLogModel**

  Class representing the changes that occurred in the resource. This contains ChangeLogEntry instances representing each specific change (add, modify, delete) made for each user.

  - **ChangeLogEntry**

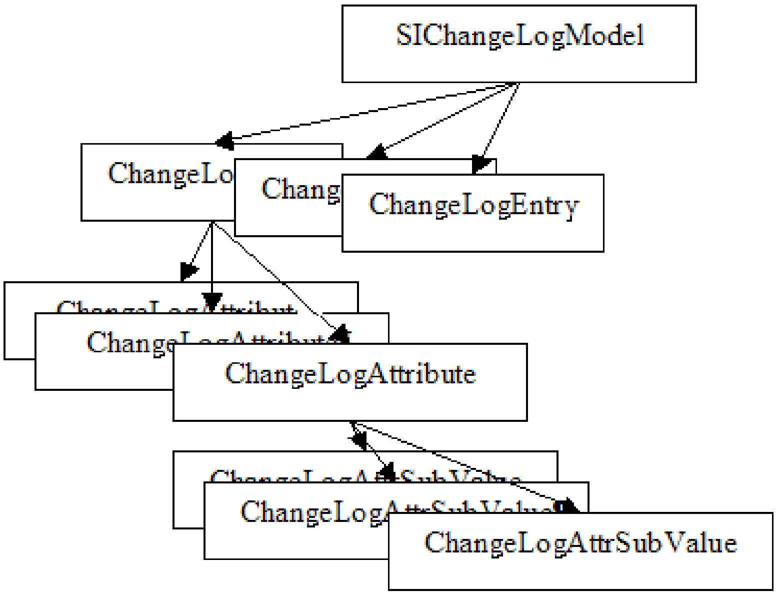
    Represents a change in resource for each user (example add/modify/delete). There can be multiple instances of this class in the SIChangeLogModel.

  - **ChangeLogAttribute**

    Models changes to user attributes. This class represents one attribute in the change log along with the operation performed.

  Following is a diagram illustrating the structure of SIChangeLogModel:

**Figure 4 SIChangeLogModel Structure**



- **ChangeLogAttrSubValue**

  Models changes to user attributes. This class represents each of the sub-values of an attribute along with the operation performed.

- **ChangeLogCursor**

  Models a cursor used with change detection. This class represents a cursor that models a check point to a previous call to getChangeLog() invoked on the connector.

- **TAConnectorRequestIntf**

  Provides a generic interface that sends a request to the connector. Use this interface if there is a requirement that cannot be supported by the existing provisioning API methods.

  — **TAConnectorRequest**

  Implements the TAConnectorRequestIntf interface. This is to be used as an extension to the existing API methods.

— **TAConnectorResponseIntf**

Provides a generic interface that stores responses from the connector. Use this interface if there is a requirement that cannot be supported by the existing provisioning API methods.

— **TAConnectorResponse**

Implements the TAConnectorResponseIntf interface. This is to be used as an extension to the existing API methods.

— **TAAttrValueBean**

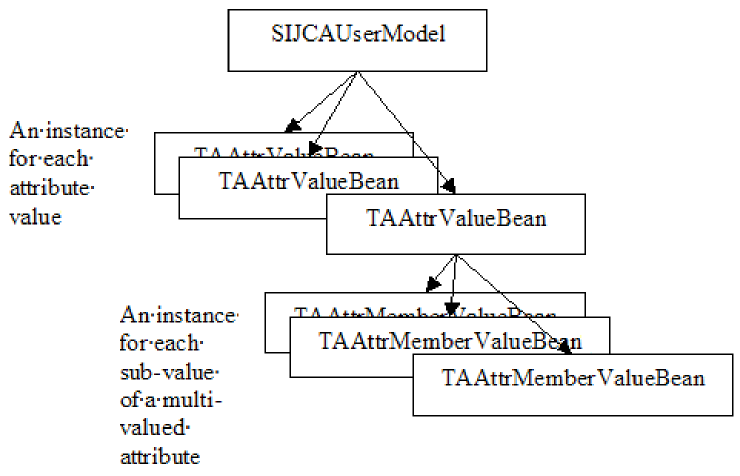
Main class containing the attribute value passed in SIJCAUserModel. This contains details on the attribute name. The attribute value could be single or multi-valued. This also contains attribute-level operations, which are useful in the case of a user modify operation.

— **TAAttrMemberValueBean**

Represents each of the multiple values of the attribute given in TAAttrValueBean.

Following is a diagram illustrating the contents of SIJCAUserModel:

**Figure 5 SIJCAUserModel Contents**



  - **TAConnectorParamBean**

    Describes a configuration parameter needed by the connector. Examples of such parameters include URLs or configuration parameters like wait time. OVSI retrieves a list of these beans to create a user interface to obtain values from the user.

  - **TAConnectorParameterFactory**

    Obtains connection-specific beans that contain connection parameter values.

  - **TAConnectorParamValueBean**

    An abstract class that represents the connection parameter values needed to establish a connection to a resource. It also contains all parameters needed to access the resource for user provisioning.

  - **TAStatus**

    Represents the status of an operation. This class contains the operation called as well as the actual operation performed by the connector on the resource, including any details. This is used as a return value of most of the methods on SIConnector.

- **EntitySupport**

  Defines the actions that can be performed on an entity, which is an object that is managed by OVSI, such as a user, group, role, or stage.

  - **RelationSupport**

    Specifies an association between identity object types, such as between a user and entitlement and vice versa.

  - **UserEntitySupport**

    Shows the level of support for user objects in the repository. In addition to supporting create, read, update, and delete tasks, UserEntitySupport specifies whether the password can be reset or changed in the resource.

- **SIConnectorInterface**

  Simplified version of the SIConnector interface that is used by the connector developer using the Generic Connector implementation.

SIConnectorInterface helps you focus on the efforts involved in provisioning to the resource while avoiding the details of JCA and the OVSI user model.

If you are implementing the simplified connector interface SIConnectorInterface, you will not be working with most of the above classes/interfaces. The main classes and interfaces you will be working with are: SIConnectorInterface, TAAttrValueBean, and TAAttrMemberValueBean.

## New Features in the 4.0 Connector Interface

The Connector API has been enhanced in OVSI version 4.0 to include support for the following additional features:

- Multi-valued attributes
- Large attribute values
- Addition/deletion/emptying of attributes
- Association/dissociation of entitlements in bulk
- Query criteria with multiple filters for entitlements retrieval
- Consolidated model for supporting different types of entitlements, such as groups, roles, privileges, ACLs and so on
- Connector SDK

  Software Development Kit, which can be used to easily develop OVSI connectors (see Connector SDK on page 43 for details). The SDK also contains the Connector Template, which provides a real example of connector implementation (see Connector Template on page 173 for details).

# 2 Functional Requirements and Development Phases

Before implementing a connector, ensure that you meet the high-level requirements outlined in this chapter. Then, review the development phases to ensure that the connector is robust and all questions are answered before implementation.

This chapter contains the following sections:

## Platform Support

The connector must be implemented and deployed as a plug-in module (J2EE Connector Architecture 1.0 resource adapter) on a J2EE-based application server hosting the OVSI server. Specifically, the connector is required to run in the following environment:

- **OVSI version**: 4.*x* or higher
- **Application server**: BEA WebLogic 8.1.4
- **Operating system**: Red Hat Linux 11
- **Database**: Oracle 10G

- **Resource platform**: Depends on the resource, though in general, the most recent version is required to be supported on the most commonly supported operating systems

➤ Not all combinations of these platforms and systems are supported by OVSI. The connector is required to run on a valid combination as published in the *HP OpenView Select Identity Release Notes*.

## Agent Communication, Security, and Logging

If an agent is implemented for the connector, the agent must be implemented as a continuously-running daemon or process that is deployed on the resource. It must handle requests sent from the connector and send responses to the connector synchronously. The connector must issue a request according to the resource's specifications. When the agent issues a request to OVSI's Web Service, it must use the SOAP protocol to send an SPML (version 1.0) payload over HTTP or HTTPS.

The connector is required to communicate with the resource (or the agent on the resource) over a secure channel, to ensure the security of the user data that is exchanged. The following encryption standards or protocols are required to be supported:

- 128 bit AES
- SSL

The connector must support logging at all levels to a configurable file that may be different from the one used by the OVSI server.

## Identity Objects and Schema Mapping

This section describes the identity objects (attributes) and operations that must be supported by the connector. It also describes the Attribute Mapping Utility, which can be used to retrieve and map resource attributes to OVSI attributes.

## Supporting and Mapping Identity Objects

The following identity objects must be supported by the connector:

- Users — This is the primary identity object that must be supported. The OVSI User object is mapped to the resource user, and the connector must support all attributes of the user that are supported by the resource, including single-valued and multi-valued attributes.
- Entitlements — Entitlements include organizational units, groups, entitlements, privileges, and access control lists on the resource. A user profile can be assigned to and de-assigned from an entitlement. OVSI entitlements are mapped to resource entitlements

An Attribute Mapping Utility is provided by OVSI to retrieve user and entitlement schema data from a resource and to map OVSI attributes to resource attributes. The utility can retrieve the complete schema from the resource, including user and group profiles and their relationships. The Attribute Mapping Utility is integrated and invoked from OVSI, so a common interface is provided. You can implement the connector to use the Attribute Mapping Utility. If so, user interface pages are required for displaying the resource schema and allowing resource attributes to be mapped to OVSI attributes.

The following is a list of user attributes that can be retrieved:

- Name
- Type (text or binary)
- Size
- Permissions (create, read, update, or delete)
- Operation support (user creation, user update, reset password, ignore all operations)
- Format/Pattern
- Description (rules to consider while providing values)
- Encryption Required
- Is Password
- Is Sensitive

- Is Multi-valued
- Entitlement relationships

The following is a list of entitlement attributes that can be retrieved:

- Name
- Type (Group, Role, Entitlement, Access Level, Privilege, or Resource profile)
- Size
- Format/Pattern
- Description (rules to consider while providing values)
- User relationships (whether the entitlement can be associated or dissociated with or from a user)

## Provisioning, Detecting Changes, and Post-provisioning

The following provisioning operations must be supported by the connector:

- User/Entitlements Discovery
- User Provisioning
- Entitlement Provisioning
- Change Detection
- Post Provisioning

### User/Entitlements Discovery

The following operations must be supported by the connector for User discovery:

- Retrieval of user IDs from the resource with filtering
- Retreival of details of a given user from the resource
- Retrieval of all entitlement IDs from the resource with filtering

## User Provisioning

The following provisioning operations must be supported by the connector:

- Add users — Add a new user object to the resource.
- Check for users' existence — Verify that the user exists on the resource.
- Modify users — Modify user attributes on the resource, including changing the value or number (single-valued or multi-valued) of the attribute, removing an attribute, or adding an attribute. If multi-valued attributes are supported by the resource, the connector must support the following modifications to that type of attribute:
  - Add one or more attributes
  - Remove one or more attributes
  - Replace an attribute value with a new value
  - Modify the attribute value
  - Add one or more sub-values
  - Remove one or more sub-values
- Modify entitlements of users — Add one or more entitlements to the user or remove one or more entitlements from the user. The association can be one-way or two-way:

  user —> entitlement, entitlement —> user

  This operation can associate a user with an entitlement on the resource or associate an entitlement with a user, or both.
- Get user details — Retrieve the details of a user from the resource.
- Reset password — Change the password of the user to a new password.
- Expire password — Set the password as expired on the resource or set the password of a user as un-expired on the resource.
- Delete user — Delete an existing user from the resource.
- Retrieve all entitlements associated with a user — Retrieve the IDs and types of all entitlements to which a user is assigned. The connector must also support filtering on entitlements to be retrieved.
- Retrieve all users associated with an entitlement — Retrieve the IDs of all users that are assigned to a given entitlement.

- Filter users to be retrieved — Filter the retrieved users based on criteria.
- Disable user — Disable the user on the resource. Following are examples of the result of this operation on the resource:
  - Disable
  - De-activate
  - Revoke account
  - Revoke login access
  - Delete all entitlements
- Enable user — Enable the user on the resource. Following are examples of the result of this operation on the resource:
  - Enable
  - Re-activate
  - Restore account
  - Grant login access
  - Add previously held entitlements back to user

## Entitlement Provisioning

The following provisioning operations must be supported by the connector:

- Add entitlement — Add a new entitlement object to the resource.
- Modify entitlement — Modify the entitlement attributes on the resource.
- Check for entitlement existence — Verify the existence of the entitlement on the resource.
- Get entitlement details — Retrieve the details of an entitlement from the resource.
- Delete entitlement — Delete an existing user from the resource.
- Add a child entitlement — Add an entitlement as a child of another entitlement with a link to the parent.
- Delete a child entitlement — Remove a parent-child relationship.
- Get children of an entitlement — Get IDs of all child entitlements of the given entitlement.

- Get parent entitlement — Get the ID of the parent entitlement of the given entitlement.
- Enable entitlement — Enable an entitlement on the resource.
- Disable entitlement — Disable an entitlement on the resource.

## Change Detection

Synchronizing OVSI with identity changes on the resource. This can be implemented in the following ways:

- Detection methods — The connector can support a pull model where the connector implements the SIChangeLogModel class. Either OVSI or a standalone program calls the connector to get the changes from the last call. The connector can also support a push model where the connector or the agent detects changes on the resource and prepares and sends an SPML Web Service request to OVSI over HTTP or HTTPS.
- Add user — Add a user to the resource.
- Modify user — Detect attribute value, single-value type, or multi-value type changes on the resource, remove an attribute, or add an attribute. If an attribute value change is detected, the connector must capture the new value. Depending on resource support, the connector is required to support multi-valued attribute modifications. If multi-values are supported, the following operations must be supported:
  - — Replace the complete multi-value
  - — Add one or more sub-values
  - — Remove one or more sub-values
- Password changes — Capture the new password of the user.
- Modify entitlements of user — Change the assigned entitlements including adding or removing one or more entitlements.
- Delete user — Delete a user in the resource.
- Disable user — Disable a user in the resource.
- Enable user — Enable a user in the resource.
- Move user — Move a user from one container to another. This is usually not detected as an attribute change. A container could be an organizational unit.

### Post Provisioning

This is the support of an interface that is called by the connector after a provisioning operation. The implementation of this interface is independent of the connector.

## Internationalization Compliance

All modules of the connector are required to support internationalization (I18N), which enables the complete connector to be localized to any foreign language without code changes. The following must be I18N-compliant:

- If the connector is implemented to use the Attribute Mapping Utility for schema mapping, all strings displayed on the Attribute Mapping Utility console, including attribute names and values
- All messages generated within the connector that are directly propagated to OVSI or combined with resource messages
- All values for user and entitlement attributes
- All user and entitlement attribute names
- If an agent is implemented, all text displayed on the agent console

## Performance and Scalability

The connector must support at least 100 provisioning transactions per minute. One transaction could mean one user addition or modification or deletion, and so on. Likewise, the connector must support at least 100 change-detection transactions per minute.

Regarding scalability, the connector must support one million users and one million entitlements, and is required to scale to support 10,000 resources.

# Development Phases

This section outlines the steps that are typically involved in the development of a connector. It is strongly recommended that you take the time to address each phase and plan for the connector's development carefully.

## Requirements Phase

Ensure that the resource supports a mechanism for user provisioning by external clients, in a secure and reliable manner. You must have an understanding of the underlying resource, including knowledge of the resource's tools and administration API. You may also need to obtain an administrative account that has privileges to provision.

Collect requirements for development, as follows:

1. Determine the requirements based on the resource system.
    - What identity information will be provisioned (users or other objects)?
    - What are the entitlements supported by the resource? Typically, resources support groups (groups or users), roles, access control levels (ACLs), privileges, and so on.
    - What are the supported attributes of the identity object based on the schema in the resource?
    - How is the schema retrieved from the resource?
    - How is the identity object addressed on the resource? This could be a DN (for LDAP-type of resources), an SSN, a user ID, hierarchical naming, and so on. This will be used as the primary key to address the identity object. The unique identifier can also be a combination of two or more attributes. In such a case, the identity object will be a combination of these attributes. The connector will build/parse this unique key within to address the identity.
    - How does the resource application support connectivity for external systems to provision identity information? This might mean accessing the system through API calls, RMI, JMS, a Web Service, a CLI such as telnet, ssh, and so on.
    - If the resource already supports a connector interface, how can you develop the OVSI connector leveraging the existing connector?

— Does the resource support an SDK or a development toolkit for administration, which might include JAR files or libraries for making calls to access and provision information?

— Are there security requirements to consider? Is SSL or any proprietary encryption/decryption information required between the connector and the resource?

— What are the performance requirements? How many objects can the resource support? How may entitlements? How many users can the connector create, read, update, or delete in a second, minute, or hour?

— What are the scalability requirements? How many connections does it support? Can the same connector support similar resources through configuration support for transactions?

— Does the resource support synchronous or asynchronous connectivity? It is possible that the resource cannot finish provisioning immediately and might finish the job at a later time. How does the connector know when the resource operation is done and how does it handle the response from the resource?

— Is the connector required to maintain state? If so, what is the required schema?

2 Determine access requirements for the resource.

— What are the addressing parameters such as TCP/IP address, port number, URL, and secure IDs?

— Is there authentication information (user ID and password)?

— Are there secure channel parameters?

— Does the connection pass through a proxy server or a firewall? If so, what are the parameters involved?

3 Determine the requirements for error reporting.

— What errors are supported by the resource?

— What kind of exceptions are reported to OVSI?

— What kind of errors in the resource are reported to OVSI?

— What are the recoverable and non-recoverable exceptions?

4 Determine the requirements for reverse synchronization.

— What changes to identity objects on the resource must be synchronized with OVSI. For example, if a user's password or address changes on the resource, is there a requirement that OVSI should be notified about this?

— How often do changes occur? Are they done in real time or as a batch job at the end of the day?

— How is information obtained from the resource? The resource might support an audit log of all changes on the resource, or it might support a log of all events that are triggered by someone like an administrator. How is this information retrieved from the resource? Should the connector support a pull model or a push model?

5 Determine the requirements for child transactions.

— Is an operation invoked on the resource that might trigger child operations within the resource?

— How should the connector notify OVSI of the status of child operations?

— What status information about child operations should be reported to OVSI?

— Is the operation "atomic" or a "best-effort?"

— How does the connector determine when the operation is done?

— Does the resource automatically rollback all previous successful child operations if one child operation fails?

6 Determine requirements for the policies supported by the resource.

— What are the policies for the identity objects? For example, the primary key of the identity object must be obtained from another external system.

— What are the attribute policies? For example, password policy might restrict in the size, content (maximum length, minimum length, maximum number of alphabetic characters, minimum number of numeric characters, and so on), encryption (one-way or two-way), and so on. What are the limitations on attribute size, masking, and other parameters?

## Design Phase

Design the connector you will implement following these guidelines:

1 Provide a high-level design of the approach taken for the provisioning process. Provide the following:

   — Mapping of functionality to be supported by the connector to the functionality supported by the resource.

   — Mapping of the OVSI schema to the schema (attribute information) supported by the resource. This is also referred to as the forward mapping.

   — The Connector API methods that are supported by the connector implementation.

   — Reverse mapping of the attribute information at the time of reverse synchronization.

   — How the implementation solves the cyclic update problem. For example, a change in object's information triggers an update on the resource, which might in turn trigger a reverse synchronization with OVSI for the same object, and vice-versa.

   — Use of the JCA framework in the design. Define how the connector makes use of the framework to address some of the requirements.

   — Resource product version. Provide any functionality changes between versions of the resource application.

2 Provide information about how to address the various requirements: synchronous versus asynchronous processing, scalability, performance, security, and so on.

   — Can the connector handle a large number of identity objects, such as users?

   — Can it handle large number of entitlements? Is caching, paging, batch loading, or file loading is used by the connector?

   — Can it handle large number of resources?

3 Define whether the connector is agent-based or agent-less.

   — Agent-based requires that an agent is installed on the resource with which the connector implementation interacts. The agent in turn interacts with the resource or the operating system. Reverse synchronization is generally possible with an agent-based solution. On the other hand, an agent-based implementation requires an installation effort and administration on the resource system.

— An agent-less connector requires complete out-of-box support for all provisioning operations by the resource or through an SDK.

— Address the advantages and disadvantages for both solutions.

## Implementation

Specific information about how to implement the JCA and Connector API methods is provided in Implementing a Select Identity Connector on page 51. This procedure provides a general overview.

1. Start with a sample application that can provision identity objects and perform entitlement assignment s on the identity objects in the resource.
2. Implement all of the required OVSI connector methods to create, read, update, and identity objects, leveraging the connector template. The main interface to implement is SIConnectorInterface.
3. Implement all entitlement association and dissociation methods.
4. Pick up all the Log and error strings from a Resource Bundle so that they can be localized.
5. If necessary, implement an agent to run on the resource machine.
6. Implement a secure way of communication between the connector and resource, and vice versa. If necessary, use certificates.
7. Implement modules to send SOAP messages containing SPML to the OVSI Web Service for reverse synchronization (password synchronization and identity object reverse synchronization).
8. If necessary, deploy the connector Tester Tool for testing the connector.
9. Use IDEs for the development and Apache ANT for build tools.
10. Use the JDK, J2EE, and third-party libraries for further development.

## Integration

Verify the connector's integration with OVSI as follows:

1 Verify that OVSI is able to look up and use the connector as a resource adapter to communicate with the new resource.
2 Create a Service that uses this resource.
3 Provision users in the Service, verifying that they are successfully created in the resource.
4 Associate and disassociate entitlements with users.
5 Verify integration with the OVSI Web Service for user provisioning through SPML payloads.

## Packaging

Package the connector as follows:

1 Include all libraries required by the connector in a RAR file.
2 If you are packaging the JAKARTA project JAR files (`commons-*.jar`), they should be of the same version as being used with OVSI.

   ➤ You need not package some of the generic JAR files that are available with OVSI.

3 Test the client for unit testing.
4 Determine any schema information (ddl, dml) needed by the connector.
5 Obtain all third-party software licenses and their installation procedures.

## Documentation

For future maintenance and distribution, compile the following information about the connector:

- Detailed documentation on the requirements and design
- User guides
- Configuration guides

- Functionality mapping document
- Schema (or attribute) mapping document
- Installation guides, for agent-less and agent-based solutions
- Javadoc
- Documentation of encryption/decryption used, port numbers of agent, size of agent foot print, and so on
- Requirements on the system administrator to install the agent on the resource
- Administration documents

# 3 Connector SDK

With OVSI 4.0, a connector SDK (Software Development Kit) is included that can be used to easily develop OVSI connectors. The SDK includes the following modules:

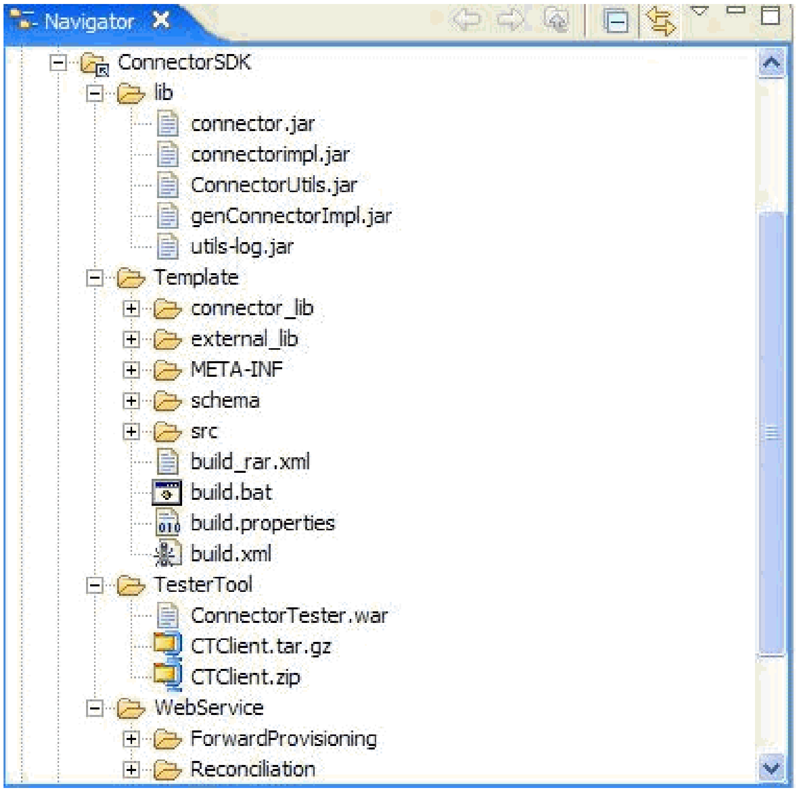
- Simplified Connector Interface
- XML Schema Handling
- Generic JCA Interface and Connector Implementation
- Connector Tester Tool
- Connector Template

The SDK provides a generic framework to quickly develop connectors for OVSI. You do not need to know details of JCA and RAR packaging to use this SDK. Most of the details of the Connector mapping file parsing and interpreting is transparent. You just need to focus on the actual connectivity to the resource and how to provision user/entitlement information into it.

The SDK includes a connector template to start the development and shows how this template can be customized to build your own connector.

The Connector SDK includes the following folders/files:

**Figure 1 Connector SDK Folder/File Structure**



Navigator

```
ConnectorSDK
  lib
    connector.jar
    connectorimpl.jar
    ConnectorUtils.jar
    genConnectorImpl.jar
    utils-log.jar
  Template
    connector_lib
    external_lib
    META-INF
    schema
    src
    build_rar.xml
    build.bat
    build.properties
    build.xml
  TesterTool
    ConnectorTester.war
    CTClient.tar.gz
    CTClient.zip
  WebService
    ForwardProvisioning
    Reconciliation
```

Following is a brief description of the contents of the SDK:

| Folder | File | Description |
|---|---|---|
| `Lib` | | Contains the library Jar files used to develop your connectors. |
| | `Connector.jar` | Main Connector interface Jar that includes SIConnector interface, SIUserModel interface and related interfaces. |
| | `connectorimpl.jar` | Implementation classes for SIUserModel, XML schema loader and so on. |

| **Folder** | **File** | **Description** |
|---|---|---|
| Lib | `genConnectorImpl.jar` | Generic Implementation of the SIConnector interface along with JCA interface implementation. This provides the simplified connector interface SIConnectorInterface. |
| | `utils-log.jar` | Some utility classes include common log implementation. |
| | `ConnectorUtils.jar` | SPML utility classes. |
| `Template` | | Contains the connector template. A fully compilable and deployable dummy connector implementation that can be customized to write your own connectors easily. This uses the generic connector implementation and implements the simplified connector interface. |
| `TesterTool` | | Contains a WAR file that includes a tester servlet that can be deployed and used to test any OVSI connector. Also included is a `tar.gz` file (for UNIX) that contains the tester tool client and scripts to invoke the tester. Several sample scripts are included that can be used to send all kinds of provisioning operations to the connector. |
| `WebService` | | This includes sample SPML requests for webservice-based provisioning into OVSI. It has two folders for ForwardProvisioning samples and Reconciliation samples. |

## Simplified Connector Interface

In addition to the existing SIConnector interface, a simplified interface is introduced in the connector framework with OVSI 4.0. This can be used to quickly develop connectors for OVSI.

The following diagram illustrates the new architecture.

**Figure 2 Simplified Connector Interface Architecture**

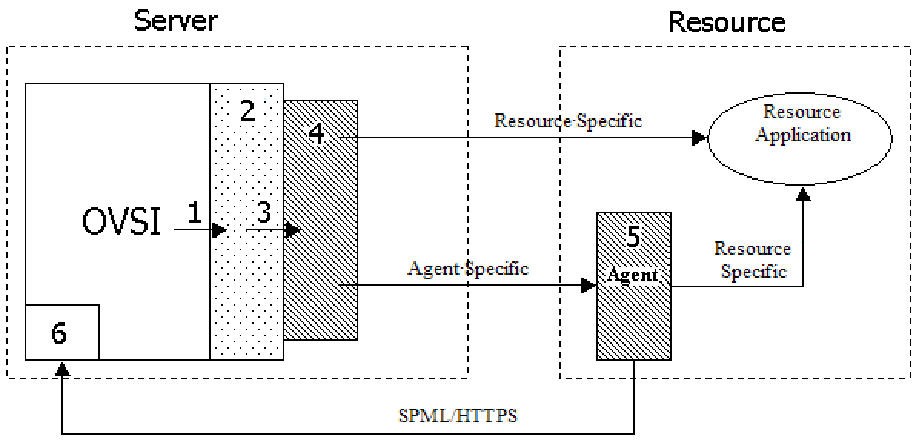


Figure 4 is annotated as follows:

1 OVSI

2 Generic Connector Implementation Library

3 SIConnectorInterface

4 Resource-specific part of the connector that communicates directly with the resource or with the agent

5 Agent implementation (for agent-based connectors)

6 OVSI Web Service

Highlights of the Simplified Connector interface are described in the following sections.

## XML Schema Handling

The XML schema mapping file is pre-processed and resource attributes are provided in the simplified interface. Therefore, you do not need to understand the structure of the XML file and how to parse it.

Advanced users can still access the schema mapping. A java image of the XML file data is passed to the connector implementation and can be used to get details of the mapping.

## Generic JCA Interface and Connector Implementation

All the required JCA class/interface implementations are provided. You only need to focus on the resource interface. This eliminates the need to spend time trying to understand JCA architecture and data flow.

A single jar file `genConnectorImpl.jar` is provided with all the required Generic Connector implementation files. The `genConnectorImpl.jar` file needs to be packaged with the connector along with your resource-specific part of the connector.

You also need to implement the simplified interface SIConnectorInterface, which contains all provisioning operations.

## Connector Tester Tool

The SDK includes a Tester Tool that can be used to test and certify your connector before you deploy it in OVSI.

After you build the connector, you can use the connector tester tool to test provisioning operations. The tool consists of the following:

- A standalone servlet WAR module, which invokes the connector directly.
- Sample scripts with SPML requests for all provisioning operations.
- A simple HTTP client to send requests to the tester servlet.

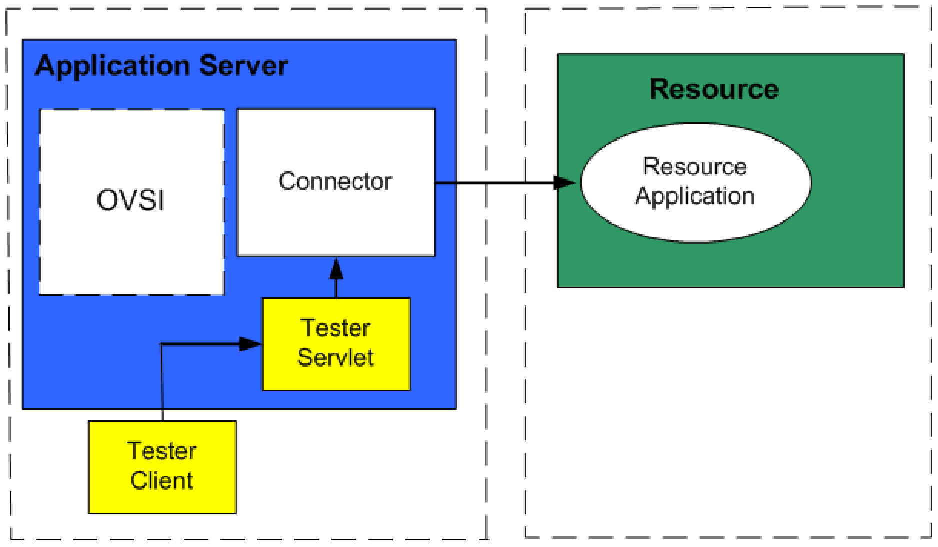
You use the client to run the SPML scripts, which send SPML requests to the servlet. These SPML requests include instructions for forward-provisioning operations. The servlet converts SPML requests to Connector API requests and invokes the connector. The connector then sends the results or errors back to the servlet. All components of the tester tool are deployed or installed on the application server where the OVSI server and target connector reside.

To use the tester tool, you must deploy a WAR file on the application server (in addition to your connector implementation). Then, you can issue SPML requests to the servlet using the client. The servlet sends the requests to the connector, to verify that it can receive requests and issue responses.

See Connector Tester Tool on page 105 for details.

The following diagram shows how the Tester Tool is used.

**Figure 3 Connector Tester Tool**



Some highlights of the Tester Tool are:

- Standalone connector development

  The servlet can be deployed in the application server along with the connector and testing can proceed without OVSI. The tester servlet directly talks to the connector and this gives the advantage of pre-certifying the connector before it is staged to OVSI.

- Test Scripts

  The Tester Tool provides many scripts with SPML requests for all operations that can be done through OVSI.

- Performance and Scalability tests

  The Tester client can be used to perform bulk/iterative operations to regression test the connector. Multiple clients can also be used to drive one connector.

## Connector Template

The SDK comes with a connector template named Dummy connector. This is a fully implemented connector and serves as a real example of connector implementation. The only missing part is the resource interaction which is different for different resources.

The Dummy connector implements the simplified interface and can be used as a reference for developing connectors. See Connector Template on page 173 for details.

# 4 Implementing a Select Identity Connector

This chapter describes how to build a connector, including the connector interface methods to be implemented and requirements of the agent.

This chapter contains the following sections:

- Development Requirements
- Steps to Implement a Connector for Select Identity
- Building a Connector for Forward Provisioning
- Building a Connector for Reverse Provisioning
- Mapping OVSI Attributes to the Resource Schema
- Some Coding Guidelines

## Development Requirements

You must have an understanding of the Java Developer Kit (JDK), version 1.4, and be familiar with the JCA, version 1.0. In addition, OVSI provides a Connector SDK that you can use to write your own connectors (see Connector SDK on page 43 for details). You can download the JCA specification from the following page:

**http://java.sun.com/j2ee/connector/download.html**

Also, refer to **http://e-docs.bea.com/wls/docs81/jconnector/index.html** if you are creating a WebLogic connector.

For information about the J2EE APIs, including those for connectors, refer to **http://java.sun.com/j2ee/1.4/docs/api/index.html**.

For an overview of the OVSI Connector APIs, see OVSI Connector API Interfaces and Classes on page 21.

When implementing a connector using the J2EE Connector APIs and the Select Identity Connector APIs, it is expected that the operations on the connector instances are called within transactions and from multiple threads. Also, the connectors must implement adequate synchronization to prevent data corruption.

For the development environment, the following tools are necessary:

- Java Integrated Development Environment (IDE) — Any Java IDE supporting JDK 1.4.1 or later, such as Eclipse 3.0, is required.
- Build tool — It is recommended that you use Apache ANT 1.6 or later.
- Connector SDK

## Steps to Implement a Connector for Select Identity

The following steps describe how to implement a connector for Select Identity:

- Step 1: Start with the Connector Template
- Step 2: Gather Connector Details
- Step 3: Working with the Connector Template

### Step 1: Start with the Connector Template

The connector template and details of files included are explained in Connector Template on page 173. This is a starting point to build your own connector for forward provisioning and also for communicating with an agent, in the case of an agent-based connector.

The template includes build files, a property file, library Jar files, an XML mapping file, and a dummy implementation of the SIConnectorInterface. You need to gather your connector-specific information to be able to work with the template.

### Step 2: Gather Connector Details

Before starting to write your own connector, you must collect the following information:

## Resource Details

- Connection parameters

  Details needed to access the resource and perform the provisioning operations, such as IP address, port, admin account, password etc.

  Along with the names of these parameters, it is required to have further details about these connection parameters such as displayName, default Value, min-length, max length, required or not, encryption needed or not. This information is needed to populate the GUI page that is integrated with SI where you provide values for these connection parameters at the time of deploying the resource.

- Max number of supported connections
- Resource EIS details

  Such as Name, Provider, Version. This is needed as part of the RAR definition.

## Resource Schema Details

- Name and details of resource user attributes:

  Attribute names such as UserName, Email, Password, CN, SN, GivenName and so on.

  The resource may support and store attributes in one of many ways. Following are some examples:

  — Physical attributes — The resource may support physical attributes that can be set with values. Resources that support physical attributes include LDAP servers and SQL databases. In this case, the connector can directly assign the Select Identity attribute value to the resource attribute value.

  — An abstraction of attributes — Some resources do not support physical attributes, such as UNIX and Windows systems. For these resources, the connector can define an intermediate attribute that is used to store the values defined by OVSI.

  — API — The resource may support an API to perform provisioning operations. Such resources include IBM Tivoli Access Manager and Netegrity SiteMinder. In this case, the connector must call the appropriate API method and pass the attribute value to the method.

Also needed are further details about each attribute such as: default value, display name, min-length, max-length, required or not.

- Entitlements supported

### Connector Code-Related Details

- Connector Name
- Connector Short Name — Used as a prefix for re-naming the template files
- Java Package name

## Step 3: Working with the Connector Template

Once you have the details on developing the connector, as listed in the above section, you can use the Connector Template to customize and build your connector.

Following are some of the main steps involved. See each step for details:

1. Prepare the Connector Template Files
2. Check the Library JAR Files
3. Implement the Connector

### 1. Prepare the Connector Template Files

Complete the following steps to prepare the Connector Template files:

a Create folders for the connector template files.

We will assume the following sample values for the connector parameters:

| **Parameter Name** | **Parameter Value** | **Description** |
|---|---|---|
| Connector `src` Folder | MainDir | This is the main folder with all the connector-related files. |
| Connector Name | My Sample Connector | A descriptive name for the connector. |

| **Parameter Name** | **Parameter Value** | **Description** |
|---|---|---|
| Connector Short Name | com.my.sample | |
| Connection Parameters | hostName<br>port<br>userName<br>password | |
| Max # of connections | 10 | |
| Resource User Attributes | userId<br>password<br>directory<br>firstName<br>lastName<br>middleName<br>fullName<br>department | userId is the primary Key in the resource. |
| Resource Entitlement ID | groupId | groupId is the primary Key in the resource. |

— Create a folder by the name `MyConnector` and copy the connector template files under the name `dummy` into this new folder.

— Create folders `MainDir/src/com/my/sample` and move the files under `src/com/hp/ovsi/connector/dummy` to this folder.

— Go to `MainDir/src/com/my/sample` and rename the files `DummyConnector.java` to `MyConnector.java` and `DummyParamResources.properties` to `MyConnectorParamResources.properties`.

b Edit the Connection Properties file.

— Edit `MyConnectorParamResources.properties` so that the connection parameters are defined according to your resource requirements.

Each connection parameter has some properties associated with it as shown below for the "hostName" connection parameter:

hostName-displayName=Host Name

hostName-defaultValue=MyHost

hostName-helpString=Host name of the server

hostName-minLength=1

hostName-maxLength=80

hostName-pattern=[.]+

hostName-required=false

hostName-tipString=

hostName-type=java.lang.String

hostName-encryptValue=false

— Provide the details for all connection parameters in this file.

— Finally, set the order of the connection parameters to appear in the property `paramOrder` at the end of this file.

  Each connection parameter is separated by commas. This is the order in which OVSI shows the connection parameters when the resource is being deployed/modified/viewed.

c Edit the Connector Implementation file.

  The connector main code is to be started from `MyConnector.java` which is explained in step 3. Implement the Connector on page 59. Edit this file to change all occurrences of the word `DummyConnector` in this file to `MyConnector`.

  Change the package name to `com.my.sample`.

d Edit the XML Mapping file.

  Go to `MainDir/schema`, and rename `DummyConnectorMapping.xml` to `MyConnectorMapping.xml`.

  This file contains the mappings of user and entitlement attributes from the Select Identity model to the resource schema. For example, if you called an attribute `userid` in the resource, you may have called it **User Name** in Select Identity. This mapping must be given even if the names are the same.

  As explained in Resource Schema Details on page 53, there may not be any physical attribute on the resource that you can map to, but just have an API. In such cases, you still need to come up with a set of logical attributes for the user and use this mapping file to map onto these logical attributes. In your connector code, you take these logical attribute names and provision the user with their values.

Each user attribute mapping is specified in the objectClassDefinition with name "`SIUser`", using an attributeDefinitionReference shown as follows:

```
<attributeDefinitionReference name="User Name" required="true"
concero:init="true" concero:tafield="User Name"
concero:resfield="userName" concero:isKey="true" />
```

The above line in the XML mapping file has the following meaning:

| `name` | Name of this particular mapping. |
|---|---|
| `required` | Specifies whether this attribute is required or an optional attribute. The values it can take are "true", "false". |
| `concero:init` | Specifies whether this attribute is needed during the creation of the user. "true" means this is needed, "false" means not needed. |
| `concero:tafield` | Name of OVSI attribute. |
| `concero:resfield` | Name of the resource attribute or the logical attribute. |
| `concero:isKey` | Specifies whether this is the identifying attribute of the user in the resource. This can be "true" only on one mapping. |

You can have a combination of OVSI attributes mapped onto the same resource attribute. In this case, the tafield will have a combination. Following is another example:

```
<attributeDefinitionReference name="Full Name" required="false"
concero:tafield="[First Name] [Middle Name] [Last Name]"
concero:resfield="fullName"/>
```

In this example, you enclose the OVSI attribute names in square brackets to prepare the combination.

e Edit the `ra.xml` file.

Go to the `MainDir/META-INF` folder and edit the file `ra.xml`, to change the Resource adapter-specific parameters. Change the following:

| **Change** | **To** |
|---|---|
| display-name value | My Sample Connector |
| vendor-name value | Name of your company |
| eis-type value | Type of the Resource EIS. Example UNIX box, My Application, and so on |
| Version value | Resource EIS version |
| `eis/DummyConnector-ParamFactory` | `"eis/MyConnector-Param Factory"` |
| `com.hp.ovsi.connector.dummy.DummyConnector` | `"com.my.sample.MyConnector"` |
| `com/hp/ovsi/connector/dummy/DummyParam Resources.properties` | `"com/my/sample/MyConnector ParamResources.properties"` |

f Edit the `weblogic-ra.xml` file.

If you are going to use BEA WebLogic to deploy this connector, go to `MainDir/META-INFO`, edit the file `weblogic-ra.xml`, and edit this file:

| | |
|---|---|
| `eis/DummyConnector` | `"eis/MyConnector"` |
| initial-capacity value | 0<br>This is the number of connections to be open when the connector is deployed. Typically this is 0 and will increase upon demand. |

g Edit the `build.properties` file.

Edit the `build.properties` file to enter all the packaging-related information:

| | |
|---|---|
| `connector.build.dir` | `/tmp`<br>This is the folder where you would like the build files to be placed. |
| `connector.pkg` | `com/my/sample` |
| `connector.rar.file` | `MyConnector.rar` |
| `schema.jar.file` | `MyConnectorSchema.jar` |
| `connection.params.props.file` | `MyConnectorParamResources.properties` |
| `connector.name` | `My Sample Connector` |
| `connector.version` | 1.0.1 |

## 2. Check the Library JAR Files

Make sure you have the latest versions of the jar files under the following folders:

- `connector_lib`
- `external_lib`

## 3. Implement the Connector

- You start with writing code in `MyConnector.java`.

  The files as they are prepared in the previous section should be ready to compile. First, make sure you can compile the source using the Apache ANT tool for the `build.xml file` in the `MainDir` directory and see if you can output the following files:

  — `MyConnector.rar`

  — `MyConnectorSchama.jar`

- Verify that `MyConnector.rar` contains `MyConnector.class`, `ra.xml`, `weblogic-ra.xml`.

- Verify that `MyConnectorSchema.jar` contains `MyConnectorMapping.xml`.

## Sample SPML Requests for Reconciliation

There are two types of SPML requests based on the type of resource. The resource could be an authoritative resource or non-authoritative.

### Authoritative Reconciliation SPML Requests

This section shows sample authoritative reconciliation SPML requests for the following actions:

- Add user
- Delete user
- Modify user

#### Add User

Following is a sample SPML request for an auth-add reconciliation request:

Note the following:

- keyFields must be <resourceName>_KEY
- all attribute names are OVSI resource attribute names or the names given in the concero:tafield in the XML mapping file

```
            <addRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP71</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>LDAP71_KEY</value>
            </attr>
            <attr name="urn:trulogica:concero:2.0#reverseSync">
                <value>true</value>
            </attr>
            <attr name="urn:trulogica:concero:2.0#taUserName">
                <value>WSu7301</value>
            </attr>
            <attr name="urn:trulogica:concero:2.0#taResourceKey">
                <value>WSu7301</value>
            </attr>
        </operationalAttributes>

        <attributes>
            <attr name="UserName">
                <value>WSu7301</value>
            </attr>
            <attr name="Email">
                <value>user.email@hp.com</value>
            </attr>
            <attr name="State">
                <value>TX</value>
            </attr>
            <attr name="FirstName">
                <value>Abigail</value>
            </attr>
            <attr name="LastName">
                <value>Anderson</value>
            </attr>
            <attr name="Employee ID">
                <value>HP</value>
            </attr>
            <attr name="Zip">
                <value>75000</value>
            </attr>
        </attributes>
    </addRequest>
```

### Delete User

Following is a sample SPML request for auth-delete recon request:

Note the following:

- keyFields must be <resourceName>_KEY
- resource key value of the user is given in the identifier section of the SPML request

```
     <deleteRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP71</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>LDAP71_KEY</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7224</id>
            </identifier>
        </deleteRequest>
```

## Modify User

Following is a sample SPML request for auth-delete recon request:

Note the following:

- keyFields must be <resourceName>_KEY
- resource key value of the user is given in the identifier section of the SPML request
- all attribute names are SI resource attribute names or the names given in the concero:tafield in the XML mapping file
- only the mapped attributes must be passed in the request

```
     <modifyRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
```

```
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP71</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>LDAP71_KEY</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7212</id>
            </identifier>

            <modifications>
                <modification name="FirstName" operation="replace">
                    <value>ANNA</value>
                </modification>
                <modification name="LastName" operation="replace">
                    <value>ALENDALE</value>
                </modification>
                <modification name="Address 1" operation="replace">
                    <value>1525 EAST GATE DRIVE, WITCHITA</value>
                </modification>
                <modification name="Zip" operation="replace">
                    <value>62005</value>
                </modification>
                <modification name="State" operation="replace">
                    <value>KS</value>
                </modification>
            </modifications>
        </modifyRequest>
```

## Non-Authoritative Reconciliation SPML Requests

Following are sample requests from a non-authoritative resource. A non-authoritative resource can only send changes to user entitlements in OVSI or delete service membership.

This section shows sample non-authoritative reconciliation SPML requests for the following actions:

- Add user entitlements
- Delete service membership
- Change user entitlements

### Add User Entitlements

Following is a request to add entitlements:

Note the following:

- keyFields must be <resourceName>_KEY
- resource key value of the user is given in the identifier section of the SPML request

```
     <addRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP70</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>LDAP70_KEY</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#taResourceKey">
```

```
                    <value>WSu7221</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7221</id>
            </identifier>

            <attributes>
                <attr name="urn:trulogica:concero:2.0#groups">
                    <value>HR Managers</value>
                    <value>PD Managers</value>
                </attr>
            </attributes>
        </addRequest>
```

## Delete Service Membership

Note the following:

- keyFields must be <resourceName>_KEY
- resource key value of the user is given in the identifier section of the SPML request

```
     <deleteRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP70</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>LDAP70_KEY</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7235</id>
            </identifier>

        </deleteRequest>
```

## Change User Entitlements

Note the following:

- keyFields must be <resourceName>_KEY
- resource key value of the user is given in the identifier section of the SPML request

```
    <modifyRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP70</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>LDAP70_KEY</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7233</id>
            </identifier>

            <modifications>
```

```
                <modification name='urn:trulogica:concero:2.0#groups'
operation='delete'>
                    <value>HR Managers</value>
                </modification>

                <modification name='urn:trulogica:concero:2.0#groups'
operation='add'>
                    <value>$UNIX2</value>
                </modification>
            </modifications>

        </modifyRequest>
```

## Building a Connector for Forward Provisioning

To build a connector that performs forward provisioning, which is the process of provisioning users and their entitlements on the resource, you can implement an agent-less or agent-based connector, as described in the following sections.

### Agentless Forward Provisioning

This section provides details on all the required methods of implementing SIConnectorInterface. This part is common for both agent-based and agent-less implementations. The only difference is that for agent-based implementation, you implement the methods so that you communicate with your agent, where as in agent-less implemenation you need to directly provision into the resource.

To build an agent-less connector, follow these guidelines:

1. Implement a connector for OVSI as described in Steps to Implement a Connector for Select Identity on page 52.
2. Implement the SIConnectorInterface interface.

   The generated template includes a skeleton implementation of SIConnectorInterface. You must expand each of the methods in the generated template to communicate with the resource and perform the provisioning process.

You *must* implement the following methods:

- doTest()

  *Purpose:* Performs a connectivity test.

  *Usage:* This is called when a new resource is deployed or an existing resource is modified in Select Identity and the **Test and Submit** button is clicked.

  *Implementation:* The connection parameters bean instance called mConInfoBean contains values for all parameters. Using this connection information, try to establish a connection to the resource and validate the connection information.

- isUserExists(String keyField, String keyValue, boolean keyExistsFlg)

  *Purpose:* Checks for the existence of a user.

  *Usage:* This method is used to check if a user is present in the resource. The keyField argument identifies the attribute that is marked as key in the attribute mapping and keyValue contains the value of this key field.

  In most cases, the key field of a user in Select Identity is the same as the key field of the user in the resource. However, in certain cases, they might be different and sometimes indeterminate until the user is actually created in the resource.

  The createUser() method should get the user's key field value after the user is created in the resource and return it the value to the caller (and eventually OVSI). In this case, the keyExistsFlg argument will be true, which means that the user was created earlier, after an initial successful user creation. You can use this to determine if this method is being called for the first time or to verify if the user exists in the resource.

  *Implementation:* Using the key value to check if the user exists in the resource and return the result.

- createUser(String keyField, String keyValue, String passwd, Map attrMap)

  *Purpose:* Creates a user.

  *Usage:* This method is called to add a user to the resource.

*Implementation:* Create the user account in the resource using the given key value, password, and attribute name-value pairs. All of the attribute name-value pairs are passed in the attrMap argument. The name of the attribute is the resource attribute name as specified in the mapping file. The value is in the form of Object[] representing multiple sub-values of the attribute, if any. For single-valued attributes, only the first element of the array is populated.

The following sample code can be used to read attribute values:

```
String lAttrId = null;

Object[] lAttrValue = null;

Iterator lIter = attrMap.keySet().iterator();

while (lIter.hasNext())

{

 lAttrId = (String) lIter.next();

 lAttrValue = (Object[]) attrMap.get(lAttrId);

 // …

}
```

Use the `lAttrValue` to set the value of the attribute for creation. If the resource supports multi-valued attributes, use the `Object[]` to set all of the multiple values. If not, you may either set the first one in the array or combine them into a single value.

After a user is successfully created, the effective key value of the user should be returned. This may be the same as the one passed in by Select Identity. Select Identity will save it and pass it back to the connector for subsequent operations on the same user.

- updateUser(String keyField, String keyValue, Map attrMap)

  ➤ The keyValue argument that is passed will be the new key value that is returned if the user is successfully created.

  *Purpose:* Updates a user.

  *Usage:* This method is called when user's attributes are modified.

*Implementation:* The attributes of the user to be modified are given in attrMap with values as instances of TAAttrValueBean. The Operation field in the TAAttrValueBean defines what must done on each of the attributes passed in the attrMap: replace, add, delete, or modify, where modify could mean the addition or deletion of sub-values.

*Details of TAAttrValueBean for a user modify operation:*

The following examples highlight the user modify operation and detail of the contents of `TAAttrValueBean` passed in the above method

The following abbreviations are used in the examples provided in the tables:

`TAAttrValueBean=av`

`TAAttrMemberValueBean=amv`

Example 1: User Modify

| **User Modify Operation Details** | **Contents of TAAttrValueBean** |
|---|---|
| Attribute a1 changed its value to a new value | a1 - av=[OP_REPLACE, List=[{--. a1sv2}]]<br>(a1sv2 is the new value.) |
| Attribute a2 has a new subvalue | a2 - av=[OP_MODIFY, List=[amv={OP_ADD, a2mv3}]]<br>(This adds subvalue a2mv3 to the two subvalues.) |
| Attribute a3 has not changed | a3 - av=[OP_NOCHANGE, List=[amv={---,a3sv1}]]<br>(only given for required fields) |
| Attribtue a4 has a new attribute added | a4 - av=[OP_ADD, List=[amv={---,a4sv1}]]<br>(This adds a new attribute.) |
| Attribute a5 is deleted | a5 - av=[OP_DELETE, List=null]<br>(An attribute in Select Identity is deleted.) |

Example 2: User Modify

| **User Modify Operation Details** | **Contents of TAAttrValueBean** |
|---|---|
| Attribute a1 is deleted | a1 - av=[OP_DELETE, List=null] |

| **User Modify Operation Details** | **Contents of TAAttrValueBean** |
|---|---|
| Attribute a2 has changed its value to a new value | a2 - av=[OP_REPLACE, List=[amv={---, a2sv4}]<br>(The value changed to a single subvalue.) |
| Attribute a3 is nullified | a3 - av=[OP_REPLACE, List=[amv=null]]<br>(only given for required fields) |
| Attribtue a4 is emptied | a4 - av=[OP_REPLACE, List=[amv={---,""}]]<br>(Use "" as a way to empty the value.) |

Please note that all the attributes marked in the Service are required and are sent no matter if their value has changed. If the value has not changed, the contents of TAAttrValueBean for those attributes will have an operation type of `TAAttrValueBean.OP_NOCHANGE`.

*Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- deleteUser(String keyField, String keyValue)

  ➤ The keyValue argument that is passed will be the new key value that is returned if the user is successfully created.

  *Purpose:* Deletes a user.

  *Usage:* This is called when a user is terminated.

  *Implementation:* Perform the delete operation on the resource.

  *Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- setUserStatus(String keyField, String keyValue, int status)

  ➤ The keyValue argument that is passed will be the new key value that is returned if the user is successfully created.

  *Purpose:* Enables or disables a user.

*Usage:* This is called when a Disable All Services or Enable All Services operation is performed using the OVSI console, with the value of status given as TAConnector.DISABLED or TAConnector.ENABLED respectively.

*Implementation:* Depending on the resource support, the user account is required to be disabled or enabled, which also might mean performing lock or unlock operations or revoke or restore operations.

*Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- findUser(String keyField, String keyValue, Map attrMap, boolean keyExistsFlg)

  The keyValue argument that is passed will be the new key value that is returned if the user is successfully created.

  *Purpose:* Gets user details.

  *Usage:* This is an optional method and Select Identity does not call on this directly. However, it is required using user discovery phase where all users are retrieved from the resource to synchronize with the OVSI database. In this case, this method is used to get all attributes of the user from the resource.

  *Implementation:* Get all attribute values from the resource for the user, if the user exists. The value of the attribute should be an instance of TAAttrValueBean.

  *Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- resetPassword(String keyField, String keyValue, String passwd)

  The keyValue argument that is passed will be the new key value that is returned if the user is successfully created.

  *Purpose:* Resets a user's password.

  *Usage:* This method is called when the user's password is to be changed to a new password.

*Implementation:* Use the new password passed in by the passwd argument to change the user's password in the resource.

*Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- expirePassword(String keyField, String keyValue, boolean flg)

  The keyValue argument that is passed will be the new key value that is returned if the user is successfully created.

  *Purpose:* Expires or unexpires a user's password.

  *Usage:* This is called when a user's password is required to be expired or unexpired.

  *Implementation:* If the value of flg is true, expire password of the user. After this operation is successful, the user should not be able to use the existing password to log in to the resource. If the value of flg is false, unexpire the password.

  This method is different from resetPassword() in that the old password is still valid on the resource but the user will not be able to use it.

  *Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- getAllUsers(String keyField, TAQuery query)

  *Purpose:* Gets all users in a resource.

  *Usage:* This method is not called by OVSI but is useful when the connector is used to get all users in the resource for user discovery.

  *Implementation:* Get the key values (IDs) of all users in the resource that match the given search criteria in the query argument.

- getUsers(String userKeyField, String entKeyField, String entType, String entKeyValue)

  *Purpose:* Gets all users with a specified entitlement.

*Usage:* This method is not called by OVSI for general provisioning but is used for reporting purposes when all entitlements of a user are required to be reported.

*Implementation:* Using the entKeyField, entType, and entKey values, locate the entitlement in the resource and return IDs of all users that are assigned to this entitlement.

- getEntitlementTypes()

  *Purpose:* Gets all additional entitlement types.

  *Usage:* This method is called during the initial deployment of the resource in OVSI and is useful only when the connector and resource support multiple types of entitlements, such as groups, roles, entitlements, privileges, ACLs, and responsibilities. If the connector and resource support only one kind of entitlement, this method is optional and the default entitlement type is used.

  *Implementation:* Return all additional types in the form of String instances.

- getAllEntitlements(String keyField, TAQuery query)

  *Purpose:* Gets all entitlements in the resource.

  *Usage:* The following uses are supported:

  - Retrieve all entitlements in the resource
    This is the normal usage of this method, where VSI calls on the connector to retrieve all entitlements before provisioning a user. These entitlements are assigned to the user after a successful create operation.

    The value and operation fields of the TAFilter elements in TAQuery are used to enforce a search criteria. The name field specifies the entitlement type to indicate retrieval of all entitlements of the given type.

  - Validation of a given entitlement
    This is used when OVSI tries to verify that a given entitlement is present in the resource. The value field of TAFilter element in TAQuery identifies the entitlement and operation field is EQUALITY.

  - Retrieval of all possible values of a given attribute
    This is useful if you want to provide a list of possible values to any attribute during user provisioning. Generally, the value is entered

but giving a choice restricts invalid values. This is done by configuring the attribute in OVSI with a Search Connector function. The name field in the TAFilter contains the name of the attribute.

*Implementation:* If the resource does not support entitlements, this is an optional method and should return an empty collection.

Use the TAQuery parameter to identify the usage of this method and retrieve all values from the resource. In some cases, the resource supports a primary or default entitlement on a user, which is set automatically when the user is created in the resource. The connector should filter and not return such entitlements to OVSI. Such entitlements can be managed through separate attributes on the user rather than having them as entitlements.

- getEntitlements(String userKeyField, String userKeyValue, String entKeyField)

  *Purpose:* Gets all entitlements of a user.

  *Usage:* This method is not called by OVSI for general provisioning but is used when all entitlements of a given user are required to be reported.

  *Implementation:* Return a Collection of EntitlementModel instances.

  *Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- link(String userKeyField, String userKeyValue, String entKeyField, String entType, List entIds)

  *Purpose:* Assigns entitlements to a user.

  *Usage:* This method is called when trying to assign entitlements to a user that already exists in the resource. It is required if entitlements are supported by the connector and resource.

  *Implementation:* Assigning an entitlement to a user might mean adding the user to the entitlement or adding the entitlement to the user (or both). These can be different depending on the resource. Once the user is assigned to the given entitlement, the user gets the underlying privilege or authority when he or she accesses the resource.

The connector should ignore the error condition arising from the situation where the entitlement is already assigned to the user. It can simply log the error and not throw an exception to OVSI.

*Exception:* Throw ObjectNotFoundException if the user does not exist in the resource. For all other error conditions, throw TAConnectorException with the appropriate resource-specific error message.

- unlink(String userKeyField, String userKeyValue, String entKeyField, String entType, List entIds)

  *Purpose:* Unassigns entitlements from the user.

  *Usage:* This method is called when trying to unassign entitlements from a user that exists in the resource and is required if entitlements are supported by the connector and resource.

  The connector should ignore the error condition arising from the situation where the entitlement is already unassigned from the user. It can simply log the error and not throw an exception to OVSI.

  *Implementation:* This is the reverse operation of assigning entitlements to user.

3 Package the connector.

You can use the Apache ANT build scripts and deployment descriptors that are provided with the generated templates. Run Apache ANT using the `build.xml` script. The following are the files that are generated by this script:

— RAR (resource adaptor archive) file, which is a deployable module that contains all of the classes and library JAR files for the connector.

— Schema (JAR) file, which contains the XML attribute mapping file and any XSL file, for reverse mapping, to be used with the connector. The contents of this file must be extracted into a folder that is in the class path of the application server.

## Agent-based Forward Provisioning

Developing a connector that uses an agent for forward provisioning involves developing an agent that resides on the resource platform. The agent communicates with the resource application for all forward provisioning operations.

The following are some of the general requirements for an agent to perform provisioning:

- Implementing a connector for OVSI. See Steps to Implement a Connector for Select Identity on page 52 for details.
- Provisioning users and entitlements — The agent is required to support provisioning of users and their entitlements on the resource.
- Availability — The agent must be a constantly running daemon or process so that it can accept and process provisioning requests from the client-side of the connector.
- Scalability — The agent must support a large number of requests.
- Install and Uninstall — The agent must be cleanly installable and uninstallable. This is particularly important if the agent is deployed on a large number of resource platforms.
- Security and Reliability — Communication between the client-side of the connector and agent must be over a secure channel.

The client side of the connector is the JCA side that implements SIConnectorInterface. The implementation should prepare and send requests for all forward provisioning operations to the agent residing on the resource platform and handle responses.

The agent should handle all requests by performing provisioning operations on the resource application and return the results or error cases.

## Building a Connector for Reverse Provisioning

Reverse provisioning is the process of synchronizing changes that occurred in the resource with OVSI. Changes can include user additions, modifications, deletions, password resets, entitlement changes, and so on. The connector can implement this as described in the following sections.

### Agentless Reverse Provisioning

When an agent is not implemented to detect changes on the resource, the connector should be able to poll the resource for changes. You must implement the SIConnectorInterface interface and the getChangeLog(ChangeLogCursor cursor) method. The purpose of this method is to receive a change that occurred in the resource. OVSI can be configured to poll any connector to detect changes in the resource. When configured this way, OVSI calls this method with the appropriate value of the cursor.

To implement getChangeLog, the connector must detect changes that occurred in the resource and prepare a data structure (SIChangeLogModel) with the change log entries. This instance can hold all changes that occurred in one particular polling interval in the ChangeLogEntry instances. As a checkpoint of the last change detected, a cursor is maintained on the resource so that the connector's next call only retrieves changes made since the last call. This checkpoint could be a timestamp or some sequence number (for example highest USN). OVSI will store this value and give it back to the connector when it calls for the next time.

#### Implementing getChangeLog(ChangeLogCursor)

This method should check the resource for all changes that occurred after the previous call to this method and must prepare an instance of SIChangeLogModel with the details of these changes.

SIChangeLogModel represents the changes that occurred in the resource, in a normalized format. Any resource-specific API return values or format returned must be parsed and converted into an instance of this class. This class contains the following main methods:

- setCursor(ChangeLogCursor)

The new value of the cursor must be set in SIChangeLogModel. A cursor identifies a checkpoint in the resource change log so that a next call to getChangeLog() will read the changes past this checkpoint.

The cursor class contains an int member to represent the changelog number. The changelog number is determined by the resource and/or how you detect changes occurred in the resource. The resource might already be using a number like this, for example the USN number in case of Active Directory. This change log number could also be a derivation of timestamp on the change that occurred in the resource. For example, it could be a number of seconds since Jan 1 1970 and an int is good till the end of the year 2036.

Use this integer value on the ChangeLogCurser. setNumber(int) method.

- addCLEntry(ChangeLogEntry)

  One instance of SIChangeLogModel can contain multiple instances of ChangeLogEntry instances, which represents each change. A change could be that a user is added, modified, deleted.

  Internally, SIChangeLogModel uses an ArrayList as a Collection of ChangeLogEntry instances, and so the order of the entries is maintained when the Changes are sent to SI for reconciliation.

  ChangeLogEntry has the following methods:

  — setUserId(String)

    This is used to set the id of the user in the resource.

  — setChangeType(int)

    This is to set the type of change that occurred in the resource. Following are the possible types:

      ChangeLogEntry.USER_ADDED

      ChangeLogEntry.USER_MODIFIED

      ChangeLogEntry.USER_DELETED

      ChangeLogEntry.USER_ENABLED

      ChangeLogEntry.USER_DISABLED

      ChangeLogEntry.USER_RESET_PASSWD

      addAttrEntry(ChangeLogAttribute)

setChangeType(int) is used to add the attribute value in the change. This contains the id and value of the attribute. The id should represent the OVSI id of the attribute and not the physical resource attribute. If these two are different, re-mapping of the name must be done.

As an illustration, let us say you have the forward mapping of attribute as follows:

| **Select Identity Resource Attribute** | **Physical Resource Attribute** |
|---|---|
| UserName | uid |
| Email | mail |
| FirstName | givenName |
| LastName | Sn |

The name on the left side (Select Identity resource attribute) is the attribute that Select Identity gives to the connector in SIUserModel during forward provisioning. The name on the right is the name of the attribute in the resource that you must set on the resource with the given value.

Now, when you report the attributes in ChangeLogAttribute, the change detection on the resource will give you the physical resource attribute name, such as mail or givenName, and this must be converted back to Email or FirstName.

If you are using XML mapping file for forward provisioning, the connector framework provides you access to the Java representation of this mapping in the form of an instance of TASchema class, by calling the setSchema(TASchema) method on SIConnectorInterface. The default implementation of this method is to store this instance in a member variable of the SIConnectorInterface implementation, and this can be used for reverse mapping of the attribute names. Here is an example of how to use this.

Assume we have the following definition:

```
Private TASchema mTaSchema;
```

Then, in getChangeLog() implementation you could access the following:

```
TASchemaParamBean[] lBeans = mTaSchema.getUserSchema();
```

```
for (int ii=0; ii<lBeans.length; ii++)
{
  TASchemaParamBean lBean = lBeans[ii];
  lBean.getMappingField() ... // gives the SIResourceAttribute
(or tafield in XML file)
  lBean.getResField() ... // gives the Physical resource
attribute (or resfield)
```

*Standard name for entitlement idnetifiers (IDs):*

When you are reporting ChangeLogAttribute for entitlements, you use the following keyword to represent an entitlement:

`urn:trulogica:concero:2.0#groups`

## Agent-based Reverse Provisioning

The agent is notified of changes that occurred in the resource and notifies OVSI with all detected changes. The agent notifies OVSI using SPML requests sent over HTTP or HTTPS to the OVSI Web Service URL. OVSI consumes these changes by processing them for reconciliation.

In addition to the requirements mentioned in Agent-based Forward Provisioning on page 77, the following are also required:

- Configuration — The agent's operational parameters for the SPML requests, the OVSI Web Service URL, resource identification, and response handling must be configurable.
- Response handling — The agent should be able to handle the response to the SPML request sent to OVSI. If the response indicates a success, proceed with the next event. If not, check if a retry policy should be applied.
- Retry Policy — The agent should support a policy that defines what must be done if a request does not reach OVSI or if OVSI cannot process the request for any reason. Some of the points to consider are as follows:
  - — Retry count
  - — Retry interval
  - — Event drop
  - — Request delay

The agent's change detection capabilities can include adding, modifying, or deleting a user, or resetting a user's password. The agent must prepare and send an SPML request to the OVSI Web Service URL to notify OVSI of this change. The following events are captured on the resource and a corresponding SPML request must be sent to OVSI:

- Adding a user
  A new user is added on the resource. To propagate this change back to OVSI, an SPML <addRequest> request must be sent that includes all of the user's attributes.
- Changing user attributes
  User attributes are modified on the resource. An SPML <modifyRequest> request must be sent to the OVSI server to synchronize these changes.
- Adding entitlement to a user or removing entitlements from a user
  Entitlements are associated or disassociated with an existing user on the resource. An SPML <modifyRequest> request must be sent with the new entitlements added or removed.
- Changing a user's password
  A user's password is changed or reset on the resource. An SPML <extendedRequest> request must be sent containing the new password.
- Deleting a user
  A user is deleted from the resource. An SPML <deleteRequest> request must be sent for the deleted user.
- Enabling or disabling a user
  A user is enabled or disabled on the resource. A SPML <modifyRequest> request containing all of the user attributes must be sent to propagate the change(s) to OVSI.

How the changes are captured and how the SPML request is generated are resource specific. Each generated SPML request is parsed by OVSI using an XSL file that corresponds to the XML mapping file that enables OVSI to push data to the resource. (See Mapping OVSI Attributes to the Resource Schema on page 84 for more information about creating this mapping file.)

The SPML request that is generated for reverse synchronization includes the following information:

- Operational attributes — Relate to the properties of the OVSI instance to which the reverse synchronization request is being sent.
- Resource attributes — Define user attributes on the resource.

The following is an example of the operational attributes section of an SPML request:

```
<operationalAttributes>
  <attr name='urn:trulogica:concero:2.0#reverseSync'>
    <value>true</value>
  </attr>
  <attr name='urn:trulogica:concero:2.0#resourceId'>
    <value>AD</value>
  </attr>
  <attr name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
    <value>sisa</value>
  </attr>
  <attr name='urn:trulogica:concero:2.0#resourceType'>
    <value>activedirectory</value>
  </attr>
  <attr name='urn:trulogica:concero:2.0#password'>
    <value>abc123</value>
  </attr>
</operationalAttributes>
```

The <attr> elements in this block are as follows:

- **urn:trulogica:concero:2.0#reverseSync**

  Specifies whether this request is a reverse synchronization request. The value is a boolean set to **`true`** if the request is a reverse synchronization request.

- **urn:trulogica:concero:2.0#resourceId**

  The name of the resource (in OVSI) to which this request is sent.

- **urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName**

  The username of an administrative user in OVSI.

- **urn:trulogica:concero:2.0#password**

  The password of the administrative user.

- **urn:trulogica:concero:2.0#resourceType**

  The name of the XSL file (without the .xsl extension) that is associated with the resource and that parses the reverse synchronization request.

See SPML Examples on page 125 for examples that are generated for each type of user change on the resource.

## Mapping OVSI Attributes to the Resource Schema

You must create a file that maps the OVSI fields defined for a user to the fields used by the resource. The connector will reference this mapping file to understand the target fields on the resource for each user value. This section provides an overview of the mapping file.

The LDAP connector provides three mapping files: one for an Active Directory server (`ActiveDir.xml`), one for an iPlanet server (`iPlanet.xml`), and one for ETrust (`CAEtrust.xml`). The files are created in XML, according to SPML standards, and are bundled in a JAR file called `schema.jar`. In general, all connectors that provide XML mapping files must provide the following content.

➤ This mapping file is always stored in the `com/trulogica/truaccess/connector/schema/spml` directory and the parent folder is packaged in the schema JAR file.

### General Attribute Information

The following operations can be performed in the mapping file:

- Add a new attribute mapping
- Delete an existing attribute mapping
- Modify attribute mappings

Following is an explanation of the elements in the XML mapping files provided by the LDAP connectors:

- **<Schema>**, **<providerID>**, and **<schemaID>**

  Provides standard elements for header information.

- **<objectClassDefinition>**

  Defines the actions that can be performed on the specified object as defined by that name attribute (in the <properties> element block) and the OVSI-to-resource field mappings for the object (in the <memberAttributes> block). In general, the XML mapping file supports two types of entities: users and groups. These entities are defined in the mapping file by an <objectClassDefinition> block.

- **<properties>**
  Defines the operations that are supported on the object. This can be used to control the operations that are performed through OVSI. The following operations can be controlled:

  — Create (CREATE)

  — Read (READ)

  — Update (UPDATE)

  — Delete (DELETE)

  — Enable (ENABLE)

  — Disable (DISABLE)

  — Reset password (RESET_PASSWORD)

  — Change password (CHANGE_PASSWORD)

  — Assign entitlements (LINK)

  — Unassign entitlements (UNLINK)

  — Retrieve entitlements (GETALL)

  The operation is assigned as the name of the <attr> element and access to the operation is assigned to a corresponding <value> element. You can set the values as follows:

  — true — the operation is supported by the connector

  — false — the operation is not supported by the connector and will throw a permission exception

  — bypass — the operation is not supported by the connector but will not throw an exception; the operation is simply bypassed

  Following is an example:

```
<objectClassDefinition name="SIUser" description="Oracle ERP
User">
   <properties>
    <attr name="GETCHILDREN">
      <value>true</value>
    </attr>
    <attr name="DELETE">
      <value>true</value>
    </attr>
    <attr name="EXPIREPASSWORD">
    <value>false</value>
  </attr>
  <attr name="GETALL">
    <value>true</value>
  </attr>
...
```

- **<memberAttributes>**
  Defines the attribute mappings. This element contains <attributeDefinitionReference> elements that describe the mapping for each attribute. Each <attributeDefinitionReference> can be followed by an <attributeDefinition> element that specifies details such as minimum length, maximum length, and so on.

  Each <attributeDefinitionReference> element contains the following attributes:

  — name — The name of the attribute definition reference. Make sure this is followed by an <attributeDefinition> block whose name attribute matches this name.

  — required— Whether this attribute is required in the provisioning process (set to true or false).

  — concero:tafield — The name of the attribute in OVSI. In general, the attribute assigned to tafield should be the same as the physical resource attribute, or at least the connector attribute. For example, it is recommended to have the following:

  ```
  <attributeDefinitionReference name="FirstName"
  required="false" concero:tafield="[givenname]"
  concero:resfield="givenname" concero:init="true"
  concero:isMulti="true"/>
  ```

  instead of this:

  ```
  <attributeDefinitionReference name="FirstName"
  required="false" concero:tafield="[FirstName]"
  concero:resfield="givenname" concero:init="true"
  concero:isMulti="true"/>
  ```

  — concero:resfield — The name of the attribute from the resource schema. If the resource does not support physical attributes, this can be a tag field that indicates a resource attribute mapping.

  Also, the attribute name may be case-sensitive; for example, if the attribute is defined in all uppercase letters on the resource, be sure to specify it in all uppercase letters here.

- concero:isKey — An optional attribute that, when set to true, specifies that this is the key field to identify the object on the resource. Only one <attributeDefinitionReference> can be specified where isKey="true". This key field does not need to be the same as the key field of the identity object in OVSI.

  Note that for a key field mapping where isKey=”true” and tafield is not assigned the UserName attribute, UserName should not be used in any other mapping. That is, UserName can be assigned to tafield only in cases where it is mapped to the key field in the resource. Example:

  ```
  <attributeDefinitionReference name="UserName" required="true"
  concero:tafield="[UserName]" concero:resfield="uid"
  concero:isKey="true" concero:init="true"/>
  ```

- concero:init — Set this to true if this attribute needs to be passed as part of the creation of the user. You can use this parameter to control which attributes must be specified during creation and which must be specified when a user is modified.
- concero:isPassword — Set this to true if the attribute is a password.
- concero:isMulti — Set this to true if the resource attribute is multi-valued.
- concero:isSensitive — Set this to true if the attribute is case-sensitive.

Here is an example:

```
<memberAttributes>
  <attributeDefinitionReference name="ATTR_UserName"
  required="true" concero:tafield="UserName"
  concero:resfield="[x_user_name][USER_NAME][][VARCHAR]"
  concero:isKey="true" concero:init="true"/>
...
```

The interpretation of the mapping between the connector field (as specified by the Concero:tafield attribute) and the resource field (as specified by the Concero:resfield attribute) is determined by the connector.

- **<attributeDefinition>**

  Defines the properties of each object's attribute. For example, the attribute definition for the Directory attribute defines that it must be between one and 50 characters in length and can contain the following letters, numbers, and characters: a-z, A-Z, 0-9, @, +, and a space.

  Here is an example:

```
<attributeDefinition name="ATTR_ResponsibilityKey"
  description="Responsibility Key" type="xsd:string" >
    <properties>
      <attr name="minLength">
        <value>1</value>
      </attr>
      <attr name="maxLength">
        <value>128</value>
      </attr>
      <attr name="pattern">
        <value><![CDATA[[a-zA-Z0-9@]+]]> </value>
      </attr>

    </properties>
</attributeDefinition>
```

- **<concero:entitlementMappingDefinition>**

  Defines how entitlements are mapped to users. Defining this element for each entitlement enables you to control the entitlements from the XML mapping file, instead of the requiring that the connector retrieve a list of entitlements from the resource. Using this element may not be appropriate in all cases, but this is one way to do it:

```
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Administrators" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Backup Operators" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Guests" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Network Config Operators" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Power Users" />
```

```
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Remote Desktop Users" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Replicator" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Users" />
</concero:entitlementMappingDefinition>

<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="Debugger Users" />
</concero:entitlementMappingDefinition>
<concero:entitlementMappingDefinition>
  <concero:entitlementMap name="HelpServicesGroup" />
</concero:entitlementMappingDefinition>
```

- **<concero:objectStatus>**

  Defines how to assign status to a user.

- **<concero:relationshipDefinition>**

  Defines how to create relationships between users and groups (entitlements). Here is an example:

```
<concero:relationshipDefinition>
  <properties>
    <attr name="CREATE">
      <value>true</value>
    </attr>
    <attr name="NAVIGATE">
      <value>true</value>
    </attr>
    <attr name="DELETE">
      <value>true</value>
    </attr>
  </properties>
  <concero:party concero:entity="SIUser"
   concero:cardinality="ZERO_OR_MORE" concero:start="false" />
  <concero:party concero:entity="Group"
   concero:cardinality="ZERO_OR_MORE" concero:start="false" />
</concero:relationshipDefinition>
```

  This example defines the following:

  - user-to-group link can be created

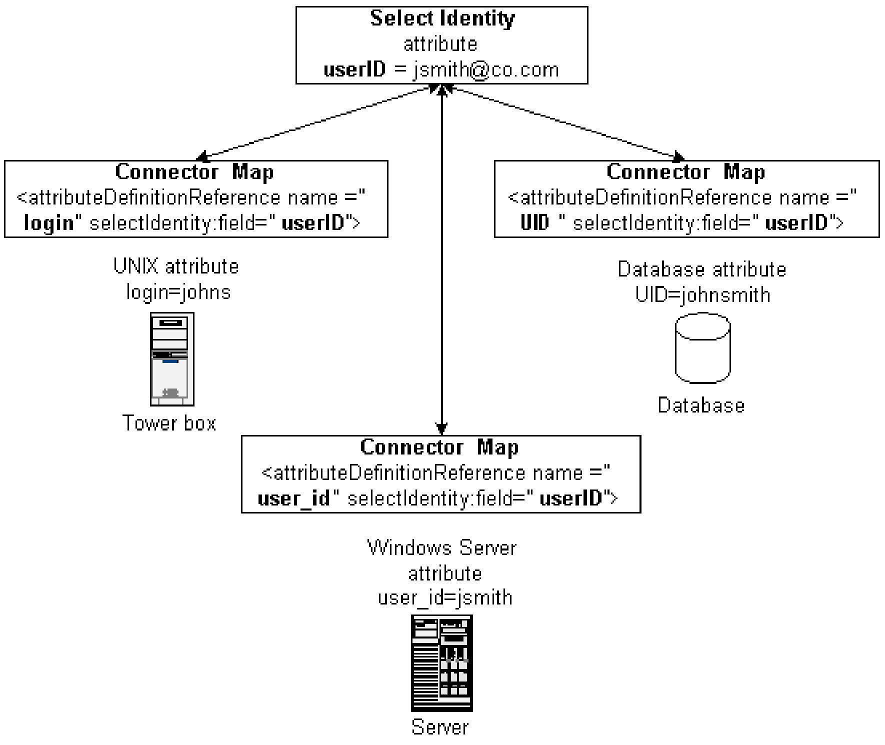
- connector and resource support this operation
- user-to-group link may be deleted
- user can be unassigned from an entitlement

## Creating a Mapping File

Create a mapping file that maps each attribute on the physical resource to an attribute on the connector. (To complete this mapping, attributes must be created using the OVSI client to map a name on the server to this name on the connector.) For example, the connector may store the user ID in a field called **userID** and the resource may store the ID in a field called **user_id**. The connector will reference the mapping file to understand the target field on the resource for each user value.

The following illustrates the relationship between the fields in OVSI, the connector, and the resource.

**Figure 4 Relationship Between Fields in OVSI, Connector and Resource**


Select Identity
attribute
userID = jsmith@co.com
Connector Map
<attributeDefinitionReference name =" login" selectIdentity:field=" userID">
UNIX attribute
login=johns
Tower box
Connector Map
<attributeDefinitionReference name =" UID " selectIdentity:field=" userID">
Database attribute
UID=johnsmith
Database
Connector Map
<attributeDefinitionReference name =" user_id" selectIdentity:field=" userID">
Windows Server
attribute
user_id=jsmith
Server

Instances of SIUserModel and EntitlementModel are populated and provided by OVSI when it calls the SIConnector methods. Obtain user and group attributes from here and map them to the resource using map file.

You determine the format of the mapping file. The connector may require only a simple mapping stored in a text file. Here is a simple text file example where the OVSI field is specified first and a pipe (|) separates the fields:

```
User Name|UserId
Password|Password
User Name|cn
First Name|givenName
Last Name|sn
```

```
[First Name] [Last Name]|displayName
Title|Title
Directory|homeDirectory
Email|Mail
Address 1|streetAddress
```

Or, the connector may require a format that supports robust mapping, such as an XML file. XML mapping files are used by all connectors built and provided by HP. Here is an excerpt from the `iPlanet.xml` file, which is provided with the LDAP connector. Refer to Mapping OVSI Attributes to the Resource Schema on page 84 for a full description of the file.

```
<objectClassDefinition name="User" description="LDAP User">
  <properties>
    <attr name="CREATE">
      <value>true</value>
    </attr>
    <attr name="READ">
      <value>true</value>
    </attr>
    <attr name="UPDATE">
      <value>true</value>
    </attr>
    <attr name="DELETE">
      <value>true</value>
    </attr>
    <attr name="ENABLE">
      <value>true</value>
    </attr>
    <attr name="DISABLE">
      <value>true</value>
    </attr>
    <attr name="RESET_PASSWORD">
      <value>true</value>
    </attr>
    <attr name="EXPIRE_PASSWORD">
      <value>false</value>
    </attr>
    <attr name="CHANGE_PASSWORD">
      <value>true</value>
    </attr>
  </properties>
  <memberAttributes>
    <!-- For iPlanet -->
```

```
<attributeDefinitionReference name="UserName" required="true"
 concero:tafield="[UserName]" concero:resfield="uid"
 concero:isKey="true" concero:init="true"/>
<attributeDefinitionReference name="Password" required="false"
 concero:tafield="[Password]" concero:resfield="userpassword"
 concero:init="true" />
```

## Some Coding Guidelines

Following are code examples for some of the commonly used functions. This assumes that you are implementing SIConnector to implement the connector.

➤ If you are directly implementing the simplified connector interface SIConnectorInterface, you can still make use of the logic in these snippets, but the exact methods will not be the same.

The code examples are in the following sections:

- Key Value Return
- Key Value Computation
- User Modification

### Key Value Return

After a successful creation of the user in the resource, the connector is supposed to know the key value of the user in the resource. This needs to be propagated back to OVSI for later referral.

Following is a code snippet to do the above. Basically, you need to call theSIUserModel.setResUserId() method.

```
  public TAStatus add( SIUserModel userModel ) throws
TAConnectorException {
      String lFuncName = "add(SIUserModel)";
      if ( msLogger.isDebugEnabled() ) {
        msLogger.debug("ENTER:\r\n"+userModel );
      }
      TAStatus lStatus = new TAStatus( TAStatus.OP_CREATE );
```

```
// compute key value
keyValue = …;

…
// add the user in resource
…

        userModel.setResUserId( keyValue );
      catch ( TAConnectorException tae ) {
        throw tae;
      }
      catch ( Exception e ) {
        if ( msLogger.isWarnEnabled() ) {
          msLogger.warn("Unable to create user:" + keyValue, e );
        }
        TAConnectorException tac = new TAConnectorException( "Unable to
create user:" + userModel.getResUserId() );
        tac.setLinkedException( e );
        throw tac;
      }
      finally {
        if ( msLogger.isDebugEnabled() ) {
          msLogger.debug("EXIT" );
        }
      }
```

## Key Value Computation

At several occurrences during the writing of the connector, the user in the resource needs to be identified with a key value, and this key value needs to be used with the underlying resource API or other methods.

It is quite possible that the key value of the user in OVSI might be different from the key value of the same user in the resource.

To properly address this user, you may want use the following code snippet:

```
   private String getKeyValue(SIUserModel um, TASchemaParamBean[]
schema)
      throws TAConnectorException
    {
      String keyValue = null;

      // first use the resource key value
      if (um.getResUserId() != null)
      {
        keyValue = um.getResUserId();
      }

      // Check if the key attribute value is set
      if ( ( null == keyValue ) || ( keyValue.trim().length() == 0 ) ) {
        for ( int i = 0; i < schema.length; i++ ) {
          if ( schema[ i ].isKey() ) {
           keyValue = getSingleValue( um, schema[ i ].getMappingField()
);
            break;
          }
        }
      }

      // finally use the OVSI user id
      if ( ( null == keyValue ) || ( keyValue.trim().length() == 0 ) ) {
        keyValue = um.getUserId();
      }

      if ( ( null == keyValue ) || ( keyValue.trim().length() == 0 ) ) {
        String lError = "No primary key specified";
          if ( msLogger.isWarnEnabled() ) {
              msLogger.warn(lError);
          }
          throw new InvalidParameterException(lError);
      }
      keyValue = keyValue.trim();

      if (msLogger.isInfoEnabled()) msLogger.info("Resource Key
Value="+keyValue);
      um.setResUserId(keyValue);
      return keyValue;
    }
```

The above code makes sure that you compute the key in this order:

- resource user id field of SIUserModel if available, or
- value of the key attribute as defined in the mapping
- value of the OVSI User id field of SIUserModel

If all of the above fail to produce a valid key field value, then you should throw an exception to the caller.

## User Modification

User modification might mean any of the following:

- Add a new attribute (with some value)
- Delete an existing attribute
- Add a new value to an existing multi-valued attribute
- Delete an existing value from a multi-valued attribute
- Clearing out all values of an attribute
- Replacing an attribute with a new value

### Loading Existing User From Resource

To perform most of the above operations, it might be necessary to load the existing value of the user from the resource. In such cases, you may want to load only those attributes that are being modified.

In OVSI 4.0, it is now possible to find out what attributes of the user are being modified by looking at the contents of SIUserModel. Following is a code snippet to do this:

```
       // List of attr Ids to be loaded from resource, for update

TASchemaParamBean[] schemaBeans = getUserSchema();
String resKeyField = getKeyField( schemaBeans, "User" );
String keyValue = getKeyValue(userModel, schemaBeans);

List lRetAttrIds = new ArrayList();
for ( int index = 0; ( index < schemaBeans.length ); index++ ) {
   bean = schemaBeans[ index ];
   lTaField = schemaBeans[ index ].getMappingField();

   // pick up only those attrs that can be updated
   if ( ( !bean.isUpdate() ) || // not updateable
     (!userModel.isAttrPresent(lTaField)) ||   // not being modified
     bean.getResField().equalsIgnoreCase( resKeyField ) ||   // key
field
     hasCompositeMapping( schemaBeans[ index ] ))             // has
composite mapping
     {
          continue;
        }

        lRetAttrIds.add(bean.getResField());
      }

      String ctx = getContext( schemaBeans, userModel, "User", false );
      Attributes lResAttrs = loadResourceAttrs(ctx, resKeyField, keyValue,
lRetAttrIds);
```

## Computing Changes to Be Made

Once the user attributes are loaded, a thorough check is needed on each attribute to see what value is being changed and the difference to be executed on the resource.

Following is a code snippet from an LDAP connector to compute this change and prepare a modification:

```
  /**
   * Build ModificationItems based on functions on th attribute value
and attr member values
   *
   * @param mods ModificatoionItem List to be updated
   * @param userModel passed in by OVSI
   * @param bean the attribute being modified
   * @param attrValueBean value of the attribute given by OVSI
   * @param resAttr Value of the attribute in resource
   */
  public static void buildAndAddModifications(
    List mods,
    SIUserModel userModel,
    TASchemaParamBean bean,
    TAAttrValueBean attrValBean,
    Attribute resAttr)

    throws Exception
  {
      String lFuncName = "buildAndAddModifications()";
      if ( msLogger.isDebugEnabled() ) {
          msLogger.debug("ENTER" );
      }

      Object[] value = null;
      ModificationItem modItem = null;
      Attribute siAttr = null;
      Attribute lMergedAttr = resAttr;

      switch ( attrValBean.getOperation() ) {
        case TAAttrValueBean.OP_REPLACE:
        {
          value = attrValBean.getValues();
          siAttr = buildLdapAttribute( bean.getResField(), value );
         mods.add( new ModificationItem( DirContext.REPLACE_ATTRIBUTE,
siAttr));
        }
        break;

        case TAAttrValueBean.OP_ADD:
        {
          value = attrValBean.getValues();
          siAttr = buildLdapAttribute( bean.getResField(), value );
          lMergedAttr = mergeAttributes(resAttr,
DirContext.ADD_ATTRIBUTE, siAttr);
          if (lMergedAttr != null)
          {
            mods.add( new ModificationItem(
DirContext.REPLACE_ATTRIBUTE, lMergedAttr));
          }
        }
        break;

        case TAAttrValueBean.OP_DELETE:
        {
          if ((resAttr != null) && (resAttr.size() > 0))
          {
            mods.add(new ModificationItem( DirContext.REMOVE_ATTRIBUTE,
              new BasicAttribute( bean.getResField(), null )));
          }
        }
        break;

        case TAAttrValueBean.OP_MODIFY:
        {
          ArrayList lAddValues = new ArrayList();
          ArrayList lDelValues = new ArrayList();
          attrValBean.categorizeValues( lAddValues, lDelValues );

          if ( lAddValues.size() > 0 ) {
            siAttr = buildLdapAttribute(
                bean.getResField(), lAddValues.toArray( new String[ 0 ]
) );
            lMergedAttr = mergeAttributes(lMergedAttr,
DirContext.ADD_ATTRIBUTE, siAttr);
            if (lMergedAttr == null)
            {
              lMergedAttr = resAttr;
            }
          }
          if ( lDelValues.size() > 0 ) {
            siAttr = buildLdapAttribute(
                bean.getResField(), lDelValues.toArray( new String[ 0 ]
) );
            lMergedAttr = mergeAttributes(lMergedAttr,
DirContext.REMOVE_ATTRIBUTE, siAttr);
          }
          if (lMergedAttr != null)
          {
           mods.add(new ModificationItem(DirContext.REPLACE_ATTRIBUTE,
lMergedAttr));
          }
        }
        break;

        default:
      }
  }

  /**
   * Merge the resource and si attrs based on operation:
   *   return (resAttr - siAttr)  or
   *   return (resAttr + siAttr)  or
   *   return siAttr if (resAttr != siAttr)
   *
   * @param siAttr
   * @param op
   * @param resAttr
   * @return
   * @throws Exception
   */
  public static Attribute mergeAttributes(Attribute resAttr, int op,
Attribute siAttr)
    throws Exception
  {
    Attribute lAttr = null;
    Object lAttrVal = null;
```

```
boolean lNoChangeFlg = true;

switch (op)
{
  case DirContext.ADD_ATTRIBUTE:
  {
    if (resAttr == null)
    {
      lAttr = siAttr;
      lNoChangeFlg = false;
    }
    else
    {
      lAttr = (Attribute) resAttr.clone();
      NamingEnumeration ne = siAttr.getAll();
      while (ne.hasMoreElements())
      {
        lAttrVal = ne.nextElement();
        if (!lAttr.contains(lAttrVal))
        {
          lAttr.add(lAttrVal);
          lNoChangeFlg = false;
        }
      }
    }
  }
  break;

  case DirContext.REMOVE_ATTRIBUTE:
  {
    if (resAttr != null)
    {
      lAttr = (Attribute) resAttr.clone();
      NamingEnumeration ne = siAttr.getAll();
      while (ne.hasMoreElements())
      {
        lAttrVal = ne.nextElement();
        if (lAttr.contains(lAttrVal))
        {
          lAttr.remove(lAttrVal);
          lNoChangeFlg = false;
        }
      }
    }
  }
  break;
```

```
      default:
      case DirContext.REPLACE_ATTRIBUTE:
      {
        if (resAttr == null)
        {
          lAttr = siAttr;
          lNoChangeFlg = false;
        }
        else
        {
          NamingEnumeration resAttrEnum = resAttr.getAll();
          while (resAttrEnum.hasMoreElements())
          {
            lAttrVal = resAttrEnum.nextElement();
            if (!siAttr.contains(lAttrVal))
            {
              lNoChangeFlg = false;
            }
          }

          if (lNoChangeFlg)
          {
            NamingEnumeration siAttrEnum = siAttr.getAll();
            while (siAttrEnum.hasMoreElements())
            {
              lAttrVal = siAttrEnum.nextElement();
              if (!resAttr.contains(lAttrVal))
              {
                lNoChangeFlg = false;
              }
            }
          }

          lAttr = siAttr; // in case, we have to replace
        }
      }
    }

    return (lNoChangeFlg) ? null : lAttr;
  }
```

## Matching Managed Connections

Connections (or instances of SIConnector) are created by the application server on a demand basis, when an operation is called on the connector. This connection is returned back to the application server connection pool upon completion of the operation. However, the physical connection to the resource need not be destroyed until the application server explicitly makes the request.

The application server calls on the ManagedConnectionFactory implementation to match connections in the pool before creating a new connection. The criteria for matching the connection must depend on all the connection parameters that are passed in the TAConnectorParamValueBean implementation.

Following is a code snippet to show the matching:

```
    public ManagedConnection matchManagedConnections(
        Set arg0,
        Subject arg1,
        ConnectionRequestInfo arg2)
        throws ResourceException {

        if (!(arg2 instanceof TAConnectorParamValueBean)) {
            throw new ResourceException(
                "Invalid parameter:Expected "
                    +
LDAPParamValueBean.class.getName());
        }

        // Make a local copy of the bean
      LDAPParamValueBean lBean = new
LDAPParamValueBean((TAConnectorParamValueBean) arg2);

        for (Iterator it = arg0.iterator(); it.hasNext();) {
            Object conn = it.next();
            if (conn instanceof LDAPManagedConnection) {
                LDAPManagedConnection ldapc = (LDAPManagedConnection)
conn;
                LDAPParamValueBean o = ldapc.getBean();
                if (o.equals(lBean)) {
                    if (msLogger.isInfoEnabled()) msLogger.info("Found
matched Connection:"+ldapc);
                    return ldapc;
                }
            }
        }
        if (msLogger.isDebugEnabled()) msLogger.warn("Unable to find
matched connection");
        return null;
    }
```

The equals() method of LDAPParamValueBean looks like this:

```
public boolean equals(LDAPParamValueBean other) {
    return hashCode() == other.hashCode();
  }

  public int hashCode()
  {
    return this.toString().hashCode();
  }

  public String toString() {
    StringBuffer sb = new StringBuffer("LDAPParamValueBean[");

    String lKey = null;
    java.util.Iterator lIter = mValuesMap.keySet().iterator();
    while (lIter.hasNext())
    {
      lKey = (String) lIter.next();
      sb.append(lKey).append("=").append(get(lKey)).append(",");
    }
    sb.append("]");
    return sb.toString();
  }
```

And so it depends on all the connection parameters kept in mValuesMap.

## Schema Reloading

The attribute mapping file (or the file that has this mapping) must be reloaded only when test() method is called. This method is called when the OVSI resource using this connector implementation is either newly deployed or updated. Following are the steps involved:

- Clear out the old mapping information
- Reload the file and mapping again

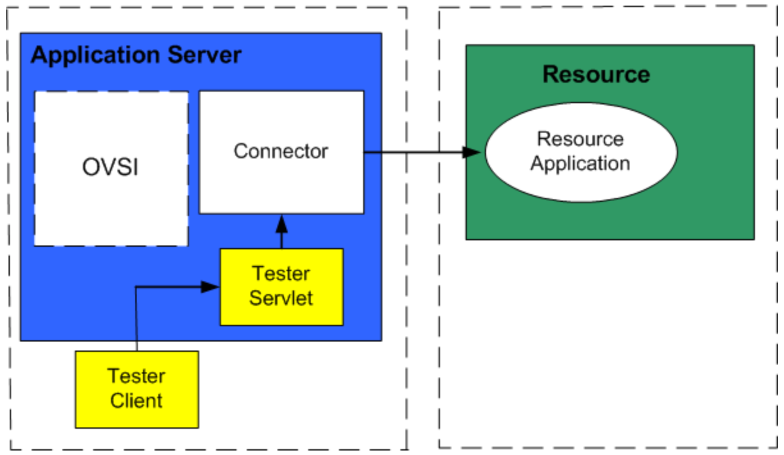
# 5 Connector Tester Tool

After you build the connector, you can use the connector tester tool to test provisioning operations. The tool certifies the connector before it is deployed in OVSI. It consists of the following:

- A standalone servlet WAR module, which is deployed on the application server where the OVSI server is deployed and where the target connector is installed
- SPML scripts that perform all forward-provisioning operations supported by OVSI
- A client that sends requests to the servlet (by running the SPML scripts)

The following diagram illustrates how the tester tool communicates with the connector.

**Figure 5 Connector Tester Tool Communication with the Connector**



Using the client, you run the scripts, which send SPML requests to the servlet. The servlet converts SPML requests to Connector API requests and invokes the connector. The connector then sends the requests to the resource application. The connector then sends results or errors back to the servlet.

The client can be used to perform bulk or iterative operations, for regression testing of the connector. You can use multiple clients for this purpose.

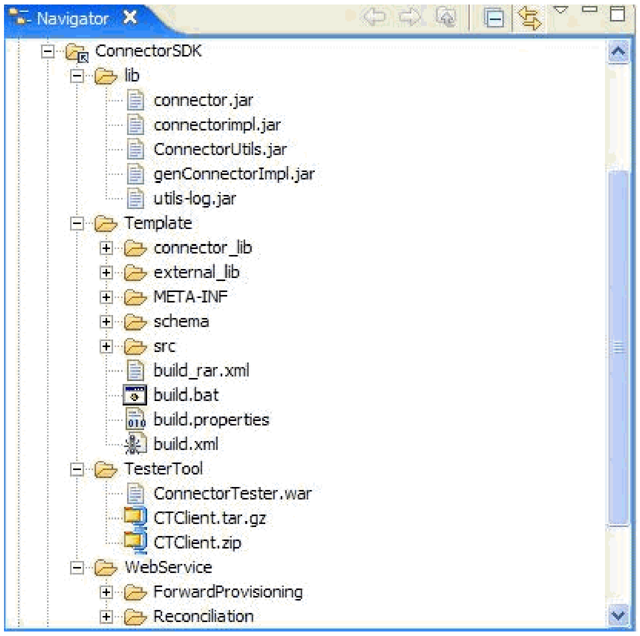
This chapter contains the following sections:

- Installing the Tester Tool
- Testing the Connector
- Tester Tool Scripts

## Installing the Tester Tool

The Connector Tester Tool is part of the Connector SDK as shown in the following figure:

**Figure 6 Connector SDK Structure With the Tester Tool**



```
Navigator
ConnectorSDK
    lib
        connector.jar
        connectorimpl.jar
        ConnectorUtils.jar
        genConnectorImpl.jar
        utils-log.jar
    Template
        connector_lib
        external_lib
        META-INF
        schema
        src
        build_rar.xml
        build.bat
        build.properties
        build.xml
    TesterTool
        ConnectorTester.war
        CTClient.tar.gz
        CTClient.zip
    WebService
        ForwardProvisioning
        Reconciliation
```

The following files are provided:

- `ConnectorTester.war` -— The web application module that contains the servlet.
- `CTClient.tar.gz` — The client library and sample scripts if you intend to install the client on a UNIX application server

Complete the following steps to deploy and install the servlet WAR module, SPML scripts, client, and connector:

1. Copy the `ConnectorTester.war` file (for UNIX) from the `/ConnectorSDK/` directory on the OVSI Connector CD to the local system.
2. Deploy the WAR file in the application server. Here is an example of how to deploy the file on WebLogic:
    a. Log on to the WebLogic Server Console. (To load the console, load its URL in a browser. The URL is typically **http://localhost:7001/console**.)
    b. Navigate to ***My_domain*** → **Deployments**.

c Click **Web Application Modules**.

d In the right side of the page, click **Deploy a new Web Application Module...** .

e Locate and select the `ConnectorTester.war` file, then click the **Target Module** button.

f Click the **Deploy** button.

WebLogic loads and deploys the WAR file. It should report "Success" in the Status of Last Action column on the next page.

For further verification, enter the URL of the tester servlet in an Internet Explorer browser: **http://*localhost*:*port*/ConnectorTester** (where *localhost* and *port* are those of the application server). If the servlet is deployed correctly, the following is displayed:

```
SI TestConnector servlet is up !!!
```

3 To install the client and scripts, extract the contents of the `CTClient.tar.gz` file to a directory on the server. The following directories and files are created in the target directory:

| **Subdirectory** | **Contents** |
|---|---|
| `bin/` | The `run.ksh` file (for UNIX), which run the client |
| `lib/` | The library JAR files needed by the client to invoke an HTTP request that is sent to the servlet |
| `samplescripts/` | The sample scripts that perform forward-provisioning operations through the connector |

4 Install and deploy your implementation of the connector on the application server. Refer to Installing a Connector On WebLogic on page 117 and Configuring a Connector in OVSI on page 120 for instructions.

To verify that the connector is deployed properly, make sure that the JNDI names for the connector's connection factory and parameter factory are listed in the application server's JNDI tree view.

# Testing the Connector

Complete the following steps to test the connector using the tester tool. See each step for details:

- Step 1: Get the connection parameters of your connector.
- Step 2: Prepare the properties file with names and values of these connection parameters.
- Step 3: Test the connection to the resource.
- Step 4: Run the Tester Tool client using one of the scripts.

## Step 1: Get the connection parameters of your connector.

a Be sure the JAVA_HOME environment variable is set.

b Change directories to the install_dir/bin directory and run run.ksh (on UNIX) to invoke the tester client.

c Be sure you have the following information to work with the tester tool scripts:

— JNDI name of the connection factory

— All parameters (and values) defined by the TAConnectorParameterFactory implementation and contained in the extension of TAConnectorParamValueBean

You can use the script getConnectionParams.xml to get the connection parameters of the connector you are testing. Following is an example:

Edit the `ctOpAttributes.properties` file to set the correct Connection factory JNDI Name of your connector. For example eis/LDAPv3 and run it against the Tester Tool as follows:

```
run ../samplescripts/getConnectionParams.xml
http://localhost:7001/ConnectorTester
```

You will see a response like this:

```
<spml:extendedResponse xmlns:spml='urn:oasis:names:tc:SPML:1:0'
xmlns:dsml='urn:oasis:names:tc:DSML:2:0:core' requestID='1769'
result='urn:oasis:names:tc:SPML:1:0#success'>
  <spml:operationalAttributes>
    <dsml:attr name='urn:trulogica:concero:2.0#resourceId'>
```

```
      <dsml:value>eis/LDAPv3</dsml:value>
    </dsml:attr>
    <dsml:attr name='urn:trulogica:concero:2.0#elapsedTime'>
      <dsml:value>511</dsml:value>
    </dsml:attr>
    <dsml:attr
name='urn:trulogica:concero:2.0#connectionParams'>
      <dsml:value>accessURL</dsml:value>
      <dsml:value>suffix</dsml:value>
      <dsml:value>rootDN</dsml:value>
      <dsml:value>rootPassword</dsml:value>
      <dsml:value>userPrefix</dsml:value>
      <dsml:value>userSuffix</dsml:value>
      <dsml:value>userObjectClass</dsml:value>
      <dsml:value>groupSuffix</dsml:value>
      <dsml:value>groupObjectClass</dsml:value>
      <dsml:value>groupIdAsDn</dsml:value>
      <dsml:value>cleanUpGrpsOnDel</dsml:value>
      <dsml:value>mappingFile</dsml:value>
    </dsml:attr>
  </spml:operationalAttributes>
</spml:extendedResponse>
```

## Step 2: Prepare the properties file with names and values of these connection parameters.

You can use the response from the above operation to put all the connection parameters for your connector. Then provide values for each of these parameters in this file.

Following is an example of the properties file for an LDAP resource:

```
urn\:trulogica\:concero\:2.0#resourceId=eis/LDAPv3
accessURL=ldap://127.0.0.1:62394
suffix=dc=americas,dc=hpqcorp,dc=net
rootDN=cn=Directory Manager
rootPassword=abcd1234
userPrefix=
userSuffix=ou=People
userObjectClass=top,person,organizationalPerson,inetorgperson
groupSuffix=ou=Groups
cleanUpGrpsOnDel=true
groupObjectClass=top,groupofuniquenames
mappingFile=iPlanet.xml
```

## Step 3: Test the connection to the resource.

Run the `doTest.xml` script to test the connectivity between the connector and the resource (or agent).

You need to do this next after running the `getConnectionParams.xml` script and setting up your `ctOpAttributes.properties` file.

Following is a sample result of doTest:

**Failure Case** (Invalid resource password used):

```
<spml:extendedResponse xmlns:spml='urn:oasis:names:tc:SPML:1:0'
xmlns:dsml='urn:oasis:names:tc:DSML:2:0:core' requestID='1769'
result='urn:oasis:names:tc:SPML:1:0#failure'
error='urn:oasis:names:tc:SPML:1:0#customError'>
  <spml:operationalAttributes>
    <dsml:attr name='urn:trulogica:concero:2.0#resourceId'>
      <dsml:value>eis/LDAPv3</dsml:value>
    </dsml:attr>
    <dsml:attr name='errorMessages'>
      <dsml:value>Code=urn:trulogica:concero:2.0#generalError,
Message=[LDAP: error code 49 - Invalid Credentials]</dsml:value>
    </dsml:attr>
  </spml:operationalAttributes>
  <spml:errorMessage>Failure in Handling request</spml:errorMessage>
</spml:extendedResponse>
```

**Success Case:**

```
<spml:extendedResponse xmlns:spml='urn:oasis:names:tc:SPML:1:0'
xmlns:dsml='urn:oasis:names:tc:DSML:2:0:core' requestID='1769'
result='urn:oasis:names:tc:SPML:1:0#success'>
  <spml:operationalAttributes>
    <dsml:attr name='urn:trulogica:concero:2.0#resourceId'>
      <dsml:value>eis/LDAPv3</dsml:value>
    </dsml:attr>
    <dsml:attr name='urn:trulogica:concero:2.0#elapsedTime'>
      <dsml:value>3826</dsml:value>
    </dsml:attr>
  </spml:operationalAttributes>
</spml:extendedResponse>
```

### Step 4: Run the Tester Tool client using one of the scripts.

Following is an example of sending an Add User Request to the connector:

```
run ../samplescripts/addUser.xml http://localhost:7001/
ConnectorTester
```

This sends the contents of the `addUser.xml` script to the servlet deployed in the local application server instance. See Tester Tool Scripts on page 113 for a list and description of each SPML script available for use with the tester client.

## Tester Tool Scripts

The servlet is driven by SPML requests. The sample scripts provide a basis for creating (or generating) your own scripts to test the connector implementation. The following sections describe the sample scripts and the operations they perform.

### Initial Connectivity-Related Scripts

- `getConnectionParams.xml`
  Retrieves the connection parameters for the resource. The properties file (created in step Step 2: Prepare the properties file with names and values of these connection parameters. on page 111) must specify the `urn\:trulogica\:concero\:2.0#resourceId` value set to the JNDI name. All others are retrieved from the connector. This is useful in the initial stage if you do not have the connection parameter information.
- `getUserAttrDefinitions.xml`
  Retrieves all user attributes as configured in the schema mapping.
- `getEntAttrDefinitions.xml`
  Retrieves all entitlement attributes.
- `doTest.xml`
  Performs a connectivity test between the connector and the resource, where all the connection parameters are validated. Typically, if this fails, one or more connection parameters is not given or is assigned an invalid value.

## Provisioning-Related Scripts

- `getAllEntitlements.xml`
  Retrieves all entitlements in the resource. Optionally, you can set the value of the identifier element with the user ID to get all entitlements of the given user.
- `getFilteredEntitlements.xml`
  Performs a filtered search for entitlements.
- `isUserExists.xml`
  Verifies that a user exists in the resource.
- `addUser.xml`
  Adds a new user.
- `addUser-ents.xml`
  Adds a user with a set of entitlements.
- `addUser-mva.xml`
  Adds a user with one multi-valued attribute.
- `modifyUser.xml`
  Modifies an attribute value of the user.
- `modifyUser-attr-del.xml`
  Modifies a user by deleting an attribute from the user.
- `modifyUser-ents-add.xml`
  Modifies a user by adding an entitlement.
- `modifyUser-ents-del.xml`
  Modifies a user by deleting an entitlement.
- `modifyUser-mva-add.xml`
  Modifies a user by adding a sub-value to a multi-valued attribute.
- `modifyUser-mva-del.xml`
  Modifies a user by deleting a sub-value from a multi-valued attribute.
- `modifyUser-mva-replace.xml`
  Modifies a user by replacing all sub-values of a multi-valued attribute.
- `resetPassword.xml`
  Resets a user’s password.
- `expirePassword.xml`
  Expires or unexpires a user's password.

- `disable.xml`
  Disables a user.
- `disableSvcMembership.xml`
  Removes all entitlements from a user.
- `enable.xml`
  Enables a user.
- `enableSvcMembership.xml`
  Adds a list of entitlements to a user.
- `getUser.xml`
  Retrieves the current attribute values for a user in the resource.
- `getUserEntitlements.xml`
  Retrieves all user entitlements.
- `deleteUser.xml`
  Deletes a user.

## Bulk Provisioning Scripts

- `batchAdd.xml`
  Adds a list of users.
- `batchModify.xml`
  Modifies one attribute on a list of users.

# 6 Installation and Deployment

This chapter describes how to install and deploy your connector once you have built it.

This chapter contains the following sections:

- Installing a Connector On WebLogic
- Configuring a Connector in OVSI

## Installing a Connector On WebLogic

To deploy the connector on the OVSI server, you must copy the connector files to the target locations and configure the application server. The following procedures provide general guidelines for installing a connector on the supported application servers; the details will depend on how the connector was implemented and the type of application server.

Complete the following steps to install the connector on the WebLogic Server:

1. Create a subdirectory in the OVSI home directory where the connector's RAR file will reside.
2. Copy the RAR file to the connector subdirectory.
3. Create a schema subdirectory in the OVSI home directory where the connector's mapping file(s) will reside.
4. Extract the contents of the JAR file to the schema subdirectory.
5. Ensure that the CLASSPATH environment variable in the WebLogic server startup script references the schema subdirectory.

6 Modify the mapping file to reflect the attribute names in OVSI and on the resource, if necessary.

7 Start the application server if it is not currently running.

8 Log on to the WebLogic Server Console.

9 Navigate to ***My_domain*** $\rightarrow$ **Deployments** $\rightarrow$ **Connector Modules.**

10 Click **Deploy a New Connector Module.**

11 Locate and select the RAR file from the list. It is stored in the connector subdirectory.

12 Click **Target Module.**

13 Select the **My Server** (your server instance) check box.

14 Click **Continue**. Review your settings.

15 Keep all default settings and click **Deploy**. The Status of Last Action column should display Success.

If the connector is a two-way connector and uses an agent, install and configure the agent on the resource with which the connector communicates to provision users. The agent may also be used to synchronize changes to the identity objects, pushing the changes from the resource to OVSI.

## Configuring a Connector in OVSI

After you create a connector, you can configure it for use by OVSI using the OVSI client (interface). The following provides an overview of the procedures you must complete in order to deploy your connector:

1 After you build and install the connector, you must register it with OVSI. Do so on the home page of the Connectors tab by clicking the **Deploy New Connector** button. Complete this procedure, referencing your connector files, as described in the "Connectors" chapter of the *HP OpenView Select Identity Administrator Guide*.

2 You must deploy the resource that uses the newly created connector. On the home page of the Resources tab, click the **Deploy New Resource** button. Complete the steps in this procedure, referencing the new connector created in step 1, as described in the "Resources" chapter of the *HP OpenView Select Identity Administrator Guide*.

3 Create attributes that link OVSI to the connector. For each mapping in the connector's mapping file, create an attribute using the Attributes capability on the OVSI client. Refer to the "Attributes" chapter in the *HP OpenView Select Identity Administrator Guide* for more information.

4 Create a Service that will use the newly created resource. To do so, click the **Deploy New Service** button on the home page of the Services tab. Complete this procedure as described in "Services" of the *HP OpenView Select Identity Administrator Guide*. You will reference your new resource created in step 2 while creating this Service.

# 7 HP Openview Select Identity Web Service

HP OpenView Select Identity (OVSI) provides the ability to provision users in repositories. Using the Web Service, you can programmatically provision users in OVSI. Consider the following example:

> Company X's Human Resources department relies on an enterprise resource planning (ERP) application to manage employees. When a new employee is hired, the HR department adds the employee to the system. However, the new hire will need email and network accounts and access to the systems on which he will fulfill his job responsibilities. The OVSI Web Service enables you to automate the ERP application to send a request to provision the user. Then, OVSI can create the necessary accounts and access privileges on Company X's systems according to the services defined for the user.

This chapter contains the following sections:

## Web Service Operations

The Web Service enables you to perform the following operations:

- User provisioning

  Most of the user operations provided by the Users home page of the OVSI client can be performed using the OVSI Web Service. These operations are initiated from an external source and the changes are made in OVSI. Here is a list of supported operations:

  — Add a user

  — Enable a user

  — Modify user attributes (except passwords) and entitlements

  — Delete a user

  — Retrieve a user profile

  — Enable or disable service membership

  — Reset or change a user's password

  — Terminate a user

- Password synchronization

  Using the Web Service, you can change a user's password on a resource then synchronize with OVSI to change the password stored in the OVSI repository. This is called reverse synchronization. This enables a resource to push user information to OVSI. The agent (provided by a two-way connector) on the resource tracks changes made on the resource and synchronizes with OVSI.

  Rules identify the Services that are affected when a reverse synchronization operation is issued based on the resource ID sent by the resource. Rules also specify the location of the reverse mapping that should to be performed for add and modify operations, such as NT Domain Resource -> ntuser.properties. Thus, reverse synchronization can be performed only for those services with specified rules a mapping for the incoming resource ID. If rules or the mapping does not exist, the request is logged and ignored.

- Reconciliation

  The Web Service also enables an external resource to issue a reconciliation request. Thus, the resource can issue a reconciliation request, sending the data to add or update in OVSI. Through reconciliation, the following operations can be performed using the Web Service:

  — Add a user, if the resource is authoritative

  — Add attributes to an existing user, if the resource is non-authoritative

  — Modify a user

  — Delete a user

  These operations can be performed singularly or in a batch. For in-depth information about reconciliation and authoritative versus non-authoritative resources, refer to the *HP OpenView Select Identity Administrator Guide*.

In addition, the resource-specific attribute names contained in the SPML request must be converted to the attribute names defined by the resource (XML) mapping file. To do this, the SPML request is parsed using an XSL file, which must be provided with the connector.

## Issuing Requests

External systems can send Simple Object Access Protocol (SOAP) messages to OVSI for user provisioning, to which the Web Service will send a response. Then, OVSI can push the users to the appropriate resources as defined by the services assigned to the users. The Web Service was implemented according to the OASIS Service Provisioning Markup Language (SPML) specification, which defines concepts, operations, and the XML schema for an XML-based provisioning request and response protocol. Refer to the specification for details about all standard elements and attributes.

To issue requests to OVSI in order to provision users and synchronize data, the external system must send a SOAP message containing a SPML request. The request must be sent to the following URL:

**http://*select_identity_host*:*port*/lmz/webservice/**

Refer to the online help on the OVSI CD (in the `docs/api_help/web_service/help` directory) for a client example that issues a request and handles responses.

## SPML Requests Implemented by OVSI Web Service

The following SPML requests are supported by OVSI Web Service:

- **<addRequest>**
- **<deleteRequest>**
- **<extendedRequest>**
- **<modifyRequest>**
- **<searchRequest>**
- **<batchRequest>**

Refer to the online help provided on the OVSI CD (in the `docs/api_help/web_service/help` directory) for information about each of these elements. Also, sample XML files are provided to illustrate how to use these elements; refer to the `SampleXML/Web Service` and `SampleXML/Reconciliation/Web Service` directories on the CD.

The Web Service SPML requests can be sent for either of the two following reasons:

- Forward Provisioning

  This is the case when external systems want to provision users into OVSI services.

- Reconciliation

  This is the case when agents want to reconcile a change event that occurred in the resource and want to sync up with OVSI. This reconcile event is handled by the OVSI reconciliation engine and is carried over to other resources that are related by the service which was affected by this change.

# SPML Examples

This section provides examples of SPML you must send when issuing requests. All sample SMPL requests are provided in the `ConnectorSDK` folder under the `WebService` subfolder.

## Forward Provisioning Examples

### Adding a User

Following is an example of the **<addRequest>** element. The **<operationalAttributes>** element provides login credentials for the admin administrator, and the service for which the user is added is the Firewall Service. The **<attributes>** element specifies information about the user. These attributes are service-specific.

**File: `WS-addUser.xml`**

```
<!--
      SPML Request to Add a new User
      ******************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <addRequest requestID='12345'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#serviceName'>
                    <value>Default</value>
                    <value>Global</value>
                    <value>USA</value>
                    <value>Texas</value>
                </attr>
            </operationalAttributes>
            <attributes>
                <attr name='UserName'>
                    <value>wsuser</value>
                </attr>
                <attr name='Password'>
                    <value>abcd1234</value>
                </attr>
                <attr name='FirstName'>
                    <value>Anna</value>
                </attr>
                <attr name='LastName'>
                    <value>Allen</value>
                </attr>
                <attr name='Email'>
                    <value>chollocker@trulogica.com</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#groups:LDAP'>
                <!-- From Training manual -->
                    <value>Camera</value>
                    <value>Video</value>
                </attr>
                <attr name='Company'>
                    <value>HP</value>
                </attr>
                <attr name="Department">
                    <value>SI</value>
                </attr>
                <attr name='City'>
                    <value>Dallas</value>
                </attr>
                <attr name='State'>
                    <value>Texas</value>
                </attr>
                <attr name='Country'>
                    <value>USA</value>
                </attr>
<!--
                <attr name='ExpirationDate'>
                    <value>08/09/2006</value>
                </attr>
-->
                <attr name='BirthDate'>
                    <value>08/09/1980</value>
                </attr>
                <attr name="Zip"/>
            </attributes>
```

```
        </addRequest>
    </soap:Body>
</soap:Envelope>
```

## Modifying a User

Following is an example of the **<modifyRequest>** element. The **<operationalAttributes>** element provides login credentials for the admin administrator, for the Firewall Service. The **<identifier>** element provides the user ID of the user to modify. The **<attributes>** element specifies information to be modified for the user.

When modifying a user, ensure that the user's current entitlements are specified as part of the request. If you do not specify the existing entitlements, they are removed from the user. Also, you cannot modify a user's password using the **<modifyRequest>** element; use the **<extendedRequest>** element for this purpose.

**File: `WS-modifyUser.xml`**

```
<!--
      SPML Request to Modify user's attributes
      ****************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <modifyRequest requestID='12345'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#serviceName'>
                    <value>USA</value>
                </attr>
            </operationalAttributes>

            <identifier
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsuser</id>
            </identifier>
            <modifications>
                <modification name='LastName' operation='replace'>
                    <value>Allen-Anderson</value>
                </modification>
                <modification
name='urn:trulogica:concero:2.0#groups:LDAP' operation='add'>
                    <value>QA Managers</value>
                </modification>
                <modification
name='urn:trulogica:concero:2.0#groups:LDAP' operation='delete'>
                    <value>Camera</value>
                </modification>
                <modification name='Email' operation='replace'>
                    <value>wsuser@hp.com</value>
                </modification>
                <modification name='City' operation='deleteAttr'/>
                <modification name='Country' operation='deleteAttr'/>
                <attr name='Password'>
                    <value>trulogica1</value>
                </attr>
            </modifications>
        </modifyRequest>
    </soap:Body>
</soap:Envelope>
```

## Deleting a User

Following is an example of the **<deleteRequest>** element. The **<operationalAttributes>** element provides login credentials for the admin administrator, for the Firewall Service. The **<identifier>** element provides the user ID of the user to delete.

**File: `WS-deleteUser.xml`**

```
<!--
      SPML Request to Delete a User
      *****************************
-->

<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>

        <deleteRequest requestID='12345'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
```

```
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#serviceName'>
                    <value>Global</value>
                </attr>
            </operationalAttributes>

            <identifier
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsup</id>
            </identifier>
        </deleteRequest>

    </soap:Body>
</soap:Envelope>
```

## Retrieving a User Profile

Following is an example of the **<searchRequest>** element.

**File: `WS-getUser.xml`**

```
<!--
      SPML Request to Get the info User wsuser. If a primary user,
      retrieves the listing of the SubAccounts, etc. as well.
      ***********************************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <searchRequest requestID='12345'
execution='urn:oasis:names:tc:SPML:1:0#synchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
            </operationalAttributes>
            <searchBase
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsuser</id>
            </searchBase>
        </searchRequest>

    </soap:Body>
</soap:Envelope>
```

## Retrieving a User by Resource

### File: `WS-getUserForResource.xml`

```
<!--
      SPML Request to Get the details of a User
      *****************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <searchRequest requestID='12345'
execution='urn:oasis:names:tc:SPML:1:0#synchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
            </operationalAttributes>

            <filter>
                <equalityMatch
name='urn:trulogica:concero:2.0#resourceId'>
                    <value>LDAP</value>
                </equalityMatch>
            </filter>

<!-- For a specific subset of Attributes, uncomment the following
section.
            <attributes>
                <attr name='ConceroUserId'/>
                <attr name='ConceroEmail'/>
                <attr name='FirstName'/>
                <attr name='LastName'/>
            </attributes>
```

```
-->
        </searchRequest>

    </soap:Body>
</soap:Envelope>
```

### Retrieving a User for Service

**File: `WS-getUserForService.xml`**

```
<!--
      SPML Request to Get the details of all Users of specified
Service(s)

*******************************************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <searchRequest requestID='12345'
execution='urn:oasis:names:tc:SPML:1:0#synchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
            </operationalAttributes>

            <filter>
                <equalityMatch
name='urn:trulogica:concero:2.0#serviceName'>
                    <value>Default</value>
                    <value>Global</value>
                </equalityMatch>
            </filter>

<!-- For a specific subset of Attributes, uncomment the following
section.
            <attributes>
                <attr name='ConceroUserId'/>
                <attr name='ConceroEmail'/>
                <attr name='FirstName'/>
                <attr name='LastName'/>
            </attributes>
```

```
-->
        </searchRequest>
    </soap:Body>
</soap:Envelope>
```

## Enabling a User

Following is an example of the **<extendedRequest>** attribute, to enable a user's account.

**File: `WS-enableUser.xml`**

```
<!--
      SPML Request to enable user
      ***************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <extendedRequest requestID='1769'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
            </operationalAttributes>

            <identifier
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsuser1</id>
            </identifier>
            <providerIdentifier
providerIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <providerID>urn:trulogica:concero:2.0</providerID>
            </providerIdentifier>
            <operationIdentifier
operationIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <operationID>urn:trulogica:concero:2.0#enable</
operationID>
            </operationIdentifier>
            <attributes/>
        </extendedRequest>
    </soap:Body>
```

```
</soap:Envelope>
```

## Disabling a User

### File: **`WS-disableUser.xml`**

```
<!--
      SPML Request to disable user across all resources
      *************************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <extendedRequest requestID='1769'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
            </operationalAttributes>

            <identifier
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsuser2</id>
            </identifier>
            <providerIdentifier
providerIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <providerID>urn:trulogica:concero:2.0</providerID>
            </providerIdentifier>
            <operationIdentifier
operationIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <operationID>urn:trulogica:concero:2.0#disable</
operationID>
            </operationIdentifier>
            <attributes/>
        </extendedRequest>
    </soap:Body>
</soap:Envelope>
```

## Resetting a User’s Password

The following is an example of the **<extendedRequest>** attribute, to reset a user’s password.

**File: `WS-ResetPass.xml`**

```
<!--
      SPML Request to Change a user's password
      ****************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <extendedRequest requestID='1769'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
            </operationalAttributes>

            <identifier
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsuser</id>
            </identifier>

            <providerIdentifier
providerIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <providerID>urn:trulogica:concero:2.0</providerID>
            </providerIdentifier>

            <operationIdentifier
operationIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <operationID>urn:trulogica:concero:2.0#resetPassword</
operationID>
            </operationIdentifier>

            <attributes>
                <!--
                    Default Password for all unspecified resources
                -->
                <attr name='urn:trulogica:concero:2.0#rcPassword'>
```

```
                    <value>new:abc123</value>
                </attr>
            </attributes>

        </extendedRequest>
    </soap:Body>
</soap:Envelope>
```

## Terminating a User

Following is an example of the **<extendedRequest>** attribute, to terminate a user.

**File: `WS-terminateUser.xml`**

```
<!--
      SPML Request to terminate a user's account
      ******************************************
-->
<soap:Envelope xmlns:soap='http://schemas.xmlsoap.org/soap/envelope/'>
    <soap:Body>
        <extendedRequest requestID='1769'
execution='urn:oasis:names:tc:SPML:1:0#asynchronous'>
            <operationalAttributes>
                <attr
name='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                    <value>sisa</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#password'>
                    <value>abc123</value>
                </attr>
                <attr name='urn:trulogica:concero:2.0#serviceName'>
                    <value>Global</value>
                </attr>
            </operationalAttributes>

            <identifier
type='urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName'>
                <id>wsuser1</id>
            </identifier>
            <providerIdentifier
providerIDType='urn:oasis:names:tc:SPML:1:0#URN'>
                <providerID>urn:trulogica:concero:2.0</providerID>
            </providerIdentifier>
            <operationIdentifier
operationIDType='urn:oasis:names:tc:SPML:1:0#URN'>
```

```
                <operationID>urn:trulogica:concero:2.0#terminate</
operationID>
            </operationIdentifier>
        </extendedRequest>
    </soap:Body>
</soap:Envelope>
```

## Reconciliation SPML Request Examples

### Recon Auth Add User

**File: `WSReconAuthAdd.xml`**

```
<!--
      SPML Request to Add a new User from a recon auth resource
      ******************************
  -->
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <addRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP71</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>UserName</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#taUserName">
                    <value>WSu7301</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#taResourceKey">
                    <value>WSu7301</value>
                </attr>
            </operationalAttributes>

            <attributes>
                <attr name="UserName">
                    <value>WSu7301</value>
                </attr>
                <attr name="Email">
                    <value>user.email@hp.com</value>
                </attr>
                <attr name="State">
                    <value>TX</value>
                </attr>
                <attr name="FirstName">
                    <value>Abigail</value>
                </attr>
                <attr name="LastName">
                    <value>Anderson</value>
                </attr>
                <attr name="Employee ID">
                    <value>HP</value>
                </attr>
                <attr name="Zip">
                    <value>75000</value>
                </attr>
            </attributes>
        </addRequest>
    </soap:Body>
</soap:Envelope>
```

## Recon Auth Modify User

### File: `WSReconAuthMod.xml`

```
 <!--
      SPML Request to modify a new User from a recon auth resource
      ******************************
  -->
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <modifyRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP71</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>UserName</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7212</id>
            </identifier>

            <modifications>
                <modification name="FirstName" operation="replace">
                    <value>ANNA</value>
                </modification>
                <modification name="LastName" operation="replace">
                    <value>ALENDALE</value>
                </modification>
                <modification name="Address 1" operation="replace">
                    <value>1525 EAST GATE DRIVE, WITCHITA</value>
                </modification>
                <modification name="Zip" operation="replace">
                    <value>62005</value>
                </modification>
                <modification name="State" operation="replace">
                    <value>KS</value>
                </modification>
            </modifications>
        </modifyRequest>
    </soap:Body>
</soap:Envelope>
```

## Recon Auth Delete User

**File: `WSReconAuthDel.xml`**

```
 <!--
      SPML Request to delete a User from a recon auth resource
      ******************************
  -->
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <deleteRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP71</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>UserName</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7224</id>
            </identifier>
        </deleteRequest>

    </soap:Body>
</soap:Envelope>
```

## Recon Non-Auth Add User

**File: `WSReconNonAuthAdd.xml`**

```
<!--
      SPML Request to Add a new User from a non-authorative user
      ******************************
  -->
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <addRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP70</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>UserName</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#taResourceKey">
                    <value>WSu7221</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7221</id>
            </identifier>

            <attributes>
                <attr name="urn:trulogica:concero:2.0#groups">
                    <value>HR Managers</value>
                    <value>PD Managers</value>
                </attr>
            </attributes>
        </addRequest>
    </soap:Body>
</soap:Envelope>
```

## Recon Non-Auth Modify  User

### File: **`WSReconNonAuthMod.xml`**

```
 <!--
      SPML Request to modify a User from a non authorative resource
      ******************************
  -->
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <modifyRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP70</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>UserName</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7233</id>
            </identifier>

            <modifications>
                <modification name='urn:trulogica:concero:2.0#groups'
operation='delete'>
                    <value>HR Managers</value>
                </modification>
                <modification name='urn:trulogica:concero:2.0#groups'
operation='add'>
                    <value>$UNIX2</value>
                </modification>
            </modifications>

        </modifyRequest>
    </soap:Body>
</soap:Envelope>
```

## Recon Non-Auth Delete User

### File: **`WSReconNonAuthDel.xml`**

```
<!--
      SPML Request to delete a User from non-auth resource
      ******************************
  -->
<soap:Envelope xmlns:soap="http://schemas.xmlsoap.org/soap/envelope/">
    <soap:Body>
        <deleteRequest requestID="12345"
execution="urn:oasis:names:tc:SPML:1:0#asynchronous">
            <operationalAttributes>
                <attr
name="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                    <value>sisa</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#password">
                    <value>abc123</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#resourceId">
                    <value>LDAP70</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#keyFields">
                    <value>UserName</value>
                </attr>
                <attr name="urn:trulogica:concero:2.0#reverseSync">
                    <value>true</value>
                </attr>
            </operationalAttributes>

            <identifier xmlns=""
type="urn:oasis:names:tc:SPML:1:0#UserIDAndOrDomainName">
                <id>WSu7235</id>
            </identifier>
        </deleteRequest>
    </soap:Body>
</soap:Envelope>
```

## External Authentication of Requests

In addition to authentication by the OVSI server, SPML requests sent to the OVSI Web Service can be authenticated by a Windows Active Directory LDAP server. If you wish to authenticate requests this way, complete the steps in the following procedure:

1 Create a user on the LDAP server that has the same credentials (user name and password) as those of the OVSI user that is authenticated (such as the **sisa** account).

2 Modify the `TruAccess.properties` file on the OVSI server to uncomment (remove the leading # characters) from the following lines:

```
#com.hp.si.webservice.auth.resource=ldap
#com.hp.si.webservice.auth.ldap.accessurl=ldap://localhost:389
#com.hp.si.webservice.auth.ldap.uidattr=uid
#com.hp.si.webservice.auth.ldap.suffix=ou=People,
 dc=trulogica,dc=com
#com.hp.si.webservice.auth.ldap.needssl=false
```

3 Change these properties as follows:

| **Property** | **Value** |
|---|---|
| `com.hp.si.webservice.auth.ldap.accessurl` | The URL of the Active Directory LDAP server. |

| **Property** | **Value** |
|---|---|
| `com.hp.si.webservice.auth.ldap.uidattr` | The name of the key attribute for users. |
| `com.hp.si.webservice.auth.ldap.suffix` | The suffix of the DN for the administrative account created for OVSI. This account must be the same as the one used for OVSI authentication.<br>For example, if you create a user with this DN:<br>`Cn=sisa,ou=Users,dc=amegy,dc=com`<br>The suffix is `ou=Users,dc=amegy,dc=com`.. |

Following is an example:

```
com.hp.si.webservice.auth.resource=ldap
com.hp.si.webservice.auth.ldap.accessurl=
  ldap://ad-server-ip:389
com.hp.si.webservice.auth.ldap.uidattr=cn
com.hp.si.webservice.auth.ldap.suffix=ou=users,dc=amegy,dc=com
com.hp.si.webservice.auth.ldap.needssl=false
```

4 Save and close the `TruAccess.properties` file.

# 8 Connector Migration

This chapter provides detailed information on migrating OVSI 3.3.x connectors to OVSI 4.0.

This chapter contains the following:

## Reasons to Migrate

The Connector API has been enhanced with OVSI 4.0 with the additional support of the following features. You need to update your OVSI 3.3.x-based connector to take advantage of one or more of the new features.

However, the OVSI 3.3.x connector should be able to run without any changes with OVSI 4.0, using the new `connector.jar` file in the CLASSPATH.

- Multi-valued attributes

  Each attribute can have multiple values in OVSI 4.0. The value passed to the Connector by OVSI is in an instance of TAAttrValueBean which holds the complete value of the attribute. Refer to the Javadoc of this class to explain the details on how to get the value of the attribute, specifically for add and modify operations.

- Multiple types of entitlements

  Depending on resource support, connectors can now support multiple types of entitlements such as groups, roles, ACLs and so on.

  There is a type field in EntitlementModel which contains the entitlement type.

- Addition/deletion/modification/emptying of attributes

  Modify user might mean not only replacing the attribute value, but also the addition of a new attribute, deletion of an existing attribute, cleaning up all the values of the attribute, or modifying the attribute. This might further mean adding/deleting sub-values. All this can be done with OVSI 4.0 connectors.

- Enhanced User Modify

  The user modify operation called by OVSI now contains only the changed attributes, as compared to earlier versions where all attributes are passed and the connector does not know which ones are changed.

  This allows the connector to update only the changed attributes on the resource.

- Bulk association/dissociation of entitlements

  The OVSI 3.3.x interface supports assignment/de-assignment of entitlements one at a time. For example, if you are adding a user with 10 entitlements in OVSI 3.3.x, there will be one call to add the user on the connector, followed by 10 calls to assign each entitlement to the user.

  With the OVSI 4.0 interface, all the entitlements are given in one List instance and it is up to the connector to carry out the bulk assignment or call multiple times on the resource.

- Enhanced Search criteria for entitlements retrieval

  Multiple Search criteria can be given to retrieve entitlements from the resource.

## Interface Changes

This section lists all the changes in the OVSI 4.0 connector API. Follow this section closely to understand what needs to be done to migrate your OVSI 3.3.x connector.

This section contains the following subsections:

- Connector API Changes
- Attribute Operations
- Schema Changes

## Connector API Changes

The tables in the following sections show the changes on the OVSI Connector API:

- Classes and Interfaces
- Connector Interface

### Classes and Interfaces

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `TAConnector` | `SIConnector` | This is the main connector interface. That is the interface that OVSI uses to talk to every connector. The name of this interface has changed along with cleanup of some of the unused methods. |
| `AbstractTAConnector` | `AbstractSIConnector` | Connector implementation can alternatively extend this abstract class, which provides some dummy implementation for the rarely used methods. Removed some un-used methods. |
| `TAConnectorFactory` | `SIConnectorFactory` | This is the factory for the new connector implementation. |

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `UserModel` | `SIUserModel` | Main Java interface that holds the user attribute data. This is what is passed from OVSI to the connector. There are many changes in this Java interface to support more granular support for attribute level operations. |
| `JCAUserModel` | `SIJCAUserModel` | Implementation class for SIUserModel Java interface. |
| `GroupModel` | `EntitlementModel` | Java interface that holds the user entitlement data. This has been enhanced to hold different types of entitlements such as groups, roles, privileges, ACLs, responsibilities, or any generic entitlement type. |
| `JCAGroupModel` | `JCAEntitlementModel` | Implementation class for EntitlementModel Java interface. |
| `RoleModel` | `Removed` | Not used any longer. |
| `EntitlementModel` | `Removed` | Not used any longer. |

| **OVSI 3.3 framework** | **OVSI 4.0 framework** | **Comments** |
|---|---|---|
| `ChangeLogModel` | `SIChangeLogModel` | This is the Java class to report changes that occurred in the resource when OVSI polls the connector. This class has been enhanced to use a cursor class. This cursor replaces the interface used earlier, which is not sufficient in most cases. |
| `Absent` | `TAConnectorRequestIntf`, `TAConnectorResponseIntf`, `TAConnectorRequest`, `TAConnectorResponse` | Introducing a generic interface to address all future API changes. |

## Connector Interface

This section details the connector interface. The following table shows the main changes to the SIConnector interface:

| **OVSI 3.3 framework** | **OVSI 4.0 framework** | **Comments** |
|---|---|---|
| All provisioning methods that have UserModel argument | Changed to use SIUserModel | |

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| Methods that have GroupModel argument | Changed to have EntitlementModel | All methods that get entitlements from the resource, link and unlink methods to associate and dissociate entitlements to/from users must now use the EntitlementModel interface — actually the implementation class JCAEntitlementModel) instead of GroupModel (or JCAGroupModel class). |
| link(UserModel, GroupModel)unlink(UserModel, GroupModel) | link(SIUserModel, List)unlink(SIUserModel, List) | All single link/unlink operations must now change to link/unlink multiple entitlements that are passed in the Java List instance. This helps limit the number of times OVSI calls the entitlements. It is up to the connector and resource to support bulk link/unlink operations. |

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `getGroups()` and `getGroups(TAFilter)` | `getEntitlements(TAQuery)` | Earlier use of TAFilter had the limitation of just one filter. TAQuery is a combination of a many TAFilter instances. This API supports multiple search criteria provided by OVSI. |
| `getUsers()` | `getUsers(TAQuery)` | This method is mainly used for User Import. This now supports filtered retrieval of users. |
| `getUserAttributes()` | `getUserAttributes()` | Name of API has no change, but the implementation now must return all different entitlement types that are supported by the connector and resource.<br>Example: GROUP, ROLE, ACL, and so on.<br>Default is ENTITLEMENTS (if no entitlement types are returned). |

| **OVSI 3.3 framework** | **OVSI 4.0 framework** | **Comments** |
|---|---|---|
| String attribute value | `TAAttrValueBean` and `TAAttrMemberValueBean` | Enhanced way of more granular control over attribute values and operations on these values. Example: add/delete/ modify attributes sent as part of a modify user. Modify attribute value might further be add/delete sub-values. |
| void API return | `TAStatus` | Return status of API methods. |
| `getChangeLog(int)` | `getChangeLog(ChangeLogCursor)` | Cursor for iterative retrieval of records. Earlier it was just a single integer which might not be sufficient in all cases. |
| Absent | `loadResourceSchema()` | New method introduced for connectors to load schema from the resource. Can be used by attribute mapper. |
| Absent | `process(TAConnectorRequestIntf)` | Added a new method to support any/all future API change requirements. Generic enough to hold any data agreed upon by the caller and the connector implementation. |

## Attribute Operations

Starting with OVSI 4.0 the following operations are supported with an update user operation. This information is carried in the TAAttrValueBean instance.

- Replace attribute value

This was the only operation supported in earlier operations, to replace the attribute value with a new value.

- Add attribute

  Add a new attribute to the user in resource, with a possible value.

- Modify attribute value

  For multi-valued attributes a Modify operation is supported which might mean:

  — Add one or more sub-values

  — Remove one or more sub-values

- Delete attribute

  Remove the attribute from user in the resource.

- No change

  This means that OVSI has not changed this attribute, but is being given to the connector since it is marked as a required attribute in the mapping. Do not modify the user attribute in the resource. However, you may use the value given — for example, to address the user in the resource.

## Schema Changes

The XML schema mapping file has added more properties for each mapping. The tables in the following sections explain the changes to the XML schema mapping file:

- Entity Definition
- Relationship Definition
- XML Mapping File Changes

## Entity Definition

This defines how entities (users and entitlements) are mapped onto the resource. The following table shows the change in the objectClassDefinition of the XML mapping file.

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `name="User"` | `"Name="SIUser"` | To identify the user model co-relating to SIUserModel. |

## Relationship Definition

This defines the entity relationships. The following table shows the change in the `relationshipDefinition` of the XML mapping file..

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `concero:entity="User"` | `"concero:entity= "SIUser"` | To identify the user model co-relating to SIUserModel. |

## XML Mapping File Changes

This defines each attribute mapping from the Select Identity attribute onto the resource/connector attribute. The following table shows the changes in the attributeDefinitionReference in the new interface.

The old mapping file will still work without any changes with the new interface. Change the mapping file only to take advantage of the new features as shown in the following table.

s

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `name` | `name` | no change |
| `required` | `required` | no change |
| `concero:tafield` | `concero:tafield` | no change |

| OVSI 3.3 framework | OVSI 4.0 framework | Comments |
|---|---|---|
| `concero:resfield` | `concero:resfield` | no change |
| `concero:init` | `concero:init` | no change |
| `absent` | `concero:isPassword` | Added this to identify the password attribute mapping. |
| `absent` | `concero:isMulti` | To specify if the resource attribute can take a multi-valued value. |
| `absent` | `concero:isSensitive` | To identify mappings of sensitive attributes. May be used to avoid logging these values. |

## Steps to Migrate Connectors

Following are the main steps to migrate existing connectors to the new interface. See details in each step:

- Step 1: Change the Connector Implementation
- Step 2: Change the XML Mapping File
- Step 3: Remove Deprecated Methods
- Step 4: Use Commons Logging
- Step 5: Package the Connector
- Step 6: Use the Connector Tester Tool

## Step 1: Change the Connector Implementation

Change the Connector implementation so that it now implements the SIConnector interface and all the required methods in it.

Change all occurrences of UserModel to SIUserModel and all occurrences of GroupModel to EntitlementModel.

### Implement the SIConnector

Change your current implementation of TAConnector to SIConnector interface. Follow the details in the Java doc of the SIConnector to implement all the required interface methods. It might be better to extend the abstract class AbstractSIConnector, which has default implementations for most of the rarely used methods so that you could focus only on the mainly required methods.

Following is a detailed explanation of the changes to be done in each of the most commonly implemented connector methods:

- **getUserAttributes()**

  This method should return all the attributes supported by the connector/ resource. In addition to what the earlier version of this method does, you need to return all the types of entitlements supported as follows:

```
   ArrayList attrList = new ArrayList();

// Add all attribute TAConnectorParamBean instances first
...
...

// add all entitlement types here
       TAConnectorParamBean entitlementBean = new TAConnectorParamBean(
"ENTITLEMENTS",

TAConnectorParamBean.ATTR_TYPE_ENTITLEMENT );
        entitlementBean.setMaxLength( 255 );
        entitlementBean.setMultiValued( true );
        entitlementBean.setRequired( true );
        attrList.add( entitlementBean );

        ret = ( TAConnectorParamBean[] ) attrList.toArray( new
TAConnectorParamBean[ 0 ] );
        return ret;
```

The above example shows the return of only the default entitlement type. This could very well return all types of entitlements supported by the connector and the resource. Following is another example returning 3 types:

```
     ArrayList attrList = new ArrayList();

// Add all attribute TAConnectorParamBean instances first
...
...


// add all entitlement types here
       TAConnectorParamBean entitlementBean = new TAConnectorParamBean(
"GROUPS",

TAConnectorParamBean.ATTR_TYPE_ENTITLEMENT );
        entitlementBean.setMaxLength( 255 );
        entitlementBean.setMultiValued( true );
        entitlementBean.setRequired( true );
        attrList.add( entitlementBean );

entitlementBean = new TAConnectorParamBean( "ROLES",

TAConnectorParamBean.ATTR_TYPE_ENTITLEMENT );
        entitlementBean.setMaxLength( 255 );
        entitlementBean.setMultiValued( true );
        entitlementBean.setRequired( true );
        attrList.add( entitlementBean );

entitlementBean = new TAConnectorParamBean( "ACLs",

TAConnectorParamBean.ATTR_TYPE_ENTITLEMENT );
        entitlementBean.setMaxLength( 255 );
        entitlementBean.setMultiValued( true );
        entitlementBean.setRequired( true );
        attrList.add( entitlementBean );

        ret = ( TAConnectorParamBean[] ) attrList.toArray( new
TAConnectorParamBean[ 0 ] );
        return ret;
```

Note that the same type is returned to the connector in the getEntitlements(), link() and unlink() methods in the TAFilter instance in TAQuery. These methods are explained below.

- **getEntitlementAttributes()**

  Earlier method: This was getGroupAttributes().

  This must now be changed to getEntitlementAttributes()

- **add(SIUserModel)**

  New signature of this method is:

  public TAStatus add(SIUserModel userModel) throws TAConnectorException

  userModel has been changed to SIUserModel. The value of each attribute obtained is no longer a Java String as in the earlier userModel. It is now an instance of a bean class TAAttrValueBean. Change your code to now work with this bean instance.

  Following are some of the important methods in SIUserModel:

  — getUserId()

    This returns the OVSI user id value. That means this is the key identifying value of the user in OVSI

  — getResUserId()

    This returns the user id value in the resource. After an initial add() operation is successful, the connector returns the key value of the user in the resource by calling the method setResUserId(). This key value can be brought back for use in other methods, by calling getResUserId(). This is useful in cases where the key value of the user is different in OVSI and the resource. Even if the key value is the same in OVSI and the resource, you must call setResUserId() with the key value at the end of a successful add() operation.

  — get(String)

    The signature of this method shows the return value as Object, but the method actually now returns an instance of the TAAttrValueBean class. This bean represents the value of the attribute passed to the connector by OVSI. See the Javadoc of this class for details on how to extract the attribute value.

— getStrValue()

For connectors that support only single valued attributes, there is a new method in SIUserModel to return the string value of the attribute passed in by OVSI. This is a convenience method and if the connector implementation knows that the value is single valued, it can directly use this method instead of SIUserModel.get(), which returns TAAttrValueBean and extracts the single string value out of it.

— getAttrNames()

This returns the names of attributes present in userModel. In OVSI 3.3.x, it was not possible to get this list, and the connector had to iterate through all the mappings in the XML mapping file. It is possible that OVSI is currently interested in only a few of the attributes that are mapped in the mapping file.

Following is a brief explanation of the value contained in TAAttrValuBean for the passed in SIUserModel add() operation:

```
abbreviation:
     TAAttrValueBean=av
     TAAttrMemberValueBean=amv

 default operation=replace
```

Let's say we are adding a user with the following attributes:

a1 - a single value attribute
a2 - a multi-valued attribute
a3 - another single-valued attribute

```
SIUserModel looks like this:
  SIUserModel {
    a1  - av=[---, List=[amv={---, a1sv1}]], // single-valued
    a2  - av=[---, List=[amv={---, a2mv1}, amv={---, a2mv2}]],
// two values
    a3  - av=[---, List=[amv={---, a3sv1}]], // also
single-valued
       ...
     }
```

Use the above methods to change your add() implementation. The above explained methods are useful in other connector methods as well.

You must set the key value of the user in the resource upon a successful add operation by calling the userModel.setResUserId(String) method.

Finally return the result of the add() operation in the TAStatus instance.

- **update(SIUserModel)**

  Use the SIUserModel.getResUserId() to get the key value of the user so that it can be addressed in the resource.

  ➤ You must have called SIUserModel.setResUserId() in the add(SIUserModel) method.

  The major change in this method is a more granular support for user modifications. A user modify may generally mean replacing an existing user's attributes with a new set of values. With the OVSI 4.0 interface, it is now possible to go a step deeper where you could add attributes, delete attributes, replace attribute values, clear attribute values, and add/delete sub-values in a multi-valued attribute.

  All this is possible now, but it depends on resource support. For example, it is possible to think of such a level of granularity with LDAP or DB provisioning. In some cases, it is simply not possible to do this and the resource or resource API only supports replace attribute value.

  The value of the attribute value contained in TAAttrValueBean has details on the attribute level operations. Following is a brief description with an example:

```
abbreviation:
    TAAttrValueBean=av
    TAAttrMemberValueBean=amv
    --- = not to be considered

user modify (example 1):
  Let's say a1 changed its value to a new value
       a2 has a new sub-value
       a3 has not changed
       a4 a new attribute added
       a5 got deleted
SIUserModel looks like this:

  SIUserModel {
     a1  - av=[replace, List=[{---, a1sv2}]],   // a1svc2 is
the new value
```

```
      a2  - av=[modify, List=[amv={add, a2mv3}]], // add
sub-value a2mv3 to the two sub-values

      a3  - av=[nochange, List=[amv={---, a3sv1}]], // only
given for required fields
                   // non-required fields are not given with
nochange operation

     a4  - av=[add, List=[amv={---, a4sv1}]] // new attribute
added
      a5  - av=[delete, List=null] // attribute deleted in
OVSI
    }
```

user modify (example 2):
  Let's say a1 attribute is deleted
       a2 value completely changed
       a3 is nullified
       a4 is emptied
 SIUserModel looks like this:

```
   SIUserModel {
      a1  - av=[delete, List=null],
      a2  - av=[replace, List=[amv={---, a2sv4}], // value
changed to a single sub-value
      a3  - av=[replace, List=[amv=null]]
      a4  - av=[replace, List=[amv={replace, ""}]]  // use ""
as a function to empty the value
    }
```

Use the above examples to convert your update() method to do the required user level as well as attribute level operations.

- Only the changed attributes are now passed to the connector. The earlier interface used to pass all attribute values and the connector had to replace all given values.
- All attributes marked as required attributes when returning the attribute list (in getUserAttributes()) method, are passed in with all operations. The operation in TAAttrValueBean instance for these attributes is marked with NOCHANGE, so that you know this need not be updated on the resource.

- **isUserExists(SIUserModel)**

  This is a new method introduced in OVSI 4.0 and is called by OVSI to check if a user exists in the resource. Earlier implementation of get(UserModel) must be changed to this method, with a small change as shown in the following note.

  ➤ As noted earlier all the required attributes are passed in SIUserModel. If you need to compute the key you may use these attributes.

  This method returns a Boolean and should not throw ObjectNotFoundException if the user does not exist in the resource. Instead, it should return false.

- **get(SIUserModel)**

  This method is not used by OVSI to check for user existence any longer. This changed to isUserExists(SIUserModel) as explained above.

  get(SIUserModel) is used in User Import to get the details of a user in a resource. It must throw ObjectNotFoundException if the user does not exist.

- **remove(SIUserModel)**

  Use SIUserModel.getResUserId() to perform the delete user operation in resource. If the user is not present, this method must throw ObjectNotFoundException.

  ➤ All attributes marked as required when returning the attribute list (in the getUserAttributes()) method, are passed in with all operations.

- **getEntitlements(TAQuery)**

  This method was called getGroups(). This method should return all entitlements in the resource. Note that there is a new argument TAQuery, which might include a TAFilter, which gives the type of entitlement that OVSI is looking for.

If TAQuery and its TAFilter list is not empty, you must return only those types of entitlements.

➤ This method may also be used to verify entitlements that were returned earlier. In this case, the TAFilter instances in TAQuery contain values and operations to match the specific entitlement. This is a required part of the implementation of this method, to return only the entitlements asked for in TAQuery.

TAQuery is a grouping of TAFilter instances. Following are some of the main methods in this class:

— getTaFilterList()

  This returns a Java List of TAFilter instances.

— getMaxResults()

  This contains the maximum number of values to be returned.

— isFilterListAnded()

  This is a boolean indicating whether the TAFilter instances need to be ANDed or ORed. If true, this means that all TAFilter instances must match, and if false this means that any of the TAFilter instances can match.

TAFilter is a filter criteria to match the results of an operation. Following are some of the main methods in this class:

— getName()

  This returns the name of the TAFilter. In the context of entitlements this means the type of entitlement. If the connector implements only one type of entitlement, then this name can be ignored. If it implements multiple types, then this contains one of the types returned in the getUserAttributes() method.

— getOperation()

  This returns the operation or criteria for the filter. The value returned is one of the following:

    TAFilter.EQUALITY

    TAFilter.BEGINS_WITH

    TAFilter.ENDS_WITH

    TAFilter.CONTAINS

TAFilter.GTE

TAFilter.LTE

TAFilter.NOT_EQUAL

TAFilter.NOT_CONTAINS

- **link(SIUserModel, List)**

  This method was called link(UserModel, GroupModel). This new method now allows bulk link operation from OVSI. It is up to the connector to do it one-by-one or in a group.

  Use SIUserModel.getResUserId() to get the resource key value of the user.

  The List contains instances of JCAEntitlementModel class. Following are some of the useful methods in this class:

  — getId()

    This method was called GroupModel.getGroupId(), and returns the id of the entitlement. Now change all places where you called getGroupId() to getId().

  — getType()

    This method is useful in cases where the connector/resource supports multiple entitlement types. This type returns the type of entitlement being linked to the user.

  ➤ This is one of the types that you returned in the getUserAttributes() method.

- **unlink(SIUserModel, List)**

  This method was called unlink(UserModel, GroupModel). This new method now allows the bulk unlink operation from OVSI. It is up to the connector to do it one-by-one or in a group.

  Use SIUserModel.getResUserId() to get the resource key value of the user.

  The List contains instances of the JCAEntitlementModel class. Following are some of the useful methods in this class:

  — getId()

    This method was called GroupModel.getGroupId(), and returns the id of the entitlement. Now, change all places where you called getGroupId() to getId().

— getType()

This method is useful in cases where the connector/resource supports multiple entitlement types. This type returns the type of entitlement being linked to the user.

➤ This is one of the types that you returned in getUserAttributes() method.

- **setStatus(SIUserModel, int)**

  Earlier method: setStatus(UserModel, int)

  Use SIUserModel.getResUserId() to get the resource key value of the user.

- **resetPassword(SIUserModel)**

  Earlier method: resetPassword(UserModel)

  Use the method SIUserModel.getPassword() to get the new value of the password to replace with on the resource.

- **expirePassword(SIUserModel, boolean)**

  Earlier method: expirePassword(UserModel, boolean)

  Use SIUserModel.getResUserId() to get the resource key value of the user.

- **getChangeLog(ChangeLogCursor)**

  Earlier method: getChangeLog(int)

  This method should check the resource for all changes that occurred after the previous call to this method and must prepare an instance of SIChangeLogModel with the details of these changes.

  The SIChangeLogModel method represents the changes that occurred in the resource, in a normalized format. Any resource-specific API return values or format returned, must be parsed and converted into an instance of this class. This class contains the following main methods:

  — setCursor(ChangeLogCursor)

  The new value of the cursor must be set in SIChangeLogModel. A cursor identifies a checkpoint in the resource change log, so that a next call to getChangeLog() will read the changes past this checkpoint.

With OVSI 3.3.x, an integer number was used as the checkpoint, which may not be sufficient. With OVSI 4.0, you can use this cursor which has an integer along with a Java Serializable object, which can hold more information about this checkpoint.

— addCLEntry(ChangeLogEntry)

  One instance of SIChangeLogModel can contain multiple instances of ChangeLogEntry instances which represents each change. For example, user added, user modified, user deleted are all different changes that can be reported.

  ChangeLogEntry contains the following useful methods:

  - setUserId(String)

    This is used to set the id of the user in the resource.

  - setChangeType(int)

    This is to set the type of change that occurred in a resource. Following are the possible types:

    ChangeLogEntry.USER_ADDED

    ChangeLogEntry.USER_MODIFIED

    ChangeLogEntry.USER_DELETED

    ChangeLogEntry.USER_ENABLED

    ChangeLogEntry.USER_DISABLED

    ChangeLogEntry.USER_RESET_PASSWD

  - addAttrEntry(ChangeLogAttribute)

    This is used to add the attribute value in the change. This contains the id and value of the attribute. The id should represent the OVSI id of the attribute and not the physical resource attribute. If these two are different, re-mapping of the name must be done.

## ConnectorFactory Implementation

This is a factory of SIConnector instances which are returned by calling the method: getConnection(TAConnectorParamValueBean).

The factory must implement SIConnectorFactory. Earlier implementation used to implement ConnectorFactory. This must be changed.

## Step 2: Change the XML Mapping File

If you are using XML Mapping file to map OVSI attributes onto resource attributes, you must change the following (see each section for details):

- ObjectClass Definition
- Attribute Mapping Definitions
- Relationship Definition

### ObjectClass Definition

Change the name of the user object class to SIUser. Earlier this was "User". Following is an example:

```
<objectClassDefinition name="SIUser" description="LDAP User">
   <properties>
        <!--
          "value" can be one of: true/false/bypass
             true: the operation is supported
             false: operation is not supported and results in an
exception being thrown
             bypass: not supported, but exception is suppressed
                                   (currently on CREATE, UPDATE,
DELETE)
        -->
        <attr name="CREATE">
             <value>true</value>
        </attr>
        <attr name="READ">
             <value>true</value>
        </attr>
        <attr name="UPDATE">
             <value>true</value>
        </attr>
        <attr name="DELETE">
             <value>true</value>
        </attr>
        <attr name="ENABLE">
             <value>true</value>
        </attr>
        <attr name="DISABLE">
             <value>true</value>
        </attr>
        <attr name="RESET_PASSWORD">
             <value>true</value>
        </attr>
        <attr name="EXPIRE_PASSWORD">
             <value>false</value>
        </attr>
        <attr name="CHANGE_PASSWORD">
             <value>true</value>
        </attr>

   </properties>
...
...
```

## Attribute Mapping Definitions

You can now mark an attribute as multi-valued, password, sensitive and so on. This is optional, in the sense that the same mapping file that was used with the OVSI 3.3.x connector can be used with the OVSI 4.0 interface.

Following is an example taken from `iPlanet.xml`:

```
<memberAttributes>
        <!-- For iPlanet -->
        <attributeDefinitionReference name="UserName" required="true"
concero:tafield="[UserName]" concero:resfield="uid"
concero:isKey="true" concero:init="true"/>
        <attributeDefinitionReference name="Password" required="false"
concero:tafield="[Password]" concero:resfield="userpassword"
concero:init="true" concero:isPassword="true"/>

        <attributeDefinitionReference name="Email" required="false"
concero:tafield="[Email]" concero:resfield="mail" concero:init="true"
concero:isMulti="true"/>
```

```
        <attributeDefinitionReference name="FirstName" required="false"
concero:tafield="[FirstName]" concero:resfield="givenname"
concero:init="true" concero:isMulti="true"/>
        <attributeDefinitionReference name="LastName" required="false"
concero:tafield="[LastName]" concero:resfield="sn" concero:init="true"
concero:isMulti="true"/>
        <attributeDefinitionReference name="Common Name"
required="true" concero:tafield="[FirstName] [LastName]"
concero:resfield="cn" concero:init="true" concero:isMulti="true"/>

        <attributeDefinitionReference name="employeenumber"
required="false" concero:tafield="[Employee ID]"
concero:resfield="employeenumber" concero:init="true"/>
        <attributeDefinitionReference name="telephoneNumber"
required="false" concero:tafield="[Business Phone]"
concero:resfield="telephoneNumber" concero:init="true"
concero:isMulti="true"/>

...

...

</memberAttributes>
```

## Relationship Definition

Change the user entity name in the relationship definition to use "SIUser". Following is an example:

```
     <concero:relationshipDefinition>
          <properties>
          <attr name="CREATE">
          <value>true</value>
          </attr>
          <attr name="NAVIGATE">
          <value>true</value>
          </attr>
          <attr name="DELETE">
          <value>true</value>
          </attr>
          </properties>
          <concero:party concero:entity="SIUser"
concero:cardinality="ZERO_OR_MORE" concero:start="false" />
```

```
           <concero:party entity="Group"
concero:cardinality="ZERO_OR_MORE" concero:start="true"
concero:linkfield="uniqueMember"/>
     </concero:relationshipDefinition>
```

## Step 3: Remove Deprecated Methods

Many of the unused methods in the OVSI 3.3.x interface are now deprecated or removed. Compile your code with the Java compile option depreciation="true", so that all usages of deprecated methods are displayed. Fix all these in your code, as they are no longer supported by OVSI 4.0.

## Step 4: Use Commons Logging

Earlier connectors used the OVSI-provided utils logging. This is comparatively slower and it is highly recommended to use the commons logging API. Following is sample code to show the usage:

```
import org.apache.commons.logging.Log;
import org.apache.commons.logging.LogFactory;

…

public class LDAPConnector extends AbstractSIConnector {
    private static final String msClsName =
LDAPConnector.class.getName();
    private static final Log msLogger = LogFactory.getLog( msClsName );



…

    public TAStatus add( SIUserModel userModel ) throws
TAConnectorException {
      if ( msLogger.isDebugEnabled() ) {
        msLogger.debug("ENTER:\r\n"+userModel );
      }

…
…
```

```
      if (msLogger.isInfoEnabled()) msLogger.info("Resource Key
Value="+keyValue);
      um.setResUserId(keyValue);
```

## Step 5: Package the Connector

Make sure you package the connector as one single RAR and it includes all the required library Jar files that are used within the connector.

All schema files (XML mapping file or any others) are to be packaged in a single JAR file.

➤ This is not any different from the previous version, but just a recommended style.

## Step 6: Use the Connector Tester Tool

With OVSI 4.0, a connector tester tool is packaged along with sample scripts. Use this tool to perform complete functionality testing of the connector. This saves time, and once this is done, the connector can be quickly integrated with OVSI.

# A Connector Template

This appendix contains the following sections:

- Template Files
- Connector Template Code

## Template Files

The connector template comes with the following files. Following is a brief explanation of the main files included in this template:

| File Name | Description |
|---|---|
| `ra.xml` | Deployment descriptor for the Resource Adapter (RA) representing the connector. |
| `weblogic-ra.xml` | Weblogic specific additional deployment descriptor for the RA. |
| `DummyConnectorMapping.xml` | XML Schema mapping file that maps OVSI attribute names onto Resource attribute names. |
| `DummyConnector.java` | Main connector implementation. |
| `DummyParamResources.properties` | Connection parameters definitions. |

| File Name | Description |
|---|---|
| Build.xml | Main build file for Apache ANT tool. |
| build_rar.xml | RAR build file for Apache ANT tool. |
| build.properties | Properties file for building the connector, which includes the details of the name and package name of the connector being built. |

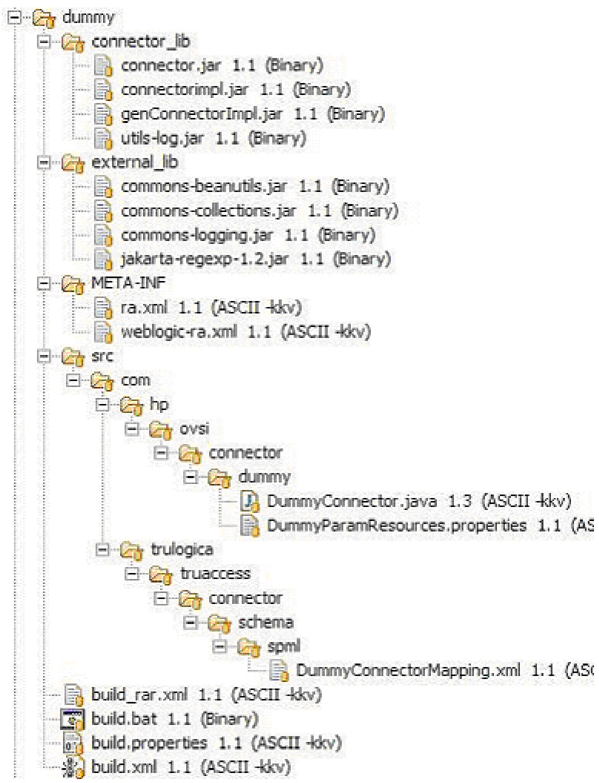
## Connector Template Code

An example connector called the Dummy Connector is provided in the `Connector SDK/Template` directory on the HP OpenView Select Identity product CD.

This section provides snapshots of the source code that implements the Dummy Connector, the build files used to build the connector, and the schema JAR and RAR files. Use this example to help you build your own connector.

The following snapshot shows the hierarchy of the Dummy Connector source:

**Figure 7 Hierarchy of the Dummy Connector Source**



```
dummy
  connector_lib
    connector.jar  1.1  (Binary)
    connectorimpl.jar  1.1  (Binary)
    genConnectorImpl.jar  1.1  (Binary)
    utils-log.jar  1.1  (Binary)
  external_lib
    commons-beanutils.jar  1.1  (Binary)
    commons-collections.jar  1.1  (Binary)
    commons-logging.jar  1.1  (Binary)
    jakarta-regexp-1.2.jar  1.1  (Binary)
  META-INF
    ra.xml  1.1  (ASCII -kkv)
    weblogic-ra.xml  1.1  (ASCII -kkv)
  src
    com
      hp
        ovsi
          connector
            dummy
              DummyConnector.java  1.3  (ASCII -kkv)
              DummyParamResources.properties  1.1  (AS
      trulogica
        truaccess
          connector
            schema
              spml
                DummyConnectorMapping.xml  1.1  (AS
  build_rar.xml  1.1  (ASCII -kkv)
  build.bat  1.1  (Binary)
  build.properties  1.1  (ASCII -kkv)
  build.xml  1.1  (ASCII -kkv)
```

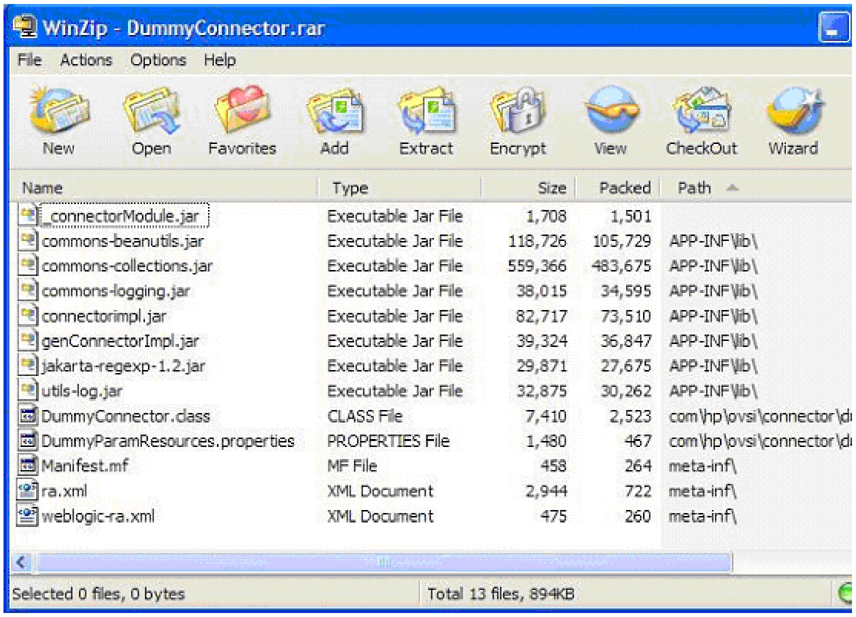
Following is an explanation of the folders:

- The connector-related JAR files are in the `connector_lib` folder and the external JAR files are in `external_lib` folder.
- `ra.xml` and `weblogic-ra.xml` are in the `META-INF` folder.
- Source code and the connection parameters properties file are in the `src/com/hp/ovsi/connector/dummy` folder.
- The schema mapping file called `DummyConnectorMapping.xml` is in `src/com/trulogica/truaccess/connector/schema/spml` (the file *must* reside in this location when it is installed).

- All build files are in the main folder:
  - `build.properties` contains all properties needed to build the connector including the connector-specific properties such as the name, package name, RAR name, and so on.
  - `build.xml` is the overall build file that invokes `build_rar.xml`.
  - `build_rar.xml` compiles and builds the connector RAR and the schema JAR containing the mapping XML.

Following are the contents of the RAR file that is built from the Dummy Connector source:

**Figure 8 RAR File Contents Built From the Dummy Connector Source**

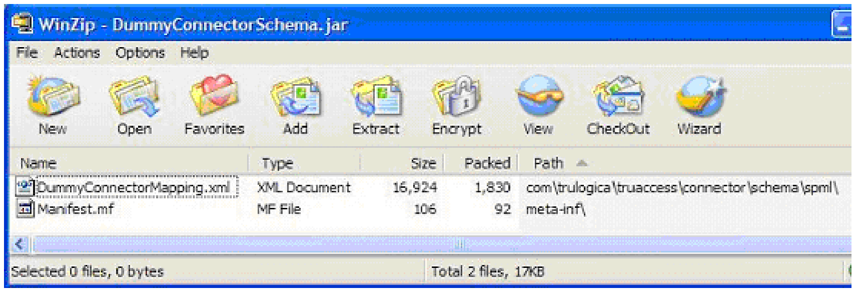

WinZip - DummyConnector.rar
File Actions Options Help
New Open Favorites Add Extract Encrypt View CheckOut Wizard

| Name | Type | Size | Packed | Path |
|---|---|---|---|---|
| _connectorModule.jar | Executable Jar File | 1,708 | 1,501 | |
| commons-beanutils.jar | Executable Jar File | 118,726 | 105,729 | APP-INF\lib\ |
| commons-collections.jar | Executable Jar File | 559,366 | 483,675 | APP-INF\lib\ |
| commons-logging.jar | Executable Jar File | 38,015 | 34,595 | APP-INF\lib\ |
| connectorimpl.jar | Executable Jar File | 82,717 | 73,510 | APP-INF\lib\ |
| genConnectorImpl.jar | Executable Jar File | 39,324 | 36,847 | APP-INF\lib\ |
| jakarta-regexp-1.2.jar | Executable Jar File | 29,871 | 27,675 | APP-INF\lib\ |
| utils-log.jar | Executable Jar File | 32,875 | 30,262 | APP-INF\lib\ |
| DummyConnector.class | CLASS File | 7,410 | 2,523 | com\hp\ovsi\connector\d |
| DummyParamResources.properties | PROPERTIES File | 1,480 | 467 | com\hp\ovsi\connector\d |
| Manifest.mf | MF File | 458 | 264 | meta-inf\ |
| ra.xml | XML Document | 2,944 | 722 | meta-inf\ |
| weblogic-ra.xml | XML Document | 475 | 260 | meta-inf\ |

Selected 0 files, 0 bytes    Total 13 files, 894KB

Following are the contents of the schema JAR file, which contains only one mapping file called `DummyConnectorMapping.xml`:

**Figure 9 Schema JAR File Contents**



| Name | Type | Size | Packed | Path |
|---|---|---|---|---|
| DummyConnectorMapping.xml | XML Document | 16,924 | 1,830 | com\trulogica\truaccess\connector\schema\spml\ |
| Manifest.mf | MF File | 106 | 92 | meta-inf\ |

Selected 0 files, 0 bytes    Total 2 files, 17KB

# Index