

# HP OpenView Select Identity

Software Version: 4.13

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## External Call Developer Guide

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# 1 Introduction

HP Select Identity supports the ability to invoke calls to external systems. This guide provides technical information about the structure and architectural context of external calls. It also describes how to develop them, and provides code samples.

Use external calls to perform the following types of tasks:

- Generate a user ID or password. See [Attribute Value Generation External Call Type](#) on page 13.
- Provide a list of possible attribute values. See [Attribute Value Constraint External Call Type](#) on page 14.
- Validate the value of an attribute. See [Attribute Value Validation External Call Type](#) on page 15.
- Verify the value of an attribute. See [Attribute Value Verification External Call Type](#) on page 16.
- Query an external system for a list of approvers. See [Approver Selection External Call Type](#) on page 16.
- Perform a workflow task. See [Workflow Action External Call Type](#) on page 17.
- Retrieve a certificate from an external system. See [Certification Management Function External Call Type](#) on page 19.
- Convert an extended SPML file containing account reconciliation data into standard SPML, or customize an SPML request. See [SPML Request Filter External Call Type](#) on page 20.

## Java Classes and Interfaces

Creating an external call entails coding one or more Java classes. You must be familiar with the Java Developer Kit (JDK), version 1.4 or later. For information about the J2EE APIs, refer to <http://java.sun.com/j2se/1.4.2/docs/api/index.html>.

You must code the classes called by external calls using the External Call and Workflow APIs. These APIs define Java-based interfaces for creating external callouts. The Select Identity-facing portion of the interface must be written in Java.

## JavaDoc for External Calls

JavaDoc is provided for the External Call API and Workflow API in the `/docs/api_help/external_calls/Javadoc` directory on the Select Identity product CD. Refer to this Web-based help for implementation and usage details.

## External Call API Value Classes

The External Call API provides the following classes and interfaces, which are available for creating value external calls:

- **SConstraintIntf**

This interface must be implemented by classes that generate possible values for an attribute. For example, you would implement this interface in an external call that provides a list of department codes for presentation as options in a form, or to validate data. It is recommended that you use this interface, and not **TValueConstraintIntf**, when developing new external calls.

- **TValueConstraintIntf**

This interface must be implemented by classes that provide a set of possible values for an attribute. The **SConstraintIntf** interface is an extension of this interface.

- **TValueConstraintIntf.TValueConstraintBeanIntf**

External calls that generate or provide a set of possible values for an attribute must return the values in a Java bean that implements this interface. For example, this applies to the department codes returned by the external call.

- **TValueGenerationIntf**

This interface must be implemented by external call classes that generate attribute values. For example, a class that implements this interface can generate a random password for a user.

- **TValueValidationIntf**

This interface must be implemented by external call classes that validate attribute values. For example, if a user enters a value into a form, the implementing class validates the value via this interface.

- **TAPolicyVerificationIntf**

This interface must be implemented by external calls that validate the value of an attribute for a particular user. For example, you use a class that implements this interface to verify that a user's password stored outside of Select Identity is correct. Currently, only password attributes are verified in this way.

- **TAttributeDefinitionException** and **TAttributeValueValidationException**

Exceptions defined for use by external calls.

- **ISpmlRequestFilter**

This interface is implemented by the SPML Filter external call. It applies a filter to an incoming SPML request, and may convert the request to a new request as a result.

## Workflow API Approver Selection and Workflow Classes

The Workflow API provides the following classes and interfaces for use in approver selection and workflow external calls.

- **WfSelectApproverIntf**

Provides the contract between Select Identity and an external entity to select an approver. Objects that implement this interface can be registered with Select Identity and used in approval stages to dynamically select an approver.

- **IWfClient**  
This interface invokes a workflow template, thereby creating a workflow instance. It can also resume an inactivated workflow instance, or terminate an instance.
- **IWfQuery**  
This interface retrieves runtime and configuration information about a workflow at the template, instance, block, or activity level.
- **IWfDataUpdate**  
Updates workflow variables.
- **StatelessServiceObjectFactory**  
Creates a component that implements the **IWfClient**, **IWfQuery**, and **IWfDataUpdate** interfaces, and forces these interfaces to behave like stateless Enterprise Java Beans (EJB) while hiding EJB-specific code and deployment information.
- **WfExternalCall**  
External calls invoked by workflow instances must implement this interface. It provides the contract between Select Identity and an external stage in a workflow. Select Identity can invoke classes that implement this interface to perform actions in a workflow. This class returns a collection of approvers.
- **WfExternalCallException**  
Defines exceptions used by the Workflow API.
- **WfExternalCallStatus**  
Returns the status of an approval activity to Select Identity. Along with the status of the stage, it can also return changes to the user profile, including attributes and entitlements.

## Select Identity Request and Approval Classes

Use the following classes to explore Select Identity requests and approval frameworks:

- **AttributeRecord**  
Represents an attribute.
- **ChangeRecord**  
Represents a change in an attribute. Objects of this class can be used to communicate changes to Select Identity from external calls.
- **Request**  
Defines methods to retrieve and set all information related to an incoming request in the Select Identity system.
- **RequestJobItem**  
Defines the job that handles the request in the Select Identity system.
- **RequestTarget**  
Defines the target of a request.
- **RequestTargetParam**  
Defines the parameters of a request target.
- **RequestTargetParamValue**

Gets parameter values.

- **TAFilter**  
A general class that stores filter criteria for a selection (search) procedure.
- **TAResourceAction**  
Represents the action to take place on the target resource.
- **TAResourceEvent**  
Represents the event for the request.
- **TAResourceType**  
Represents the type of request.

## 2 Default External Calls

Select Identity provides default external calls through which you interact with external systems for workflow steps and approver lookups. Each external call is defined within one of the following call types:

- **Attribute Value Generation** — generates a user name, user ID, password, and other attributes, such as the user's company or department. See [Attribute Value Generation External Call Type](#) on page 13.
- **Attribute Value Constraint** — provides a list of possible values for an attribute. See [Attribute Value Constraint External Call Type](#) on page 14.
- **Attribute Value Validation** — validates the value of an attribute. See [Attribute Value Validation External Call Type](#) on page 15.
- **Attribute Value Verification** — verifies the value of an attribute. See [Attribute Value Verification External Call Type](#) on page 16.
- **Approver Selection** — searches an external system for a list of users who can approve provisioning requests during a workflow. See [Approver Selection External Call Type](#) on page 16.
- **Workflow Action** — performs a task as part of a workflow, to integrate approval processes with external processes and systems. See [Workflow Action External Call Type](#) on page 17.
- **Certification Management** — enables you to retrieve a certificate from an external system. See [Certification Management Function External Call Type](#) on page 19.
- **SPML Filter** — filters SPML data files used for account reconciliation. See [SPML Request Filter External Call Type](#) on page 20.

Most external calls have predefined parameters that you can modify. The following sections list and describe the functionality of the external calls and their parameters, by call type.

### Attribute Value Generation External Call Type

Attribute value generation external call types generate the name or ID of a user, the user's password, and any other attribute, such as the user's company or department. Attribute value generation external calls include the following:

- `IDValueGeneration`
- `PasswordValueGeneration`
- `UserIDValueGeneration`

#### `IDValueGeneration` External Call

The `IDValueGeneration` external call generates an attribute that is a unique number.

This external call has the following parameters:

Parameter Name	Parameter Value Description
Suffix	Use after the number.
Prefix	Use before the number.

## PasswordValueGeneration External Call

The **PasswordValueGeneration** external call generates a password that may contain both letters and numbers. The password must contain at least one number, and the letters must be lowercase. The password value is constrained by the **minLength** and **maxLength** parameters. Special characters ("/", "+", "-") are not permitted.

Parameter Name	Parameter Value Description
minLength	The minimum password length.
maxLength	The maximum password length .

## UserIDValueGeneration External Call

The **UserIDValueGeneration** external call generates a user ID based on another attribute.

Parameter Name	Parameter Value Description
MaxRetryAttempts	Maximum number of tries to create a unique ID.
Length	The number of characters (alphanumeric or special) in the generated ID.
AttributeName	Attribute name from which the user ID is generated (such as from email).

## Attribute Value Constraint External Call Type

Attribute value constraint external call types provide a list of possible values for an attribute. Attribute value constraint external call types include the following:

- **Search Connector**
- **Search Table**

## Search Connector External Call

The **Search Connector** external call constrains attributes based on the Select Identity resource name specified.

Parameter Name	Parameter Value Description
<b>resource_name</b>	Select Identity resource name.

## Search Table External Call

The **Search Table** external call constrains attributes based on the specified **query** and **valuefield** parameters. The query is executed using the specified **poolname** parameter value.

Parameter Name	Parameter Value Description
<b>query</b>	Select query with two result columns.
<b>valuefield</b>	The name of the column used to derive the constraint value. Other result columns are used as display.
<b>poolname</b>	JNDI name for the data source and poolname for which the query is to be executed.

## Attribute Value Validation External Call Type

Attribute value validation external call types validate the values of attributes against specified validation criteria. Attribute value validation external call types include the following:

- **IsAlphaNumeric**
- **ManageExpireValidation**
- **PasswordValidation**
- **AttributeValueValidation**

### IsAlphaNumeric External Call

The **IsAlphaNumeric** external call validates if the attribute value is alphanumeric. No parameters are editable with this external call.

## ManageExpireValidation External Call

The **ManageExpireValidation** external call validates the value of the **ExpirationDate** attribute, which must be more than 30 days from the current date. An error message results if the value of the **ExpirationDate** attribute is less than 30 days. No parameters are editable with this external call.

## PasswordValidation External Call

The **PasswordValidation** external call validates that a password contains the minimum number of each type of characters specified.

Parameter Name	Parameter Value Description
<b>Special Characters</b>	Number of required non-alphanumeric or special characters.
<b>List of Special Characters</b>	Comma-delimited list of valid special characters.
<b>Lower Case Letters</b>	Number of required lowercase letters.
<b>Upper Case Letters</b>	Number of required uppercase letters.
<b>Numerics</b>	Number of required numeric values.
<b>Letters</b>	Number of required letters.



This external call is also used with password policy settings.

## Attribute Value Verification External Call Type

The **AttributeValueVerification** external call type verifies the value of an attribute. No parameters are editable with this external call.

## Approver Selection External Call Type

Approver selection external call types search an external system for a list of users who can approve provisioning requests during a workflow. The approver selection external call type includes **WFGetApproverSampleExtCall**.



## WFGetApproverSampleExtCall External Call

The **WFGetApproverSampleExtCall** external call is a sample external call that specifies a list of users to use for approvals.

Parameter Name	Parameter Value Description
<b>SampleApprovers</b>	Comma-delimited list of Select Identity user IDs to use for approvals.

## Workflow Action External Call Type

Workflow action external call types perform a task as part of a workflow, to integrate approval processes with external processes and systems. Workflow action external calls include the following:

- **LoadUserServices**
- **UserEnableDisableWFExtCall**
- **WorkflowCertificateRequest**
- **ExclusionRuleCall**

## LoadUserServices External Call

The **LoadUserServices** external call adds services to a user based on a change of context. For an example of how to use this external call, see the topic titled *Scenario: Adding Services to a User* in the *Workflow Studio online help*.

Parameter Name	Parameter Value Description
<b>ServicesRule</b>	Specifies the rule name.

## UserEnableDisableWFExtCall External Call

The **UserEnableDisableWFExtCall** external call enables or disables a user based on the value stored in a specified attribute.

Parameter Name	Parameter Value Description
<b>AttributeName</b>	Attribute name for which the value is checked.
<b>EnableValue</b>	If the value of the user attribute in <b>AttributeName</b> matches this parameter, the external call enables the user when the user is disabled.
<b>DisableValue</b>	If the value of the user attribute in <b>AttributeName</b> matches this parameter, the external call disables the user when the user is enabled.
<b>UserName</b>	Administrator with authority to modify users who use this external call.
<b>Password</b>	Administrator's password.
<b>url</b>	Web services URL.

## WorkflowCertificateRequest External Call

The **WorkflowCertificateRequest** manages certificates. For information on using this external call, see the certificate management topics in the *Select Identity Workflow Studio online help*.

Parameter Name	Parameter Value Description
<b>DN_FieldName</b>	Attribute name storing the user's distinguished name (DN) from the certificate.
<b>CertificateFieldName</b>	Challenge password assigned at the time of user registration.

Parameter Name	Parameter Value Description
<b>EmailTemplateName</b>	Default email template from Select Identity, to send email to the user.
<b>CertificateProviderName</b>	Certificate provider name. In the case of Verisign, the name must be "Verisign." In all other cases, the administrator can assign the name.
<b>ExternalCallName</b>	Name of the CA-specific Java class implementing validation and generation functions for the certificate.

## ExclusionRuleCall External Call

The **ExclusionRuleCall** external call prevents users from receiving services when the users have existing or pending conflicting services or entitlements.

Parameter Name	Parameter Value Description
<b>RuleName</b> <b>UniqueServicePrefix</b>	Parameter specifying which rule to run.
<b>WFVariableName</b> <b>\$RuleExclusionMsg</b>	Workflow variable specifying the result message.

## Certification Management Function External Call Type

Certification management function external call types implement validation and generation functions for the certificate. Certification management function external call types include only **VerisignCertImpl**. For detailed information about Verisign certificate management, see the *Select Identity Workflow Studio online help*.

### VerisignCertImpl External Call

The **VerisignCertImpl** external call is called by the **WorkFlowCertificateRequest** external call, which validates certificate requests. This external call has no editable parameters. For more information, see the *Select Identity Workflow Studio online help*.

# SPML Request Filter External Call Type

The **SPML Request Filter** external call type is invoked during reconciliation, to convert and filter an incoming SPML request. It converts an extended SPML request into a standard SPML request, or customizes an SPML request.

The filter class should implement the interface **ISpmIRequestFilter**. This interface class and its associated model and exception classes are packaged into `clientintf.jar`, which is distributed for external call implementation.

## Using the Extended SPML Request Filter

This section provides information about how to use the **ExtendedSpmIRequestFilter** External Call in a Select Identity system.

### Configuration

Select Identity should provide the user interface mechanism to configure the **ExtendedSpmIRequestFilter** external call for a given resource. The selection should be similar to other types of external configuration. If the filter is not configured, incoming SPML requests are not processed.

### Invocation

When an SPML request is handed over to the Select Identity reconciliation module (via file upload, Web service, or direct polling), the filter class is loaded from the resource configuration. The external call parameters defined in the configuration are also loaded.

### Extended Request

The reconciliation module adds two extra parameters to the additional arguments map for the extended request:

- **Key: "UserName"** — The attribute name for the Select Identity user ID.
  - **Value:** The name of resource attribute name that mapped to this attribute.
- **Key: "Password"** — The attribute name for the Select Identity default password
  - **Value:** The name of resource attribute name that mapped to this attribute.

After filtering, Select Identity expects that the extended request is converted to another request, typically an SPML `<modifyRequest>`. The reconciliation modify process should follow after filtering.

### Add/Modify/Delete request

The reconciliation module does not add parameters to SPML add, modify, or delete requests.

### Sample Filter Implementation

The **ExtendedSpmIRequestFilter** external call handles the following extended requests:

- **Reset and Change Password**

Reset and change password requests are converted to modify requests with the password as the modification. If key fields are not provided in the original request, the mapped Select Identity user ID attribute is inserted as the key field.

The following extended request attributes are converted to a modification on the mapped Select Identity default password attribute:

- urn:trulogica:concerro:2.0# rcPassword
- urn:trulogica:concerro:2.0# newPassword
- urn:trulogica:concerro:2.0# password

Other attributes are converted to modifications.

The operation tags for all modifications are “REPLACE”.

- **Enable and Disable**

Enable and disable requests are converted to modify requests

If key fields are not provided in the original request, the mapped Select Identity user ID attribute is inserted as the key field.

If the enable/disable requests do not contain any attributes that actually identify what is changed on the resource to cause connector agents to send enable/disable, then a modification with the name “UserEnabled”, Value “1/0”, Operation=REPLACE is inserted the modification list. The resource mapping file *must* contain an artificial field named **UserEnabled**. The corresponding Select Identity attribute should also be created. This artificial resource attribute should only allow sync-in but not sync-out.



# 3 Creating an External Call

The sections in this chapter describe how to implement an external call of each type. Refer to the JavaDoc provided in the `/docs/api_help/external_calls/Javadoc` directory on the HP Select Identity product CD for details about specific APIs.

## Coding Attribute Value External Calls

To create an external call, follow these guidelines:

- **Attribute Value Generation** external calls must implement the **TValueGenerationIntf** interface. See [Attribute Value Generation External Call](#) on page 33 for code examples.
- **Attribute Value Constraint** external calls must implement the **TValueConstraintIntf** and **SIConstraintIntf** interfaces. See [Attribute Value Constraint External Call](#) on page 34 for code examples.
- **Attribute Value Validation** external calls must implement the **TValueValidationIntf** interface. See [Attribute Value Validation External Call](#) on page 45 for code examples.
- **Attribute Value Verification** external calls must implement the **TAPolicyVerificationIntf** interface.

## Retrieving Parameters, Attributes, and Data

The following guidelines describe how to obtain input parameters, Select Identity attributes, and the data that needs to be returned:

- To retrieve an external call parameter defined on the Select Identity **External Calls** page, use the `containsKey` and `get` methods. The `containsKey` method verifies the existence of the specified parameter, and the `get` method retrieves the parameter. For example:

```
if (attrs.containsKey("parametername"))  
    String parameter = (String)  
    attrs.get("parametername")
```

- To retrieve a Select Identity attribute, use one of the methods provided by the `RequestTarget` class, such as `getSingleRequestParamStr`. This example retrieves a single value attribute:

```
String attributeValue=(String) requestTarget.  
getSingleRequestParamStr("attributename");
```

To retrieve the values of a multivalued attribute, use the `getRequestParam` method. For example:

```
Set attributeValues=(Set) requestTarget.  
getRequestParam("attributename").getRequestTargetParamValue()
```

- Throw `TAAAttributeDefinitionException` if the external call is unsuccessful.

- If you write an external call function that must access data in the Select Identity database, the function can access the database using the JNDI name specified by the `truaccess.dataSource` property in the `truaccess.properties` file. However, the function can access the Select Identity database in other ways; it depends on how you construct the function.

For more information about the `TruAccess.properties` file, see the *HP OpenView Select Identity Installation and Configuration Guide*.

- Use any logging mechanism to log messages and errors. The examples shown in this guide use an internal logging mechanism that is not available externally.
- Select Identity passes the following parameters for **ValueConstraint**:
  - **OVSIServiceName**
  - **OVSIServiceID**
  - **OVSIContextAttrName**
  - **OVSIContextAttrId**
  - **OVSIContextAttrValue**
  - **OVSIContextName**
  - **OVSIServiceRoleName**

## Sample Code Using the SIConstraint External Call

The following sample shows how to use the **SIConstraint** external call to get service and context information. The service name, context name, context values, and other data are passed to the **SIConstraint** external call.

```
public List getValueConstraint( String attribName,
                              TAFilter filter,
                              Map args )
                              throws TAAAttributeDefinitionException {
    // name of the service
    String serviceName = ( String )args.get(
        SIConstraintIntf.OVSI_SERVICE_NAME);
    // identifier of the service
    String serviceIdStr = ( String ) args.get(
        SIConstraintIntf.OVSI_SERVICE_ID);
    // name of the context attribute
    String contextAttrName = ( String ) args.get(
        SIConstraintIntf.OVSI_CTX_ATTR_NAME);

    // Identifier of the context attribute
    String contextAttrIdStr = ( String ) args.get(
        SIConstraintIntf.OVSI_CTX_ATTR_ID);
    // Value of context attribute that user selects
    //in registration form
    String contextAttrValue = ( String ) args.get(
        SIConstraintIntf.OVSI_CTX_ATTR_VALUE);
    // name of context name as defined in Service Context
    String contextName = ( String ) args.get(
        SIConstraintIntf.OVSI_CTX_NAME);
    // name of the service role as defined in Service Role
    String serviceRoleName = ( String ) args.get(
        SIConstraintIntf.OVSI_SR_NAME);

    try{

        // write code to use these values and return List of object of
        // type TAValueConstraintIntf.TAValueConstraintBeanIntf
    }
    catch (Exception e) {
```



```

        // throws TAAAttributeDefinitionException exception in
        // of any error
        throw new TAAAttributeDefinitionException(e.getMessage());
    }
}

```

## Coding Approver Selection External Calls

For approver selection external calls, the APIs support synchronous communication. The external system must complete its processing and provide status information as part of the call. The call is required to return status indicating how Select Identity will proceed with the workflow.

### External Call Variables

The following variables are available for use in your approver selection external call:

Variable Name	Description
<code>_activityId</code>	The activity ID string for the activity currently in execution. This variable is maintained by the engine and cannot be updated in the template. A string value is assigned to this variable.
<code>_instActivityId</code>	An internal variable representing the instance activity ID for the current activity in execution. This variable is maintained by the engine and cannot be updated in template. The variable is assigned an integer value.
<code>_joinCommand</code>	Passed into the workflow by an external application invoked as an action in a workflow template activity. This variable is not persistent. Possible values are as follows: <ul style="list-style-type: none"> <li><code>exit</code> — exits the block unconditionally.</li> <li><code>exitAll</code> — exits the current block and all parent blocks unconditionally.</li> <li><code>reset</code> — resets the value of the <code>joinCount</code> property set in the block.</li> </ul> For example, the application could pass this variable to the workflow to instruct it to exit a block unconditionally (even if, for instance, the <code>_joinCount</code> value is not met).
<code>_pushVar</code>	Passed into the workflow by an external application invoked as an action in a workflow template activity. The object is then added to workflow's internal <code>pushList</code> block variable. The pushed objects in the list can be displayed later in tabular format in a report. You can specify any Java object as the value of this variable.
<code>\$_blockId</code>	The block ID for the current block. You can assign any string value to this variable.
<code>\$_instId</code>	The workflow instance ID. This variable is maintained by the engine and cannot be updated. An integer value is assigned to this variable.

## Implementation

The following provides general information about how to implement an approver selection external call, how to obtain to input parameters and Select Identity attributes, and what data needs to be returned.

- Approver selection external calls must implement the **WfSelectApproverIntf** interface.
- The main method of the external call must be called `getApprover`. Here is the call signature of the `getApprover` method:

```
public Collection getApprover(RequestTarget reqTarget,  
    HashMap attrs)  
    throws WfExternalCallException;
```

- The Workflow external call must return a collection of Select Identity user IDs. In addition, the external call must return data that is valid in Select Identity.
- To retrieve an external call parameter defined on the Select Identity **External Calls** page, use `containsKey` and `get` methods. The `containsKey` method verifies the existence of the specified parameter, and the `get` method retrieves the parameter. For example:

```
if (attrs.containsKey("parametername"))  
    String parameter = (String)  
    attrs.get("parametername")
```

## Standard Parameters

Select Identity defines the following standard parameters in the map:

- `WfExternalCall.WF_PARAM_SERVICENAME` — for the service name. This is a string object.
- `WfExternalCall.WF_PARAM_ADMINUSERID` — for the requestor's user name. This parameter is empty for a self-registration or system-generated request. This is a string object.
- `WfExternalCall.WF_PARAM_REQUESTID` — for the request identifier. This is an integer object.
- `WfExternalCall.WF_PARAM_WORKFLOWINSTID` — for the workflow instance ID. This is an integer object.

## Retrieving Attributes and Variables

To retrieve a Select Identity attribute, use one of the methods provided by the **RequestTarget** class, such as `getSingleRequestParamStr`. For example, you may need to populate the values for each user attribute defined by a map in an external call that is called by a workflow template.

The following examples illustrate various types of attribute and variable retrieval:

- Here is an example that retrieves a single-value attribute:

```
String attributeValue=(String)requestTarget.  
getSingleRequestParamStr("attributename");
```

- To retrieve the values of a multi-value attribute, use the following method:

```
Set attributeValues=(Set)requestTarget.  
getRequestParam("attributename").getRequestTargetParamValue()
```

For a more extensive example, see [Retrieving Request Object Data to Set Workflow Variables](#) on page 52.

- To retrieve workflow variables, use the **IWfQuery** interface as in the following example:

```
IWfQuery query = (IWfQuery) StatelessServiceObjectFactory.  
create(IWfQuery.class);  
  
int instanceId = query.  
getInstanceInfoByInstActivityId(instActivityId).getInstId();  
Map varMap = query.getCurrentVariableMap(instanceId);  
String comment = (String) varMap.get("$ApproverComments");
```

- To set and update a workflow variable, use the methods provided by the **IWfDataUpdate** interface, as follows:

```
IWfDataUpdate du = (IWfDataUpdate) StatelessServiceObjectFactory.  
create(IWfDataUpdate.class);  
du.setWorkflowVar(instId, "workflowvariablename", "value");
```

- A workflow variable can be any Java object. However, if it is a persistent variable with its name preceded by \$, you may either use `HashMap` to contain object attributes, or use the Java object marked as `Serializable`. If the persistent variable is a Java object, add following line to the Java class:

```
static final long serialVersionUID = uid;
```

where `uid` can be 0 for the newly created class or found by running JDK's server command.

- You can use any logging mechanism to log messages and errors. The examples in this guide use an internal logging mechanism that is not available externally.

## Approver Selection External Call Code Example

This code example illustrates how to select a manager as an approver. Request or user attributes must contain **ManagerId** attribute. This attribute name can be passed through an external call parameter.

```
public Collection getApprover(RequestTarget reqTarget,  
                             HashMap attrs)  
    throws WfExternalCallException{  
  
    ArrayList ret = new ArrayList();  
    try{  
        String query = (String) params.get(PARAM_QUERY);  
        String jndiPool = (String) params.get(PARAM_POOL);  
        String mgrAttrName = (String) attrs.get("MANAGER_ATTR");  
  
        String managerUserId = reqTarget.getParamValueString(  
            mgrAttrName);  
  
        if (managerUserId == null){  
            String userName = reqTarget.getKeyFieldValue();  
            if (userName == null){  
                WfExternalCallException exp =  
                    new WfExternalCallException(  
                        "UserName can not be null");  
                throw exp;  
            }  
        }  
  
        String query2getMgrIdFromDB = "select stringValue from"  
        + " TAUser u, TAAtribute a where u.userId = "  
        + " a.identObjId and u.conceroUserId = "  
        + "'" + userName + "'" + " and a.name = "  
        + managerAttributeName + "'";
```

```

managerUserId = getAttributeValueFromDB (
    query2getMgrIdFromDB, jndiPool );

if (managerUserId == null){
    WfExternalCallException exp = new
        WfExternalCallException(
            "Unable to get manager Id from user profile");
    throw exp;
}

} // managerUserId == null

if (managerUserId == null){
    WfExternalCallException exp = new
        WfExternalCallException(
            "Unable to get approver Id for this request");
    throw exp;
}
ret.add(managerUserId);
return ret;
}
catch (Exception e){
    WfExternalCallException exp = new
        WfExternalCallException(
            e.getMessage());
    throw exp;
}

return ret;
}

```

## Coding Workflow Action External Calls

For workflow action external calls, the APIs support synchronous communication. Select Identity requires the external system to complete its processing and provide status information as part of the callout. The callout is required to return status indicating how Select Identity proceeds with the workflow.

### Implementation

The following provides information about how to implement a workflow action external call, how to obtain to input parameters and Select Identity attributes, and what data needs to be returned:

- Workflow external calls must implement the **WfExternalCall** interface.
- The main method of the external call must be called `process`. This method expects four input parameters.

The following is an example of the call signature for the `process` method:

```

WfExternalCallStatus process(String stageId,
RequestTarget requestTarget,
AttributeRecord [] availGrp,
AttributeRecord [] availRole,
AttributeRecord [] availEntitlements,
Map map) throws WfExternalCallException

```

- The workflow action external call must return `WfExternalCallStatus`. In addition, the external call must return data that is valid in Select Identity.

- To retrieve an external call parameter defined on the Select Identity **External Calls** page, use the `containsKey` and `get` methods. The `containsKey` method verifies the existence of the specified parameter, and the `get` method retrieves the parameter, as in the following example:

```
if (attrs.containsKey("parametername"))
    String parameter = (String)
    attrs.get("parametername")
```

- To log messages and errors, you can use any logging mechanism. The examples shown in this guide, however, use an internal logging mechanism that is not available externally.

## Standard Parameters

Select Identity defines the following standard parameters in the map:

- `WfExternalCall.WF_PARAM_SERVICENAME` — for the service name. This is a string object.
- `WfExternalCall.WF_PARAM_ADMINUSERID` — for the requestor's user name. This is a string object.
- `WfExternalCall.WF_PARAM_REQUESTID` — for the request identifier. This is an integer object.
- `WfExternalCall.WF_PARAM_WORKFLOWINSTID` — for the workflow instance ID. This is an integer object.

## Retrieving Attributes and Variables

To retrieve a Select Identity attribute, use one of the methods provided by the **RequestTarget** class, such as `getSingleRequestParamStr`.

- The following example retrieves a single-value attribute:

```
String attributeValue=(String) requestTarget.
getSingleRequestParamStr("attributename");
```

- To retrieve the values of a multi-value attribute, use the `getRequestParam` method. For example:

```
Set attributeValues=(Set) requestTarget.
getRequestParam("attributename").getRequestTargetParamValue()
```

- To retrieve workflow variables, use the **IWfQuery** interface, as in the following example:

```
IWfQuery query =(IWfQuery) StatelessServiceObjectFactory.
create(IWfQuery.class);

int instanceId = query.
getInstanceInfoByInstActivityId(instActivityId).getInstId();
Map varMap = query.getCurrentVariableMap(instanceId);
String comment = (String) varMap.get("$ApproverComments");
```

- To set and update a workflow variable, use the methods provided by the **IWfDataUpdate** interface, as in the following example:

```
IWfDataUpdate du =(IWfDataUpdate) StatelessServiceObjectFactory.
create(IWfDataUpdate.class);
du.setWorkflowVar(instId, "workflowvariablename", "value");
```

- Update a Select Identity attribute as follows:

```

WfExternalCallStatus ecs = new WfExternalCallStatus(stageId);
ChangeRecord changeRecord = new ChangeRecord();

// Update the attribute in the change record
changeRecord.setName("attributename");
changeRecord.addValue("newattributevalue");

ecs.addAttributeChange(changeRecord);

```

## Updating Workflow Variables

Update workflow variables that need to be persisted using `setStatus()` provided by the **WfExternalCallStatus** class. All variable names starting with `$` are assumed to be workflow variables and are persisted when the call returns.

- The default `changeRecord` operation is `ADD`. See Javadoc for `changeRecord` for additional details.
- To set the return status of a workflow external call, use the **WfExternalCallStatus** class and methods, as follows:

```

ecs = new WfExternalCallStatus(stageId);

If the call returns successfully, use the following:

ecs.setStatus(WfExternalCallStatus.STATUS_APPROVED);

If the call is unsuccessful, use the following:

ecs.setStatus(WfExternalCallStatus.STATUS_REJECT_TERMINATE);

```

## External Call Variables

The following variables are available for use in your external call:

Variable Name	Description
<code>_activityId</code>	The activity ID string for the activity currently in execution. This variable is maintained by the engine and cannot be updated in the template. A string value is assigned to this variable.
<code>_instActivityId</code>	An internal variable representing the instance activity ID for the current activity in execution. This variable is maintained by the engine and cannot be updated in template. The variable is assigned an integer value.
<code>_joinCommand</code>	Passed into the workflow by an external application invoked as an action in a workflow template activity. This variable is not persistent. Possible values are as follows: <ul style="list-style-type: none"> <li>• <code>exit</code> — exits the block unconditionally.</li> <li>• <code>exitAll</code> — exits the current block and all parent blocks unconditionally.</li> <li>• <code>reset</code> — resets the value of the <code>joinCount</code> property set in the block.</li> </ul> For example, the application could pass this variable to the workflow to instruct it to exit a block unconditionally (even if, for instance, the <code>_joinCount</code> value is not met).

Variable Name	Description
<b>_pushVar</b>	Passed into the workflow by an external application invoked as an action in a workflow template activity. The object is then added to workflow's internal <code>pushList</code> block variable. The pushed objects in the list can be displayed later in tabular format in a report. You can specify any Java object as the value of this variable.
<b>\$_blockId</b>	The block ID for the current block. You can assign any string value to this variable.
<b>\$_instId</b>	The workflow instance ID. This variable is maintained by the engine and cannot be updated. An integer value is assigned to this variable.

## Workflow Action External Call Code Examples

This example illustrates how to get the JDBC connection in an external call. The JDBC connection pool name can be passed through external call parameters.

```
protected Connection getConnection(String connectionPoolName)
    throws Exception {
    InitialContext ctx = null;
    try {
        ctx = new InitialContext();
        DataSource ds =(DataSource)ctx.lookup(connectionPoolName);
        return ds.getConnection();
    } finally {
        try {
            if (null != ctx) {
                ctx.close();
            }
            ctx = null;
        }
        catch (Throwable t) {
            //log.warn("Error closing context", t);
        }
    }
}
//end finally
//end getConnection
}
```

This example illustrates how to get an attribute value from a request and set it as a workflow variable. The attribute name and workflow variable name must begin with “\_” and can be passed through external call parameters.

```
public WfExternalCallStatus process(String stageId,
    RequestTarget reqTarget,
    AttributeRecord[] availableGroups,
    AttributeRecord[] availableRoles,
    AttributeRecord[] availableEntitlements, Map params)
    throws WfExternalCallException {

    try {
        String attrName = (String) params.get(ATTR_NAME);
        // workflow variable name starts with '_' if it
        // is set using ChangeRecord
        String wfVarName = (String) params.get(WF_VAR_NAME);

        //
        String attrValue =
            reqTarget.getParamValueString(attrName);

        //
    }
}
```

```
ChangeRecord chRec = new ChangeRecord();
chRec.setName(wfVarName);
chRec.addValue(attrValue);

WfExternalCallStatus status = new
    WfExternalCallStatus(stageId);
status.addAttributeChange(chRec);
status.setStatus(WfExternalCallStatus.STATUS_APPROVED);
return status;
} catch (Throwable t) {
    WfExternalCallException exp = new
        WfExternalCallException(
            "Unable to lookup the Attribute value ");
    throw exp;
}
}
```



## 4 Examples

This chapter provides examples for each type of external call. Refer to the Javadoc in the `/docs/api_help/external_calls` and `workflow` directories on the HP Select Identity product CD for information about the APIs.

- ▶ These examples are included in the Select Identity EAR file deployed during installation. If you wish to modify and register one of the example calls, you must change the class name.

### Attribute Value Generation External Call

This class generates the password from a Social Security Number or ID. The configuration arguments to the function are the `SSN_FIELD` and `PERSONNUMBER_FIELD` attributes. The supporting class, `UserNameValueBean.java`, follows this example on [page 34](#).

```
package com.trulogica.truaccess.externalcall.generatefunction;

import java.util.StringTokenizer;
import java.util.Random;
import java.util.Map;
import com.trulogica.truaccess.request.model.RequestTarget;
import com.trulogica.truaccess.attribute.TAValueGenerationIntf;
import com.trulogica.truaccess.attribute.exception.
TAAttributeDefinitionException;
import com.trulogica.truaccess.util.logging.misc.Logger;
import com.trulogica.truaccess.util.logging.misc.Level;
import com.trulogica.truaccess.externalcall.generatefunction.
UserNameValueBean;
/**
 * Generates a String ID with the format Prefix + ID + Suffix
 * Prefix and Suffix are specified as parameters to the call
 */
public class SimpleValueGenerator implements TAValueGenerationIntf
{
    public Object generateValue(String attribName,
                                RequestTarget reqTarget, Map args)
                                throws TAAttributeDefinitionException
    {
        try {
            if (mLogger.isLoggable(Level.FINEST))
                mLogger.finest("Generating the value of :"+attribName);
            if (mLogger.isLoggable(Level.FINEST))
                mLogger.finest("RequestTarget:"+reqTarget.toString());

            String prefix = (String)args.get(PARAM_PREFIX);
            String suffix = (String)args.get(PARAM_SUFFIX);

            StringBuffer sb = new StringBuffer();

            sb.append((null==prefix)?"":prefix).append((new
Random()).nextInt()).append((null==suffix)?"":suffix);

            if (mLogger.isLoggable(Level.FINEST))
                mLogger.finest("Returning a value of : " + sb.toString() +
                " : for attribute" + attribName);
            return new UserNameValueBean(sb.toString());
        }
    }
}
```

```

        } catch (Throwable t) {
            if (mLogger.isLoggable(Level.WARNING))
                mLogger.log(Level.WARNING, "Unable to generate attribute
                    value for attribute:"+attribName,t);
            TAAAttributeDefinitionException exp = new
                TAAAttributeDefinitionException("Unable to generate
                    attribute value for
                    attribute:"+attribName+t.getMessage());
            exp.setCausedBy(t);
            throw exp;
        }
    }

    private static final Logger mLogger =
        Logger.getLogger(SimpleValueGenerator.class.getName());
    private static final String PARAM_PREFIX="prefix";
    private static final String PARAM_SUFFIX="suffix";
}

```



The value generation function above calls the class below:

```

package com.truologica.truaccess.externalcall.generatefunction;
import com.truologica.truaccess.attribute.TAValueConstraintIntf.
TAValueConstraintBeanIntf;
public class UserNameValueBean implements TAValueConstraintBeanIntf

{
    String value = null;
    public UserNameValueBean(String _value)
    {
        value = _value;
    }
    public String getName() {
        return null;
    }

    public Object getValue() {
        return value;
    }
}

```

## Attribute Value Constraint External Call

The following examples implement a simple table-based lookup of possible constraint values. The examples use external arguments —poolname and SQL string— to query the database tables. The supporting class, `SearchResult.java`, follows the main classes.

### Implementing the TAValueConstraintIntf Interface

```

package com.truologica.truaccess.externalcall.constraintfunction;

import java.util.*;
import com.truologica.truaccess.util.logging.misc.Logger;
import com.truologica.truaccess.util.logging.misc.Level;

import com.truologica.truaccess.base.TAFilter;
import com.truologica.truaccess.attribute.TAValueConstraintIntf;
import com.truologica.truaccess.attribute.exception.
TAAAttributeDefinitionException;

```

```

import com.truologica.truaccess.externalcall.constraintfunction.
SearchResult;

import com.truologica.truaccess.util.Tools;
import com.truologica.truaccess.util.DBTool;
import javax.naming.InitialContext;
import javax.sql.DataSource;
import java.sql.Connection;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.ResultSetMetaData;
import java.sql.Types;

/**
 * This class implements simple table-based lookups of possible constraint
 * values. It uses the external arguments poolname and sql string to query
 * the database tables.
 */
public class SearchTable implements TAValueConstraintIntf {

    private static final Logger mLogger =
        Logger.getLogger(SearchTable.class.getName());

    public static final String PARAM_POOLNAME = "poolname";
    public static final String PARAM_SQLSTRING = "query";
    public static final String PARAM_VALUEFIELD = "valuefield";

    private String poolname = null;
    private String query = null;
    private String valuefield = null;

    /**
     * Returns a List of all possible values.
     * Since this list can be very large it should be used sparingly.
     * @param attribName
     * @param args
     * @return
     * @throws TAAAttributeDefinitionException
     * @see com.truologica.truaccess.attribute.TAValueConstraintIntf
     */

    public List getValueConstraint(String attribName, Map args) throws
    TAAAttributeDefinitionException
    {
        return getValueConstraint(attribName,null,args);
    }

    public List getValueConstraint(String attribName,TAFilter filter, Map
    args) throws TAAAttributeDefinitionException
    {
        Connection connection = null;
        PreparedStatement pStmt = null;
        ResultSet rs = null;
        ArrayList ar = new ArrayList();
        try {
            poolname = (String)args.get(PARAM_POOLNAME);
            query = (String)args.get(PARAM_SQLSTRING);
            valuefield = (String)args.get(PARAM_VALUEFIELD);

            checkParam(poolname,PARAM_POOLNAME);
            checkParam(query,PARAM_SQLSTRING);
            checkParam(valuefield,PARAM_VALUEFIELD);

            if (mLogger.isLoggable(Level.FINEST)) mLogger.finest("Trying
            to locate values for attribute:"+attribName);
            String modFilter = "";
            boolean hasParam = false;
            if (null != filter) {

                switch (filter.getOperation()) {
                    case TAFilter.EQUALITY:
                        modFilter = " "+valuefield+" = ?";
                }
            }
        }
    }

```

```

        break;
    case TAFilter.BEGINS WITH:
        modFilter = " " + valuefield + " LIKE ?";
        filter.setValue(filter.getValue() + "%");
        break;
    case TAFilter.ENDS WITH:
        modFilter = "-" + valuefield + " LIKE ?";
        filter.setValue("%" + filter.getValue());
        break;
    case TAFilter.CONTAINS:
        modFilter = " " + valuefield + " LIKE ?";
        filter.setValue("%" + filter.getValue() + "%");
        break;
    }

    String query2Check = query;
    query2Check = query2Check.toUpperCase();

    if (modFilter.length() > 0) {
        if (query2Check.indexOf(" WHERE ") > 0) {
            query = query + " AND " + modFilter;
        } else {
            query = query + " WHERE " + modFilter;
        }
        hasParam = true;
    }
}
connection = this.getConnection();

pStmt = connection.prepareStatement(query);

if (mLogger.isLoggable(Level.FINEST))
    mLogger.finest("query: (" + query + ") :modfilter: " + modFilter);
if (hasParam) {
    pStmt.setString(1, filter.getValue());
}

rs = pStmt.executeQuery();
ResultSetMetaData rsMetaData = rs.getMetaData();
int nameColumn=0;

//Select the first String field whose column name does not match the
//value field

for (int i = 1; i <= rsMetaData.getColumnCount(); i++)
{
    if (((rsMetaData.getColumnType(i) == Types.VARCHAR) ||
        (rsMetaData.getColumnType(i) == Types.CHAR))
        && (!rsMetaData.getColumnName(i).equalsIgnoreCase(
            valuefield))) {
        nameColumn=i;
        break;
    }
}

while (rs.next())
{
    SearchResult sr = new SearchResult();

    sr.setValue(rs.getString(valuefield));

    if (nameColumn > 0)
        sr.setName(rs.getString(nameColumn));
    else
        sr.setName((String) sr.getValue());

    ar.add(sr);
}

return ar;
} catch (Exception e) {

```

```

        if (mLogger.isLoggable(Level.WARNING))
            mLogger.log(Level.WARNING, "Unable to obtain the values", e);
        TAAAttributeDefinitionException exp = new
            TAAAttributeDefinitionException();
        exp.setCausedBy(e);
        throw exp;
    } finally {
        DBTool.close(rs);
        DBTool.close(pStmt);
        DBTool.close(connection);
    }
}

private Connection getConnection() throws Exception
{
    InitialContext ctx = null;

    try {
        ctx = new InitialContext();
        DataSource ds = (DataSource)ctx.lookup(poolname);
        return ds.getConnection();
    } finally {

        Tools.close(ctx);
    }
}

private void checkParam(String value, String name) throws Exception
{
    if ((null == value) || (value.trim().length() == 0))
        throw new Exception("The value of "+name+" is needed");
}
}

```



The following code is called by the class listed above.

```

package com.truologica.truaccess.externalcall.constraintfunction;

import com.truologica.truaccess.attribute.TAValueConstraintIntf;

public class SearchResult implements
TAValueConstraintIntf.TAValueConstraintBeanIntf
{
    private String name;
    private Object value;

    public SearchResult() {
    }

    public String getName() {
        return name;
    }

    public void setName(String _name) {
        name = _name;
    }

    public Object getValue() {
        return value;
    }

    public void setValue(Object _value)
    {
        value = _value;
    }
}

```

Implementing the SIConstraintIntf Interface

```

package com.trulogica.truaccess.externalcall.constraintfunction;

import java.sql.Connection;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.ResultSetMetaData;
import java.sql.SQLException;
import java.sql.Types;
import java.util.ArrayList;
import java.util.Collection;
import java.util.Iterator;
import java.util.List;
import java.util.Map;

import javax.naming.InitialContext;
import javax.naming.NamingException;
import javax.sql.DataSource;

import org.apache.commons.logging.Log;
import org.apache.commons.logging.LogFactory;

import com.hp.ovsi.attribute.SIConstraintIntf;
import com.hp.ovsi.attribute.api.GetConstraintsCommand;
import com.hp.ovsi.attribute.api.GetConstraintsResponse;
import com.hp.ovsi.base.Command;
import com.hp.ovsi.base.Response;
import com.trulogica.truaccess.attribute.exception.
    TAAtributeDefinitionException;
import com.trulogica.truaccess.base.TAFilter;
import com.trulogica.truaccess.base.TAQuery;
import com.trulogica.truaccess.base.exception.CommandException;
import com.trulogica.truaccess.util.DBTool;
import com.trulogica.truaccess.util.Tools;

public class SearchTable implements SIConstraintIntf //TAValueConstraintIntf
{
    private static final Log LOGGER =
        LogFactory.getLog(SearchTable.class );

    public static final String PARAM_POOLNAME = "poolname";
    public static final String PARAM_SQLSTRING = "query";
    public static final String PARAM_VALUEFIELD = "valuefield";

    private String poolname = null;
    private String query = null;
    private String valuefield = null;

    /**
     * Default NoArg Constructor
     */
    public SearchTable() {
        //end <init>
    }

    public SearchTable(final Map args) throws
        TAAtributeDefinitionException{
        setParams(args);
        //end <init>
    }

    /**
     * Returns a List of all possible values. Because this list can be
     * potentially very large, it should be used sparingly.
     *
     * @param attribName
     * @param args
     *
     * @return
     *
     * @throws TAAtributeDefinitionException
     * @see com.trulogica.truaccess.attribute.TAValueConstraintIntf
     */
}

```

```

public List getValueConstraint( String attribName, Map args ) throws
    TAAAttributeDefinitionException {
    return getValueConstraint( attribName, null, args );
}

/**
 * @see com.truologica.truaccess.attribute.TAValueConstraintIntf#
 *     * getValueConstraint( java.lang.String,
 *     com.truologica.truaccess.base.* TAFilter, java.util.Map)
 */
public List getValueConstraint( String attribName, TAFilter filter,
    Map args ) throws TAAAttributeDefinitionException {
    PreparedStatement pStmt = null;
    ResultSet rs = null;
    ArrayList ar = new ArrayList();
    //FIXME: Why store the params, when replaced after every call?
    setParams(args);

    if ( LOGGER.isTraceEnabled() ) {
        LOGGER.trace( "Trying to locate values for attribute:" +
            attribName );
    }
    String modFilter = "";
    boolean hasParam = false;
    if ( null != filter ) {
        switch ( filter.getOperation() ) {
        case TAFilter.EQUALITY:
            modFilter = " " + this.valuefield + " = ?";
            break;
        case TAFilter.BEGINS WITH:
            modFilter = " " + this.valuefield + " LIKE ?";
            filter.setValue( filter.getValue() + "%" );
            break;
        case TAFilter.ENDS WITH:
            modFilter = " " + this.valuefield + " LIKE ?";
            filter.setValue( "%" + filter.getValue() );
            break;
        case TAFilter.CONTAINS:
            modFilter = " " + this.valuefield + " LIKE ?";
            filter.setValue( "%" + filter.getValue() + "%" );
            break;
        }
    }
    String query2Check = this.query;
    query2Check = query2Check.toUpperCase();
    if ( modFilter.length() > 0 ) {
        if ( query2Check.indexOf( " WHERE " ) > 0 ) {
            this.query = this.query + " AND " + modFilter;
        } else {
            this.query = this.query + " WHERE " + modFilter;
        }
        hasParam = true;
    } //end if ( modFilter.length() > 0
} //end if ( null != filter
final Connection connection = getConnection();
try {
    pStmt = connection.prepareStatement( this.query );
    if ( LOGGER.isTraceEnabled() ) {
        LOGGER.trace( "query:( " + this.query + " ):modfilter:" +
            modFilter );
    }
    if ( hasParam ) {
        pStmt.setString( 1, filter.getValue() );
    }
    rs = pStmt.executeQuery();
}

```

```

ResultSetMetaData rsMetaData = rs.getMetaData();
int nameColumn = 0;
//Select the first String field whose column name does not
// match the value field
for ( int i = 1; i <= rsMetaData.getColumnCount(); i++ ) {
    if ((rsMetaData.getColumnType(i) == Types.VARCHAR) ||

        (rsMetaData.getColumnType(i) == Types.CHAR)
            && (!rsMetaData.getColumnName(i).

                equalsIgnoreCase(this.valuefield))) {
        nameColumn = i;
        break;
    } //end if
} //end for

while ( rs.next() ) {
    SearchResult sr = new SearchResult();

    sr.setValue(rs.getString(this.valuefield));

    if (nameColumn > 0) {
        sr.setName(rs.getString(nameColumn));
    } else {
        sr.setName((String) sr.getValue());
    }

    ar.add(sr);
}
return ar;
} catch (SQLException e) {
    LOGGER.fatal("Unable to obtain the values", e);
    TAAAttributeDefinitionException exp =
        new
        TAAAttributeDefinitionException();
    exp.initCause(e);

    throw exp;
} finally {
    DBTool.close(rs);
    DBTool.close(pStmt);
    DBTool.close(connection);
} //end finally
} //end getValueConstraint
}

/**
 * Gets the Connection to the Database.
 * @return Connection to the database.
 * @throws TAAAttributeDefinitionException Thrown if an Exception
 * occurs looking up DataSource, or making Connection
 * to the Database.
 */
private Connection getConnection() throws
    TAAAttributeDefinitionException {
    InitialContext ctx = null;

    try {
        ctx = new InitialContext();
        DataSource ds = (DataSource) ctx.lookup(this.poolname);
        return ds.getConnection();
    } catch (NamingException e) {
        final String msg = "Unable to retrieve Data Connection: " +
            e.getMessage();

        LOGGER.fatal(msg, e);
        throw new TAAAttributeDefinitionException(msg);
    } catch (SQLException e) {
        final String msg = "Unable to make Connection to Database: " +
            e.getMessage();

        LOGGER.fatal(msg, e);
        throw new TAAAttributeDefinitionException(msg);
    } finally {

```



```

        Tools.close(ctx);
    }
    //end getConnection
}

/**
 * Convert the Filter (if supplied) into its SQL format, and return
 * the SQL Query.
 * @param query Base SQL Query to apply filter to.
 * @param valuefield
 * @param filter
 * @return
 * @deprecated
 * @see TAFilter#getPreparedStmtStr(String)
 */
protected static String getFilteredQuery(final String query,
    final String valuefield,
    final TAFilter filter) {
    if ( null != filter ) {
        final StringBuffer modFilter = new StringBuffer(32);
        modFilter.append(' ');
        modFilter.append(valuefield);
        switch ( filter.getOperation() ) {
            case TAFilter.EQUALITY:
                modFilter.append(" = ?");
                break;
            case TAFilter.BEGINS_WITH:
                modFilter.append(" LIKE ?");
                filter.setValue( filter.getValue() + "%" );
                break;
            case TAFilter.ENDS_WITH:
                modFilter.append(" LIKE ?");
                filter.setValue( "%" + filter.getValue() );
                break;
            case TAFilter.CONTAINS:
                modFilter.append(" LIKE ?");
                filter.setValue( "%" + filter.getValue() + "%" );
                break;
        }

        String query2Check = query;

        query2Check = query2Check.toUpperCase();

        if (modFilter.length() > 1) {
            if (query2Check.indexOf(" WHERE ") > 0) {
                return(query + " AND " + modFilter);
            } // else
            return(query + " WHERE " + modFilter);
        } //end if (modFilter.length() > 0)
    } //end if (null != filter)
    //else
    return(query);
    //end getFilteredQuery
}

private void checkParam( String value, String name ) throws
    TAAAttributeDefinitionException {
    if ( ( null == value ) || ( value.trim().length() == 0 ) ) {
        throw new TAAAttributeDefinitionException( "The value of " +
            name + " is needed" );
    } //end if
    //end checkParam
}

/**
 * @see com.hp.ovsi.attribute.SIConstraintIntf#getConstraints(com.hp.
 *     * ovsi.attribute.api.GetConstraintsCommand)
 */
public GetConstraintsResponse getConstraints(GetConstraintsCommand
    command) throws TAAAttributeDefinitionException{
    //TODO: Normal getConstraintValue
    final TAQuery query = command.getQuery();
    final List filters = query.getTaFilterList();

```

```

        //FIXME: This only sends the first filter!
        final TAFilter filter = filters == null || filters.size() < 1 ? null :
        TAFilter)filters.get(0);
        final List constraints = getValueConstraint(command.getAttrName(),
            filter, command.getParams());
        final GetConstraintsResponse response = new
            GetConstraintsResponse(constraints);
        return(response);
        //end getConstraints
    }

    /**
     * @see com.hp.ovsi.attribute.SIConstraintIntf#getDisplayName(com.hp.
     *     * ovsi.base.Command)
     * INPUT = values
     * OUTPUT = DiaplayValues(Name)/Values pairs
     */
    public Response getDisplayName(Command command) throws
        TAAAttributeDefinitionException{
        final TAQuery taQuery = command.getQuery();
        final Collection filters = taQuery.getTaFilterList();
        String sqlQuery;
        if (filters != null && filters.size() > 0 ) {
            sqlQuery = this.query + makeWhereClause(filters,
                taQuery.isFilterListAnded());
        } else {
            sqlQuery = this.query;
        }
        LOGGER.debug(sqlQuery);
        final Connection connection = getConnection();
        PreparedStatement ps = null;
        ResultSet rs = null;
        try {
            ps = connection.prepareStatement(sqlQuery);
            if (filters != null && filters.size() > 0 ) {
                int idx = 1;
                for (Iterator it = filters.iterator(); it.hasNext();idx++) {
                    TAFilter filter = (TAFilter) it.next();
                    ps.setObject(idx, filter.getValueAsObject());
                } //end for
            } //end if
            rs = ps.executeQuery();
            final int valCol = rs.findColumn(this.valuefield);
            // The Name column should be either the first or second column
            // retrieved.
            final int nameCol = rs.getMetaData().getColumnCount() > 1 ?
                (valCol == 1 ? 2 : 1) : 0;
            final boolean namePresent = nameCol > 0;
            final List resultList = new ArrayList(32);
            while(rs.next()) {
                final SearchResult sr = new SearchResult();
                final Object name = namePresent ? rs.getObject(nameCol) :
                    null;
                sr.setName(name == null ? null : name.toString());
                final String value = rs.getString(valCol);
                sr.setValue(value == null ? null : value.toString());
                resultList.add(sr);
            } //end while
            return(new Response(resultList));
        } catch (SQLException e) {
            final String msg = "Exception retrieving SQL: " + e.getMessage();
            LOGGER.fatal(msg, e);
            throw new TAAAttributeDefinitionException(msg);
        } finally {
            DBTool.close(rs);
            DBTool.close(ps);
            DBTool.close(connection);
        }
        //end getDisplayName
    }

    /**
     * Create the SQL Where clause based on the Filters.

```

```

* @param filters The Filters to create the Where clause on.
* @param anded Whether the filters should be Anded or OR'd together.
* @return SQL Where Clause.
*/
protected StringBuffer makeWhereClause(final Collection filters,
    final boolean anded) {
    final StringBuffer whereClause = new StringBuffer(1024);
    final StringBuffer inSegment = new StringBuffer(filters.size() * 3);
    for (Iterator it = filters.iterator(); it.hasNext(); it.next()) {
        inSegment.append("?,");
    } //end for
    final int length = inSegment.length();
    if (length > 0) {
        inSegment.deleteCharAt(length - 1);
        inSegment.append(' ');
        if (this.query.toUpperCase().indexOf("WHERE") < 0) {
            whereClause.append(" WHERE ");
        } else {
            whereClause.append(" AND ");
        }
        whereClause.append(this.valuefield);
        whereClause.append(" IN (");
        whereClause.append(inSegment);
    }
    return (whereClause);
} //end makeWhereClause
}

/**
 * @see com.hp.ovsi.attribute.SIConstraintIntf#setParams(java.util.Map)
 */
public void setParams(final Map args) throws
    TAAAttributeDefinitionException {
    this.poolname = (String) args.get(PARAM_POOLNAME);
    this.query = (String) args.get(PARAM_SQLSTRING);
    this.valuefield = (String) args.get(PARAM_VALUEFIELD);

    checkParam(this.poolname, PARAM_POOLNAME);
    checkParam(this.query, PARAM_SQLSTRING);
    checkParam(this.valuefield, PARAM_VALUEFIELD);
} //end setParams
}

/**
 * @see com.hp.ovsi.attribute.SIConstraintIntf#size(java.lang.String)
 */
public int size(final String attrName) throws
    TAAAttributeDefinitionException {
    return (size(attrName, null));
}

/**
 * @see com.hp.ovsi.attribute.SIConstraintIntf#size(String, TAFILTER)
 */
public int size(final String attrName, final TAFILTER filter) throws
    TAAAttributeDefinitionException {
    if (LOGGER.isTraceEnabled()) {
        LOGGER.trace("Trying to count # of values for attribute:" +
            attrName);
    }

    final Connection connection = getConnection();
    PreparedStatement ps = null;
    ResultSet rs = null;
    try {
        ps = connection.prepareStatement(getSizeQuery(filter));
        if (filter != null) {
            ps.setString(1, filter.getValue());
        } //end if
        rs = ps.executeQuery();
        if (rs.next()) {
            return (rs.getInt(1)); //Only one column, the count, returned
        } //else
    }
}

```

```

        throw new TAAAttributeDefinitionException("Count not
            retrieved.");
    } catch (SQLException e) {
        final String msg = "Exception retrieving Row Count from the
            Database: " + e.getMessage();

        LOGGER.fatal(msg, e);
        throw new TAAAttributeDefinitionException(msg);
    } finally {
        DBTool.close(rs);
        DBTool.close(ps);
        DBTool.close(connection);
    } //end finally
    //end size
}

/**
 * Create the Query to compute the size of the retrieved result set.
 * @param filter Filter to use to filter the results.
 * @return SQL Query based on the supplied filter.
 */
protected String getSizeQuery(TAFilter filter) {
    if (this.query == null) {
        throw new IllegalStateException("Query not set.");
    }
    String query = this.query.toUpperCase();
    final int fromIdx = query.indexOf("FROM");
    int toIdx = query.indexOf("ORDER");

    if (fromIdx < 0) {
        throw new IllegalStateException("Illegal Query Statement Set:
            " + this.query);
    }
    String substr = "";
    if (toIdx > 0){
        substr = this.query.substring(fromIdx, toIdx);
    }
    else {
        substr = this.query.substring(fromIdx);
    }
    query = "SELECT COUNT(*) " + substr ;
    return(getFilteredQuery(query, this.valuefield, filter));
    //end getSizeQuery
}

/**
 * @see com.hp.ovsi.Commandable#execute(com.hp.ovsi.base.Command)
 */
public Response execute(Command command) throws
    UnsupportedOperationException, CommandException {
    final int commandCode = command.getCommand();
    try {
        if (commandCode == GetConstraintsCommand.COMMAND_VALUE) {
            final GetConstraintsCommand gcc =
                (GetConstraintsCommand) command;
            setParams(gcc.getParams());
            return(getConstraints((GetConstraintsCommand) command));
        } else if (commandCode == SIConstraintIntf.DISPLAY_COMMAND) {
            try {
                final GetConstraintsCommand gcc =

                    (GetConstraintsCommand) command;
                setParams(gcc.getParams());
                return(getDisplayName(command));
            } catch (TAAAttributeDefinitionException e) {
                throw new CommandException(e.getMessage(), e);
            }
        } else if (commandCode == SIConstraintIntf.SIZE_COMMAND) {
            final GetConstraintsCommand gcc =

                (GetConstraintsCommand) command;
            setParams(gcc.getParams());
            final TAQuery query = gcc.getQuery();

```

```

        final List filterList = query == null ? null :
        query.getTaFilterList();
        final TAFilter filter = filterList == null ? null :
        filterList.size() > 0 ? (TAFilter)filterList.get(0) : null;
        final int size = size(gcc.getAttrName(), filter);
        return(new Response(new Integer(size)));
    }
} catch (TAAttributeDefinitionException e) {
    throw new CommandException(e.getMessage(), e);
}
//else
throw new UnsupportedOperationException("Command not understood.");
//end execute
}

} //end SearchTable
The following is called by the class listed above:
package com.trulogica.truaccess.externalcall.constraintfunction;

import com.trulogica.truaccess.attribute.TAValueConstraintIntf;

public class SearchResult implements
TAValueConstraintIntf.TAValueConstraintBeanIntf {
    private String name;
    private Object value;

    public SearchResult() {
        //Default Constructor }

    public String getName() {
        return this.name; }

    public void setName( String name ) {
        this.name = name; }

    public Object getValue() {
        return this.value; }

    public void setValue( Object value ) {
        this.value = value; }
}

```

## Attribute Value Validation External Call

This class determines whether a value is alphanumeric.

```

package com.trulogica.truaccess.externalcall.validation;
import com.trulogica.truaccess.util.logging.misc.Logger;
import com.trulogica.truaccess.util.logging.misc.Level;
import com.trulogica.truaccess.attribute.TAValueValidationIntf;
import com.trulogica.truaccess.attribute.exception.
TAAttributeValueValidationException;
import java.util.*;
public class IsAlphaNumeric implements TAValueValidationIntf
{
    private static final Logger mLogger =
    Logger.getLogger("com.trulogica.truaccess.externalcall.
    validation.IsAlphaNumeric");
    public void validateValue(String attribName, Object value, Map args)
    throws TAAttributeValueValidationException
    {
        String password = (String ) value;
        if (mLogger.isLoggable(Level.FINE)) mLogger.fine("Entering the
        IsAlphaNumeric method ");
        boolean containsDigit = false;

```

```

boolean containsLetter = false;
for (int i = 0, n = password.length(); i < n; i++)
{
    // checkNum(word.charAt(i));
    if (Character.isDigit(password.charAt(i)))
    {
        containsDigit = true;
        break;
    }
}
for (int i = 0, n = password.length(); i < n; i++)
{
    if (Character.isLetter(password.charAt(i)))
    {
        containsLetter = true;
        break;
    }
}
if (mLogger.isLoggable(Level.FINE)) mLogger.fine("The return of the
containsDigit is " + containsDigit);
if (mLogger.isLoggable(Level.FINE)) mLogger.fine("The return of the
containsLetter is " + containsLetter);
if (containsLetter && containsDigit)
{
    if (mLogger.isLoggable(Level.FINE)) mLogger.fine("The external
call validation is fine. For is digit and alphabets present. ");
}
else
{
    if (mLogger.isLoggable(Level.FINE))
    {
        mLogger.fine("The external call validation is NOT fine.
For is digit and alphabets not present. ");
    }
    throw new TAAtributeValueValidationException(
"The field:" + attribName + " is not alpha numeric. It must
contain at least one numeric and one non-numeric field",
attribName);
}
}
}
}

```

## Approver Selection External Call

The following example creates a class that collects information from an existing request and concatenates the information to produce a new value for an attribute. The `getApprover()` function is called by `Select Identity` to get an approver.

```

package com.truologica.truaccess.wfenginesvcs.wfexternalcall.support;
import com.truologica.truaccess.wfengine.wfexternalcall.
    WfSelectApproverIntf;
import com.truologica.truaccess.wfengine.wfexternalcall.
    WfExternalCallException;
import com.truologica.truaccess.request.model.RequestTarget;
import com.truologica.truaccess.util.logging.misc.*;
import java.util.*;
public class WfSelectApproverSample implements WfSelectApproverIntf
{
    /**
     * @param reqtarget is the Request target associated with the workflow
     * @param attrs a list of parameters (standard and custom) for the call
     * The standard parameters are
     * serviceid: Internal identifier of the service
     * servicename: Name of the service
     */
}

```

```

*           roleid: The role name of the approver
* The specific parameter is SampleApprovers, which contains comma
* separated user ids
*
* @return The collection of Concerro userid of the approver
* @throws ApprovalStageException
*/
public Collection getApprover(RequestTarget reqTarget, HashMap attrs)
    throws WfExternalCallException
{
    ArrayList ret = new ArrayList();
    try
    {
        String value = (String) attrs.get("SampleApprovers");
        if (value != null)
        {
            StringTokenizer tokens = new StringTokenizer(value, ",");
            while (tokens.hasMoreTokens())
            {
                String user = tokens.nextToken();
                ret.add(user);
            }
        }
    }
    catch (Exception e)
    {
    }
    return ret;
}
}

```

## Workflow Action External Call

Two examples are provided in this section. The first example provides two files. The first file generates an attribute value and adds it to a user, and the second file extends the first by adding an ID. The second example changes a user's attributes and entitlements based on whether the user's department has changed.

### Adding a Generated Value to a User

This class generates the new attribute value and adds the value to the user in Select Identity.

```

package com.truologica.truaccess.wfenginesvcs.wfexternalcall.support;

import com.truologica.truaccess.wfengine.wfexternalcall.WfExternalCall;
import com.truologica.truaccess.wfengine.wfexternalcall.AttributeRecord;
import com.truologica.truaccess.wfengine.wfexternalcall.
    WfExternalCallStatus;
import com.truologica.truaccess.wfengine.wfexternalcall.
    WfExternalCallException;
import com.truologica.truaccess.request.model.RequestTarget;
import com.truologica.truaccess.request.model.RequestTargetParam;
import com.truologica.truaccess.request.model.RequestTargetParamValue;
import com.truologica.truaccess.wfengine.wfexternalcall.ChangeRecord;
import com.truologica.truaccess.base.constants.UserAttributeConstants;
import java.util.*;
//import com.truologica.truaccess.workflow.external.util.*;

public abstract class WorkflowStepSample implements WfExternalCall
{
    String attribName = "";

    protected WorkflowStepSample(String _attribName)

```

```

    {
        attribName = _attribName;
    }

public WfExternalCallStatus process(String stageId,
    RequestTarget requestTarget,
    AttributeRecord [] availGrp,
    AttributeRecord [] availRole,
    AttributeRecord [] availEntitlements,
    Map map) throws WfExternalCallException
{
    try{
        WfExternalCallStatus ecs = new WfExternalCallStatus(stageId);
        String propPrepName = "", propName = "";

        propName = attribName + ".attributes";

        String attrs = System.getProperty(propName);
        if (null == attrs) {

            ecs.setStatus(WfExternalCallStatus.STATUS_REJECT_TERMINATE);
            return ecs;
        }

        StringBuffer sb = new StringBuffer();

        //The default change operation is ADD.

        ChangeRecord changeRecord = new ChangeRecord();
        changeRecord.setName(attribName);

        StringTokenizer st = new StringTokenizer( attrs,"," );
        while( st.hasMoreTokens() ) {
            String attrName = st.nextToken();
            String value =
                requestTarget.getParamValueString(attrName);
            if (null == value) {
                throw new Exception("Unable to generate the value
                    for attribute:"+attrName);
            }

            sb.append(value);
        }

        changeRecord.addValue(sb.toString());
        ecs.addAttributeChange( changeRecord );

        getSingleRequestParamStr( UserAttributeConstants.FIRST_NAME );

        ecs.setStatus(WfExternalCallStatus.STATUS_APPROVED);
        return ecs;
    }

    catch( Exception e ) {
        throw new WfExternalCallException( e );
    }
}
}

```





The following class extends the WorkflowStepSample class created above and defines a class that obtains the name of the user.

```
package com.trulogica.truaccess.wfenginesvcs.wfexternalcall.support;
import com.trulogica.truaccess.wfenginesvcs.wfexternalcall.support.
    WorkflowStepSample;

public class PersonNumberCallout extends WorkflowStepSample
{
    public PersonNumberCallout() {
        super("personId");
    }
}
```

## Retrieving and Changing Attributes and Entitlements

The following code creates a class that determines whether a user's department (attribute) changed. If the user's department has changed, the class removes entitlements associated with the old department, changes the cost center attribute, and adds new entitlements based on the new department.

```
package com.trulogica.truaccess.wfenginesvcs.wfexternalcall.support;

import java.sql.*;
import java.util.*;
import javax.naming.*;
import javax.sql.*;

import com.trulogica.truaccess.request.model.*;
import com.trulogica.truaccess.util.logging.misc.*;
import com.trulogica.truaccess.wfengine.wfexternalcall.*;

public class WfEntitlementChange
    implements WfExternalCall
{
    private static final Logger mLogger =
        Logger.getLogger(WfEntitlementChange.class.getName());

    public static final String PARAM_POOLNAME = "jdbc/TruAccess";

    //set the resource name here
    private static final String resourceName = "LDAP_70";

    private static final String USERNAMEATTRNAME = "UserName";
    private static final String DEPARTMENTATTRNAME = "Department";
    private static final String COSTCENTERATTRNAME = "CostCenter";
    private static final String ENTITLEMENTPOSTFIX = "_ENTITLEMENTS";

    private static final String findOldDeptQuery = "select A.stringValue
        from TAAAttribute A , "
        + "TAUser B where A.identObjId = B.userId AND A.name = "
        + "? and B.conceroUserId = ?";

    /*
    * If the department has changed, assign the new cost center and
    * entitlements to the user. Use the following table to assign values.
    * Department Entitlements CostCenter
    * -----
    * Sales SA-505 101
    * Finance FIN-505 205
    * HR HR-101 308
    * Corporate CORP-3 409
    */
    private static final String[] deptNames =
        {"Sales", "Finance", "HR", "Corporate"};

    private static final String[] costCenterNames =
```

```

        {"101", "102", "103", "100"};
private static final String[] entNames =
        {"SA-103", "FIN-101", "HR-102", "Corp-103"};
public WfExternalCallStatus process(String stageId, RequestTarget
    reqTarget, AttributeRecord[] attrbRec1, AttributeRecord[]
    attrbRec2, AttributeRecord[] attrbRec3, Map map) throws
    WfExternalCallException
{
    Connection connection = null;
    PreparedStatement pStmt = null;
    ResultSet rs = null;

    try
    {
        //get service name from map
        //String serviceName =

        (String)map.get(WfExternalCall.WF_PARAM_SERVICENAME);

        WfExternalCallStatus status = new WfExternalCallStatus(stageId);

        //Get the new department and user name from the Request Target
        String newDept =

        reqTarget.getParamValueString(DEPARTMENTATTRNAME);
        String userName =

        reqTarget.getParamValueString(USERNAMEATTRNAME);

        //Get the old department from SI database
        String oldDept = null;
        connection = this.getConnection();

        pStmt = connection.prepareStatement(findOldDeptQuery);
        pStmt.setString(1, DEPARTMENTATTRNAME);
        pStmt.setString(2, userName);

        rs = pStmt.executeQuery();
        if (rs.next())
        {
            oldDept = rs.getString(1);

            if (null == oldDept)
            {
                oldDept = "";
            }
        }
        else
        {
            log("There is no old department");
            oldDept = "";
        }

        //Find whether the department has been changed by the
        //reconciliation process
        boolean changed = false;
        if (!oldDept.equalsIgnoreCase(newDept))
        {
            changed = true;
            //Build the map tables
        }
        Map entMap = new HashMap();
        Map costMap = new HashMap();

        for (int i = 0; i < deptNames.length; i++)
        {
            entMap.put(deptNames[i], entNames[i]);
            costMap.put(deptNames[i], costCenterNames[i]);
        }
    }
}

```

```

}

//Form the resource attribute name from the resource name.
//Entitlement attribute names always ends with ENTITLEMENTS.
String resourceAttrib = resourceName + ENTITLEMENTPOSTFIX;

if (changed)
{
    //Create a change record to add the costcenter value
    //or replace the value if present.
    //CostCenter attribute is a single value attribute.

    ChangeRecord costCenterCR = new ChangeRecord();
    costCenterCR.setName(COSTCENTERATTRNAME);
    if(costMap.get(newDept) != null )
        costCenterCR.addValue( (String) costMap.get(newDept));

    status.addAttributeChange(costCenterCR);

    //Add entitlements to the user
    ChangeRecord entitlementsCR = new ChangeRecord();
    entitlementsCR.setName(resourceAttrib);
    if(entMap.get(newDept) != null )
        entitlementsCR.addValue( (String) entMap.get(newDept));
    /*
    * If you need to add more entitlements, use:
    * cr.addValue("Some other entitlements");
    * To delete attribute values, use:
    * cr.setOperation(ChangeRecord.DELETE);
    */

    //Entitlements are multi-value attributes. need to set change
    //operation ADD/MODIFY/... Default is ADD
    entitlementsCR.setChangeOperation(ChangeRecord.ADD);
    status.addAttributeChange(entitlementsCR);

    //set a work flow variable
    //workflow variable name starts with
        //ChangeRecord _wfVar1 = new ChangeRecord();
        // _wfVar1.setName(" WFVAR");
        //_wfVar1.addValue("Var value");
}

status.setStatus(WfExternalCallStatus.STATUS_APPROVED);
return status;
}
catch (Throwable e)
{
    log("Unable to complete the department change", e);
    WfExternalCallException exp = new
        WfExternalCallException("Unable to complete
            the department change", e);
    throw exp;
}
finally
{
    //Close all database connections, statements and result sets
    try
    {
        if (null != rs)
        {
            rs.close();
        }
        rs = null;
    }
    catch (Throwable t)
    {
        log("Error in closing resultset", t);
    }

    try
    {

```

```

        if (null != pStmt)
        {
            pStmt.close();
        }
        pStmt = null;
    }
    catch (Throwable t)
    {
        log("Error in closing statement", t);
    }
}
try
{
    if (null != connection && !connection.isClosed())
    {
        connection.close();
    }
    connection = null;
}
catch (Throwable t)
{
    log("Error in closing connection", t);
}
}
}

private Connection getConnection() throws Exception
{
    InitialContext ctx = null;
    try
    {
        ctx = new InitialContext();
        DataSource ds = (DataSource) ctx.lookup(PARAM_POOLNAME);
        return ds.getConnection();
    }
    finally
    {
        try
        {
            if (null != ctx)
            {
                ctx.close();
            }
            ctx = null;
        }
        catch (Throwable t)
        {
            log("Error closing context", t);
        }
    }
}

private void log(String msg, Throwable t)
{
    System.out.println(msg + ":Caused By:");
    t.printStackTrace();
}

private void log(String msg)
{
    System.out.println(msg);
}
}
}

```

## Retrieving Request Object Data to Set Workflow Variables

The following example provides the `WorkflowRequestCallout` class, which looks for a map called `$AttributeResourceMap` (defined in the `MAP_NAME` variable). The map must have a name-value pair whose name is `FieldName` (defined in the `FIELD_NAME` variable) and whose

value is the field to retrieve from the request target (requestTarget class). This class also retrieves the value from the request target and stores it in a workflow variable called WorkflowRequest (defined in the WORKFLOW\_REQUEST variable).

```

package com.trulogica.truaccess.workflow.external;

import java.util.ArrayList;
import java.util.Map;
import java.util.HashMap;
import java.util.Set;
import java.util.Iterator;

import com.trulogica.truaccess.wfengine.wfexternalcall.WfExternalCall;
import com.trulogica.truaccess.wfengine.wfexternalcall.AttributeRecord;
import com.trulogica.truaccess.wfengine.wfexternalcall.ChangeRecord;
import com.trulogica.truaccess.wfengine.wfexternalcall.WfExternalCallStatus;
import com.trulogica.truaccess.wfengine.wfexternalcall.WfExternalCallException;
import com.trulogica.truaccess.request.model.RequestTarget;
import com.trulogica.truaccess.base.constants.UserAttributeConstants;
import com.trulogica.truaccess.util.logging.misc.Logger;
import com.trulogica.truaccess.util.logging.misc.Level;
import com.trulogica.truaccess.wfengine.client.IWfQuery;
import com.trulogica.truaccess.wfengine.client.IWfDataUpdate;
import com.trulogica.truaccess.transport.protocol.ejb.client.StatelessServiceObjectFactory;

public class WorkflowRequestCallout implements WfExternalCall
{
    private static final Logger mLogger =
        Logger.getLogger(WorkflowRequestCallout.class.getName());
    public static final String WORKFLOW_REQUEST = "WorkflowRequest";
    public static final String FIELD_NAME = "FieldName";
    public static final String MAP_NAME = "$AttributeResourceMap";

    /*
     * Default public constructor.
     */
    public WorkflowRequestCallout()
    {
    }

    /*
     * Processes the external call request from Select Identity for the person
     * number.
     *
     * @param stageId          The stage to process
     * @param requestTarget    Object containing fixed roles, groups, and
     *                          entitlements
     * @param availGrp         Groups that can be assigned to the user
     * @param availRole        Roles that can be assigned to the user
     * @param availEntitlements Entitlements to be assigned to the user
     * @param attrs            Additional attributes needed by the call
     *
     * @return Object containing the person number
     *
     * @exception Throws WfExternalCallException if an error occurs.
     */
    public WfExternalCallStatus process(String stageId,
                                       RequestTarget requestTarget,
                                       AttributeRecord [] availGrp,
                                       AttributeRecord [] availRole,
                                       AttributeRecord [] availEntitlements,
                                       Map attrs) throws WfExternalCallException
    {
        try
        {
            WfExternalCallStatus ecs = new WfExternalCallStatus(stageId);

```

```

IWfQuery query = (IWfQuery)
    StatelessServiceObjectFactory.create( IWfQuery.class );
mLogger.finest("WorkflowRequestCallout: WF_PARAM_WORKFLOWINSTID
is " + attrs.get(WF_PARAM_WORKFLOWINSTID));

Integer workflowInstanceID = (Integer)
    attrs.get(WF_PARAM_WORKFLOWINSTID);
mLogger.finest("WorkflowRequestCallout: workflowInstanceID is "
+ workflowInstanceID);

int instanceId = workflowInstanceID.intValue();
mLogger.finest("WorkflowRequestCallout: instanceId is " +
instanceId);

Map varMap = query.getCurrentVariableMap(instanceId);
mLogger.finest("WorkflowRequestCallout: varMap is " + varMap);

HashMap attributeRequestMap = (HashMap) varMap.get(MAP_NAME);

if (attributeRequestMap != null)
{
    String field = (String) attributeRequestMap.get(FIELD_NAME);

    if (field != null)
    {
        IWfDataUpdate du =
            (IWfDataUpdate) StatelessServiceObjectFactory.
                create(IWfDataUpdate.class);
        String value =
            (String) requestTarget.getSingleRequestParamStr(field);

        du.setWorkflowVar(instanceId, WORKFLOW_REQUEST, field);

        mLogger.finest("WorkflowRequestCallout: Setting status
to approved...");

        // Set the status to approved
        ecs.setStatus(WfExternalCallStatus.STATUS_APPROVED);
    }
}
else
{
    mLogger.severe("WorkflowRequestCallout: Setting status to
rejected...");
    // Set the status to rejected
    ecs.setStatus(WfExternalCallStatus.STATUS_REJECT_TERMINATE);
}

return ecs;
}
catch(Exception e)
{
    mLogger.severe("WorkflowRequestCallout: Exception occurred: " +
e.getMessage());
    throw new WfExternalCallException( e );
}
}
}

```

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