IBM SPSS Collaboration and Deployment Services
Version 7 Release 0

Data Services Service Developer's Guide

Note
Before using this information and the product it supports, read the information in "Notices" on page 41.

Product Information

This edition applies to version 7, release 0, modification 0 of IBM SPSS Collaboration and Deployment Services and to all subsequent releases and modifications until otherwise indicated in new editions.

Contents

Chapter 1. Introduction to web services

What are web services?

At a high level, a web service is a set of functionality distributed across a network (LAN or the Internet) using a common communication protocol. The web service serves as an intermediary between an application and its clients, providing both a standardized information structure and a standardized communication protocol for interaction between the two.

Where other methods of distributed application architecture rely on a single programming language being used on both the application and its clients, a web service allows the use of loosely coupled services between non-homogenous platforms and languages. This provides a non-architecture-specific approach allowing, for example, Java services to communicate with C# clients, or vice versa.

Advantages to implementing application functionality as web services include the following:

- Software written in different languages (Java or C#) running on different platforms (UNIX or Windows) can exchange services and data
- Application functionality can be accessed by a variety of clients. For example, both a thin-client interface and a rich-client interface can take advantage of the web service operations.
- Updates to the service are immediately available to all service clients

Web service system architecture

Web services are deployed and made publicly available using an application server, such as WebSphere®, JBoss Application Server, or Oracle WebLogic Server. The published web services are hosted by this application server to handle application requests, access permissions, and process load. A high-level architecture of how web services are implemented is displayed in the following diagram.

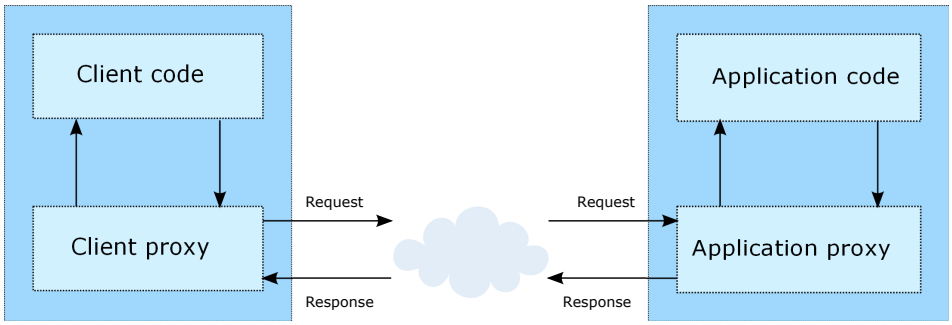

Figure 1. Web service architecture

The client code supplies input to an operation offered by a proxy class. The proxy class generates a request containing a standardized representation of the input and sends it across the network to the application. A proxy class on the server receives the request and unmarshals the contents into objects for processing by the application. Upon completing the operation, the application supplies a proxy with the output. The proxy creates a standardized representation of that output and sends the response back to the client. The client proxy unmarshals the response into native objects for subsequent processing by the client code.

Standardizing the format of the information passing between the client and the application allows a client written in one programming language to communicate with an application written in another. The proxy

classes, which are automatically generated from a web service description by a variety of toolkits, handle the translation between native programming objects and the standardized representation. See the topic "Proxies" on page 5 for more information.

Web service protocol stack

A web service implementation depends on technologies often organized in a layered stack. The implementation itself defines a standard protocol for each technology layer, with each layer depending on the layers appearing below it in the stack.

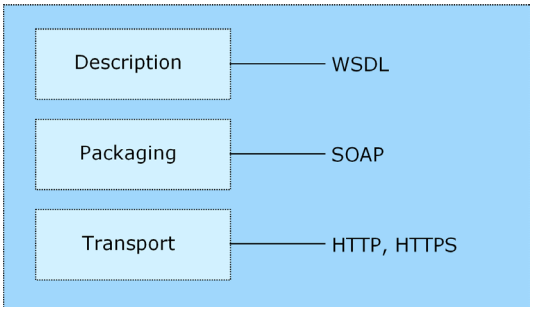

Figure 2. Web service protocol stack

Beginning at the bottom of the stack, the Transport layer defines the technology standards for communication, allowing information to move across the network. HTTP or HTTPS are often used as the standard for the transport layer.

The Packaging layer rests on top of Transport and defines the standard for structuring information for transport across the network. The SOAP format is commonly used, which offers an XML structure for packaging the data. See the topic "Simple Object Access Protocol" for more information.

The topmost layer is Description and identifies the standards used by the layers below it in the stack, as well as providing the definition of the interface available for client use. The most common means of conveying this information is through the use of a WSDL file. See the topic "Web Service Description Language" on page 3 for more information.

Simple Object Access Protocol

The Simple Object Access Protocol (SOAP) is a way to pass information between applications in an XML format.

SOAP messages are transmitted from the sending application to the receiving application, typically over an HTTP session. The actual SOAP message is made up of the Envelope element, which contains a Body element and an optional Header element.

- **Envelope.** This mandatory element is the root of the SOAP message, identifying the transmitted XML as being a SOAP packet. An envelope contains a body section and an optional header section.
- **Header.** This optional element provides an extension mechanism indicating processing information for the message. For example, if the operation using the message requires security credentials, those credentials should be part of the envelope header.
- **Body.** This element contains the message payload, the raw data being transmitted between the sending and receiving applications. The body itself may consist of multiple child elements, with an XML schema typically defining the structure of this data.

A SOAP packet and the corresponding XML is structured in the following way:

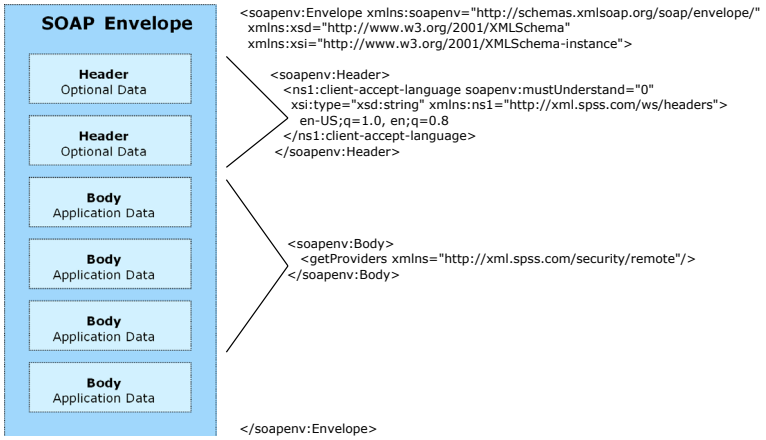

Figure 3. An example SOAP packet

Web Service Description Language

A Web Service Description Language (WSDL) file provides an XML-based map of what functionality the published web service allows, separating the implementation in the service from the interface. The WSDL defines the following:

- The access location of the web service
- Operations the web service exposes
- Parameters the exposed operations accept
- Any request or response messages associated with the operations

The WSDL provides the information necessary to generate a client-side proxy in the target programming language.

In accordance with the WSDL specification adopted by the World Wide Web Consortium, information in the WSDL is organized into the following sections:

- **Types.** Content definitions for web service operation input and output. See the topic "Types" for more information.
- **Messages.** Input and output definitions for the web service operations. See the topic "Messages" on page 4 for more information.
- **PortTypes.** Groups of operations offered by the web service. See the topic "Port types" on page 4 for more information.
- **Bindings.** Protocols and formats for the web service operations. See the topic "Bindings" on page 4 for more information.
- **Services.** Endpoints at which the web service functionality can be accessed. See the topic "Services" on page 5 for more information.

Types

The types element of a WSDL file contains the data type definitions employed by messages processed by the web service. These definitions use XML to organize the information relevant to the type element being defined. Consider the following example type definitions:

```
<wsdl:types>
  <schema targetNamespace="http://xml.spss.com/security/remote"
    xmlns="http://www.w3.org/2001/XMLSchema">
    <element name="getProviders">
      <complexType />
    </element>
    <element name="getProvidersResponse">
      <complexType>
```

```
        <sequence>
          <element name="providerInfo[unbounded]" type="tns1:providerInfo" />
        </sequence>
      </complexType>
    </element>
  </schema>
</wsdl:types>
```

This section defines two elements, *getProviders* and *getProvidersResponse*. The former is an empty element. The latter contains a sequence of *providerInfo* child elements. These children are all of the *providerInfo* type, which is defined elsewhere.

In practice, the WSDL file typically references type element definitions found in an external XML schema. For instance, the following definition uses `security-remote.xsd` to define type elements.

```
<wsdl:types>
  <xs:schema>
    <xs:import namespace="http://xml.spss.com/security/remote"
      schemaLocation="security-remote.xsd"/>
  </xs:schema>
</wsdl:types>
```

Messages

The message elements of a WSDL file defines the input or output parameters for operations available in the web service. Each message can consist of one or more parts, with the parts similar to the parameters of a function call in a traditional programming language. Consider the following two example message definitions:

```
<wsdl:message name="getProvidersResponse">
  <wsdl:part element="tns2:getProvidersResponse" name="parameters" />
</wsdl:message>
<wsdl:message name="getProvidersRequest">
  <wsdl:part element="tns2:getProviders" name="parameters" />
</wsdl:message>
```

The *getProvidersResponse* message contains a single part, corresponding to the *getProvidersResponse* element defined in the types section of the WSDL file. Similarly, the *getProvidersRequest* message also contains a single part, as defined by the *getProviders* element in the types section. See the topic "Types" on page 3 for more information.

Port types

The portType element of a WSDL file defines the actual interface to the web service. A port type is simply a group of related operations and is comparable to a function library, module, or class in a traditional programming language. The definition specifies the parameters for the operations, as well as any values returned. The parameters and return values correspond to messages defined elsewhere in the WSDL file. Consider the following example port type definition:

```
<wsdl:portType name="ProviderInformation">
  <wsdl:operation name="getProviders">
    <wsdl:input message="impl:getProvidersRequest" name="getProvidersRequest" />
    <wsdl:output message="impl:getProvidersResponse" name="getProvidersResponse" />
  </wsdl:operation>
</wsdl:portType>
```

The *ProviderInformation* port type consists of a single operation, *getProviders*. Input to this operation corresponds to the *getProvidersRequest* message. The operation returns information in the structure defined by the *getProvidersResponse* message. See the topic "Messages" for more information.

Bindings

The binding element of a WSDL file binds the interface defined by the port type to transport and messaging protocols. Consider the following example binding definition:

```
<wsdl:binding name="ProviderInformationSoapBinding" type="impl:ProviderInformation">
  <wsdlsoap:binding style="document" transport="http://schemas.xmlsoap.org/soap/http" />
  <wsdl:operation name="getProviders">
    <wsdlsoap:operation soapAction="" />
    <wsdl:input name="getProvidersRequest">
      <wsdlsoap:body namespace="http://xml.spss.com/security/remote" use="literal" />
    </wsdl:input>
    <wsdl:output name="getProvidersResponse">
```

```
      <wsdlsoap:body namespace="http://xml.spss.com/security" use="literal" />
    </wsdl:output>
  </wsdl:operation>
</wsdl:binding>
```

In this case, the transport attribute of the `wsdlsoap:binding` element defines HTTP as the transport protocol. The `getProviders` operation in the interface is bound to the SOAP messaging protocol.

Services

The service element of a WSDL file identifies the network location at which the service interface can be accessed. Consider the following example service definition:

```
<wsdl:service name="ProviderInformationService">
  <wsdl:port binding="impl:ProviderInformationSoapBinding" name="ProviderInformation">
    <wsdlsoap:address location="http://pes_server:8080/security-ws/services/ProviderInformation" />
  </wsdl:port>
</wsdl:service>
```

In this example, the operations comprising the *ProviderInformation* port type can be accessed at:

```
http://pes_server:8080/security-ws/services/ProviderInformation
```

Proxies

Proxies serve as bridges between the client and the web service. A client-side proxy marshals the input objects into a standardized representation which is sent to the web service. A server-side proxy unmarshals the information into input objects for the service operations. The results of the operation are marshalled into standard representations and returned to the client. The client proxy unmarshals the response information into objects for any additional processing by the client.

Creating a proxy is the first step when developing a web service client; the proxy is the translation-unit between your application and the web service the application is using. Fortunately, many development environments include tools for automatically generating the client proxy from the web service WSDL file, allowing the client developer to focus on the client application code instead of transport and packaging protocols.

The proxy classes generated from a WSDL file depend on the tool used. For Java, the `wsdl2java` tool, which is part of the Apache Axis project, can be used. This tool produces a Java class for each type in the WSDL. Each port type results in a Java interface. A binding creates a stub class, and a WSDL service yields a service interface with a locator implementation. These generated classes and interfaces can be called directly from a client application written in Java to access the web service functionality.

An alternative Java proxy tool is `wsimport`, which is part of JAX-WS. The general structure of the generated classes is similar to that created by the Axis tool, but there are some differences. For example, instead of using arrays for input fields and returned items, the code generated from the `wsimport` tool uses `List` collections. In addition, if an input type matches an output type for a method, the `wsimport` tool uses a `Holder` class for the parameter.

In contrast, on the .NET platform, the `wsdl.exe` tool is often used to generate a web service proxy. This tool creates a single source file in a specified language containing the proxy class. This class includes both synchronous and asynchronous methods for each operation defined in the WSDL. For example, the web service operation `getProviders` results in the methods `getProviders`, `getProvidersBegin`, and `getProvidersEnd`. The latter two can be used for asynchronous processing.

A variety of other tools exist for other programming languages. For details, consult the documentation for those tools. In each case, the tool creates native programming constructs that permit leveraging a web service regardless of the service implementation language.

Chapter 2. Data Services Service overview

The Data Services Service provides functionality used when working with the data sources defined in the IBM® SPSS® Collaboration and Deployment Services Repository for analytic and scoring tasks. In general, the service provides the ability to perform the following tasks:

- Retrieve metadata about the tables available in data sources
- Retrieve information about table columns and links

The Data Services Service is often used in conjunction with the Scoring Service. Use the Data Services Service to access information about the data used for a particular scoring configuration.

Workflow

The actual sequence of web service calls you need when working with data sources will depend on your particular application. However, the input requirements for the Data Services Service operations leads to the following general workflow for a specific data source:

1. Determine the types of tables used in the data source by using the `getTableTypes` operation.
2. Retrieve the metadata for the data source tables of the wanted type or types by using the `getTableMetaData` operation.
3. Using the metadata for a specific table, access information about the table columns by using the `getTableSimpleColumns` operation. In addition, you can you use the table metadata to retrieve information about the data sets within the data source by using the `getDataSets` operation.

Accessing the Data Services Service

To access the functionality offered by the Data Services Service, create a client application using the proxy classes generated by your preferred web service tool. The endpoint for the service is:

```
http://<host-name>:<port-number>/<context-root>/scoring/services/Data
```

The value of *<host-name>* corresponds to the name or IP address of the machine on which IBM SPSS Collaboration and Deployment Services Repository is installed.

Note: An IPv6 address must be enclosed in square brackets, such as `[3ffe:2a00:100:7031::1]`.
The value of *<port-number>* indicates the port number on which the repository server is running. The *<context-root>* value specifies the custom context root, if any, configured for your repository server. If your system does not use a context root, omit this portion of the endpoint. To access the WSDL file for the service, append *?wsdl* to the service endpoint.

For example, if IBM SPSS Collaboration and Deployment Services Repository is running on port 80 of the machine *cads_server* without a context root, the WSDL file can be accessed using the path:

```
http://cads_server:80/scoring/services/Data?wsdl
```

Calling Data Services Service operations

Clients access the operations offered by the web service using a stub for the service. The following is an example of how to acquire a stub in Java through Axis defined methods:

```
String context = "/scoring/services/data";
URL url = new URL("http", "cads_server", 80, context);
dataService service = new dataServiceLocator();
stub = service.getStatus(url);
```

The service operations can be called directly from the stub, such as:

```
stub.getTableMetaData(dsURI, credURI, type);
```

Chapter 3. Data Service concepts

Uniform Resource Identifiers

Resources within the IBM SPSS Collaboration and Deployment Services Repository are often referenced using a uniform resource identifier. A content repository URI consists of the following items:

- The scheme *spsscr:*
- A hierarchical specification consisting of an authority definition and an optional object path
- An optional query specifying an object identifier
- Optional fragments defining version information

The URI has the following format:

```
spsscr://[host][:port]/[path/filename [?hierarchyType=type] | ?id=repositoryID][#l.label | #m.marker]
```

The hierarchical portion begins with two slashes, followed by the authority definition. This information identifies the host name and port number for the repository containing the object, followed by a slash. The authority definition may be omitted, in which case the URI indicates a relative location within the repository processing the service request.

```
spsscr:///[path/filename [?hierarchyType=type] | ?id=repositoryID][#l.label | #m.marker]
```

The URI continues with either the full path to the object, including its name, or a question mark and a query term consisting of the key *id*, an equals sign, and the repository resource identifier for the object. This identifier can be obtained from the information returned by the `getResource` operation of the Content Repository Service.

If the URI specifies an object path, the path may be followed by a query parameter designating the type of hierarchy containing the object. This parameter begins with a question mark, followed by the key *hierarchyType*, an equals sign, and the hierarchy type designator. Valid hierarchy types include *folder*, *topic*, *configuration*, *server*, *credential*, *datasource*, *enterprise*, and *submitted*. If the *hierarchyType* parameter is omitted, the *folder* hierarchy is used by default. The *hierarchyType* parameter is valid only when using the path to identify the object.

Optional version fragments follow the object information. The fragments begin with a hash symbol (#), followed by a single letter indicating whether the fragment is a version label (`l`) or a version timestamp marker (`m`). The fragment ends with a period and the actual label or marker for the version. Replace any spaces in the label or marker with escape characters. For example, the URI:

```
spsscr://myserver:80/marketing/campaign1#m.0:2006-10-08%2012:34:10.223
```

refers to the version of the *campaign1* job in the *marketing* folder saved at 12:34 on October 8, 2006. A URI that does not include a version fragment references the latest version of the object. For instance, the URI:

```
spsscr://localhost/campaign2
```

refers to the latest version of the job *campaign2*.

Data sources

A data source definition defines the connection information necessary to connect to a data source. The connection properties depend on the data source type. For example, open database connectivity (ODBC) provides a mechanism for client programs to access databases or data sources. An ODBC definition consists of the data source name (DSN). Similarly, Java database connectivity (JDBC) determines how Java applications access databases. A JDBC definition consists of the driver name and URL. The data service

API also provides public Java interfaces for implementing custom drivers to access nonstandard data sources. For information on creating custom drivers, see the IBM SPSS Collaboration and Deployment Services customization documentation.

Data source definitions allow other components, such as the Enterprise View, to access the data sources used in the system. Data source definitions are typically created using the IBM SPSS Collaboration and Deployment Services Deployment Manager and are stored in the IBM SPSS Collaboration and Deployment Services Repository. For information on creating data source definitions, see the IBM SPSS Collaboration and Deployment Services Deployment Manager documentation. Data sources can be referenced using their IBM SPSS Collaboration and Deployment Services Repository uniform resource identifiers. See the topic "Uniform Resource Identifiers" on page 9 for more information.

Credentials

Some IBM SPSS Collaboration and Deployment Services Repository resources, such as Enterprise View and Data Provider Definition items, require access to data from physical data sources. In order to connect to these data sources, credential definitions must be defined and stored within the IBM SPSS Collaboration and Deployment Services Repository. Each credential definition contains a user identifier and password. In addition, some credentials require the specification of a security provider against which to validate the credential information. Credentials stored within the repository can be referenced using their uniform resource identifiers. See the topic "Uniform Resource Identifiers" on page 9 for more information.

Tables

Information within the databases referenced by the data source definitions is stored in tables having defined characteristics. Each table has a defined type within the architecture, with the list of types varying across database vendors. Commonly occurring types include `TABLE` and `VIEW`.

In addition to the table type, each table has a set of metadata values providing information useful when referencing the table. These metadata properties include the following:

- **Catalog name.** Name of the catalog containing the table.
- **Schema name.** Name of the schema on which the table is based.
- **Table name.** Name of the table within the database.
- **Qualifier separator.** In a fully qualified name, the character used between the catalog and the remainder of the name.
- **Catalog prefix.** A boolean flag indicating whether the catalog is used as a prefix or a suffix in qualified names. If the flag is true, the name format is *catalog.schema.table*. If the flag is false, the format is *schema.table.catalog*. The actual delimiter used for the catalog is defined by the qualifier separator.
- **Catalog use**. A boolean flag indicating whether or not the catalog is used in qualified names. If the flag is false, the name format is *schema.table*. If the flag is true, the name format is determined by the catalog prefix value.
- **Identifier quote character.** The character the database uses to quote user-defined identifiers. For example, a table name containing a space character, such as *My Table*, is invalid in SQL queries unless quoted. For a SQL Server database, the quote character is double quotation marks so the table would be referenced as `"My Table"`. In contrast, for a mySQL database, the quote character is a backtick so the table would be referenced as `` `My Table` ``.

The Table 1 on page 11 table displays example `SELECT` statements for various values of the metadata properties. Each example uses a catalog named *admin*, a schema named *testdb*, and a table named *My Table*.

Table 1. Example SELECT statements.

Qualifier Separator	Catalog Use	Catalog Prefix	Identifier Quote Character	SELECT Statement
.	True	True	"	`select * from admin.testdb."My Table"`
@	True	False	"	`select * from testdb."My Table"@admin`
&	False	False	`	`select * from testdb.`My Table``

The Data Services Service includes operations for retrieving the table types and the table metadata.

Chapter 4. Operation reference

The getDataSets operation

Returns information about the data sets for tables contained within a specified data source. Supply one or more table metadata definitions to limit the results to specific tables.

The information returned consists of escaped XML definitions of the columns in the tables, as well as any links involving the tables.

Input fields

The following table lists the input fields for the `getDataSets` operation.

Table 2. Fields for getDataSets.

Field	Type/Valid Values	Description
dataSourceURI	string	The data source URI.
credentialsURI	string	The credentials URI.
tableMeta	tableMeta[]	This element is used to describe the table metadata within the data source.

Return information

The following table identifies the information returned by the `getDataSets` operation.

Table 3. Return Value.

Type	Description
dataSetBundle	

Java example

To access the data sets information for a data source, supply the `getDataSets` operation with strings corresponding to the repository uniform resource identifiers for the following:

- The data source
- Valid credentials for accessing the data source

To limit the data sets information to specific tables, include an array of `TableMeta` objects describing the tables. The meta objects would typically be selected from the results of the `getTableMetaData` operation.

The following sample returns the data sets information for the fourth table returned by the `getTableMetaData` operation.

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
String type = "TABLE";
TableMeta[] meta = stub.getTableMetaData(dsURI, credURI, type);
DataSetBundle bundle = stub.getDataSets(dsURI, credURI, meta[3]);

String[] datasets = bundle.getDataSets();
for (int i = 0; i < datasets.length; i++) {
   System.out.println(datasets[i]);
}
```

```
String[] links = bundle.getLinks();
for (int j = 0; j < links.length; j++) {
   System.out.println(links[j]);
}
```

For web service clients based on JAX-WS, replace the arrays in the sample with `List` collections and update the array processing accordingly. For example:

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
List<String> typeList = Arrays.asList("TABLE", "VIEW");
List<TableMeta> metaList = stub.getTableMetaData(dsURI, credURI, typeList);
DataSetBundle bundle = stub.getDataSets(dsURI, credURI, metaList.get(3));

List<String> datasetsList = bundle.getDataSets();
for (String datasets : datasetsList)
{
   System.out.println(datasets);
}

List<String> linksList = bundle.getLinks();
for (String links : linksList)
{
   System.out.println(links);
}
```

SOAP request example

Client invocation of the `getDataSets` operation generates a SOAP request message that is sent to the server for processing. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Header>
        <wsse:Security soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0"
            xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
            <wsse:UsernameToken
                xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
                <wsse:Username>Native//admin</wsse:Username>
                <wsse:Password
                    wsse:Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0
                    #PasswordText"
                    >pass</wsse:Password>
                <wsse:Nonce>ofOShsZMlgHcdD0o6A8PkQ==</wsse:Nonce>
                <wsu:Created
                    xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd"
                    >2009-01-08T20:36:10Z</wsu:Created>
            </wsse:UsernameToken>
        </wsse:Security>
        <ns1:client-accept-language soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0" xmlns:ns1="http://xml.spss.com/ws/headers">en-US;q=1.0,
            en;q=0.8</ns1:client-accept-language>
    </soapenv:Header>
    <soapenv:Body>
        <getDataSets xmlns="http://xml.spss.com/data/remote">
            <dataSourceURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080be</dataSourceURI>
            <credentialsURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080c4</credentialsURI>
            <tableMeta xmlns="http://xml.spss.com/data">
                <catalogName>cq_ecm_data</catalogName>
                <schemaName>cq</schemaName>
                <tableName>Defect</tableName>
                <qualifierSeparator>.</qualifierSeparator>
                <catalogPrefixBool>true</catalogPrefixBool>
                <useCatalogBool>true</useCatalogBool>
                <identifierQuoteCharacter>&amp;quot;</identifierQuoteCharacter>
            </tableMeta>
        </getDataSets>
    </soapenv:Body>
</soapenv:Envelope>
```

SOAP response example

The server responds to a `getDataSets` operation call by sending a SOAP response message containing the results. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <getDataSetsResponse xmlns="http://xml.spss.com/data/remote">
            <datasets xmlns="http://xml.spss.com/data">
                <dataSets>&lt;?xml version=&quot;1.0&quot;
                    encoding=&quot;UTF-8&quot;?&gt; &lt;dataSet
                    xmlns=&quot;http://xml.spss.com/pev&quot;
                    name=&quot;Defect&quot;
                    qualifiedTableName=&quot;&amp;quot;cq_ecm_data&amp;quot;
                    .&amp;quot;cq&amp;quot;.&amp;quot;Defect&amp;quot;&quot;&gt;&lt;column
                    name=&quot;ratl_mastership&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;dbid&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;is_active&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;id&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;verificationotes&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;reflist&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;release_commitment_date&quot;
                    type=&quot;timestamp&quot;/&gt;&lt;column
                    name=&quot;release_commitment&quot;
                    type=&quot;integer&quot;/&gt;&lt;key
                    name=&quot;fk_16779512_1&quot;
                    isUnique=&quot;true&quot;&gt;&lt;keyColumn
                    name=&quot;reflist&quot;
                    type=&quot;integer&quot;/&gt;&lt;/key&gt;&lt;key
                    name=&quot;fk_16780379_2&quot;
                    isUnique=&quot;true&quot;&gt;&lt;keyColumn
                    name=&quot;deflist&quot;
                    type=&quot;integer&quot;/&gt;&lt;/key&gt;&lt;key
                    name=&quot;fk_16780379_3&quot;
                    isUnique=&quot;true&quot;&gt;&lt;keyColumn
                    name=&quot;release_commitment&quot;
                    type=&quot;integer&quot;/&gt;&lt;/key&gt;&lt;/dataSet&gt;
                </dataSets>
            </datasets>
        </getDataSetsResponse>
    </soapenv:Body>
</soapenv:Envelope>
```

The getSamples operation

Returns a data sample from a data provider based on specified inputs. For example, the operation can retrieve values for the variables *var1*, *var2*, and *var3* based on the value for the key variable *var0*. The information returned consists of a table structure containing the sample values in the rows.

Input fields

The following table lists the input fields for the `getSamples` operation.

Table 4. Fields for getSamples.

Field	Type/Valid Values	Description
sampleDetails	sampleDetails	This element is used to describe the information needed for getSamples request.

Return information

The following table identifies the information returned by the `getSamples` operation.

Table 5. Return Value.

Type	Description
sampleResult	Return type of getSamples() Web Service.

Java example

To retrieve a sample from a data provider:

1. Create a `SampleDetails` object.
2. Use the `setEvURI` method to specify the uniform resource identifier for the Enterprise View.
3. Use the `setAvURI` method to specify the uniform resource identifier for the Application View.
4. Provide the `setDpdXML` method with a string corresponding to escaped XML for the data provider definition.
5. Use the `setTableName` method to define the name of the table containing the data to sample.
6. Supply the `setResultColumnNames` method with an array of strings identifying the result columns.
7. Create a `TableType` object for the input key values. Use the `setName` method to define the name for the key. The `setColumnName` method specifies the names for the columns whose values are being supplied.
8. Create a `Value` object for the actual input values. Use the `setValue` method to specify the values.
9. Create a `RowValuesType` object for the value objects. Use the `setValue` method to assign the objects to the `RowValuesType`. Add this object to the `TableType` object using the `setRowValues` method.
10. Assign the key values to the details object using the `setKeyValues` method.
11. Use the `setSample` method to define the sample type as either `AV` or `DATASET`.
12. Supply the `getSamples` operation with the details object.

The following sample returns the `component` values in the CQdefects table for a `customerid` value of 19029.00000.

```
SampleDetails details = new SampleDetails();
details.setEvURI("spsscr:///?id=ac140f8000072ffb0000010b290a16b28003#m.4:2009-02-12%2013:10:33.289");
details.setAvURI("spsscr:///?id=0a010a077e08b4a40000011f5cabdad38098#m.2:2009-02-11%2011:37:24.848");
// The XML for the dpd is rather long. Rather than duplicate it here,
// we direct you to the SOAP request for an example.
String dpdXML = "SEE THE SOAP REQUEST FOR AN EXAMPLE OF DPD XML";
details.setDpdXML(dpdXML);
details.setTableName("CQdefects");

String[] resultCols = {
  "customerid",
  "component"
  };
details.setResultColumnNames(resultCols);

TableType keys = new TableType();
keys.setName("custID");
keys.setColumnName("customerid");
Value val = new Value();
val.setValue("19029.00000");
RowValuesType rowVals = new RowValuesType();
rowVals.setValue(val);
keys.setRowValues(rowVals);
details.setKeyValues(keys);

details.setSample(SampleType.AV);

TableType sampleTable = stub.getSamples(details);

String[] colNames = sampleTable.getColumnName();
RowValuesType[] rowValType = sampleTable.getRowValues();
for (int i = 0; i < rowValType.length; i++) {
   Value[] resultVals = rowValType[i].getValue();
   for (int j = 0; j < resultVals.length; j++) {
      System.out.println(colNames[j] + " = " + resultVals[j].getValue());
   }
}
```

For web service clients based on JAX-WS, replace the arrays in the sample with `List` collections and update the array processing accordingly. For example:

```
SampleDetails details = new SampleDetails();
details.setEvURI("spsscr:///?id=ac140f8000072ffb0000010b290a16b28003#m.4:2009-02-12%2013:10:33.289");
details.setAvURI("spsscr:///?id=0a010a077e08b4a40000011f5cabdad38098#m.2:2009-02-11%2011:37:24.848");
// The XML for the dpd is rather long. Rather than duplicate it here,
```

```
// we direct you to the SOAP request for an example.
String dpdXML = "SEE THE SOAP REQUEST FOR AN EXAMPLE OF DPD XML";
details.setDpdXML(dpdXML);
details.setTableName("CQdefects");

details.getResultColumnNames().add("customerid");
details.getResultColumnNames().add("component");

TableType keys = new TableType();
keys.setName("custID");
keys.setColumnName("customerid");
Value val = new Value();
val.setValue("19029.00000");
RowValuesType rowVals = new RowValuesType();
rowVals.setValue(val);
keys.setRowValues(rowVals);
details.setKeyValues(keys);

details.setSample(SampleType.AV);

TableType sampleTable = stub.getSamples(details);

List<String> colNamesList = sampleTable.getColumnName();
for (String colNames : colNamesList)
{
   System.out.println(colNames + "\t");
}
System.out.println("\n");
List<RowValuesType> rowValTypeList = sampleTable.getRowValues();
for (RowValuesType rowValType : rowValTypeList)
{
   List<Value> resultValsList = rowValType.getValue();
   for (Value resultVals : resultValsList)
   {
      System.out.println(resultVals.getValue() + "\t");
   }
   System.out.println("\n");
}
```

SOAP request example

Client invocation of the `getSamples` operation generates a SOAP request message that is sent to the server for processing. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Header>
        <wsse:Security soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0"
            xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
            <wsse:UsernameToken
                xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
                <wsse:Username>Native//admin</wsse:Username>
                <wsse:Password
                    wsse:Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0
                    #PasswordText"
                    >pass</wsse:Password>
                <wsse:Nonce>ofOShsZMlgHcdD0o6A8PkQ==</wsse:Nonce>
                <wsu:Created
                    xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd"
                    >2009-01-08T20:36:10Z</wsu:Created>
            </wsse:UsernameToken>
        </wsse:Security>
        <ns1:client-accept-language soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0" xmlns:ns1="http://xml.spss.com/ws/headers">en-US;q=1.0,
            en;q=0.8</ns1:client-accept-language>
    </soapenv:Header>
    <soapenv:Body>
        <getSamples xmlns="http://xml.spss.com/data/remote">
            <sampleDetails xmlns="http://xml.spss.com/data">
                <evURI>spsscr:///?id=ac140f8000072ffb0000010b290a16b28003#m.4:2009-02-12%2013:10:33.289</evURI>
                <avURI>spsscr:///?id=0a010a077e08b4a40000011f5cabdad38098#m.2:2009-02-11%2011:37:24.848</avURI>
                <dpdXML>&lt;?xml version=&quot;1.0&quot;
                    encoding=&quot;UTF-8&quot;?&gt; &lt;rtDataProviderDefinition
                    xmlns=&quot;http://xml.spss.com/pev&quot;
                    applicationViewReference=&quot;spsscr:///?id=0a010a077e08b4a40000011f5cabdad38098&quot;&gt;
                    &lt;dataSet name=&quot;Defect&quot;
                    datasourceReference=&quot;spsscr:///?id=0a010a07e123f4280000011f5babe02080be&quot;
                    qualifiedTableName=&quot;&amp;quot;cq_ecm_data&amp;quot;.&amp;quot;cq&amp;quot;
                    .&amp;quot;Defect&amp;quot;&quot;
                    credentialReference=&quot;spsscr:///?id=0a010a07e123f4280000011f5babe02080c4&quot;
```

transactionIsolationLevel="NONE"><column
name="internalcustomer"
type="integer"/><column
name="ucm_stream"
type="string"/><column
name="customer_severity"
type="string"/><column
name="state"
type="integer"/><column
name="release_commitment"
type="integer"/><column
name="target_milestone"
type="string"/><column
name="project"
type="integer"/><column
name="release_commitment_date"
type="timestamp"/><column
name="submitter"
type="integer"/><column
name="internalcustomer_1"
type="string"/><column
name="vendor"
type="integer"/><column
name="locked_by"
type="integer"/><column
name="deliverable"
type="integer"/><column
name="verification_1"
type="string"/><column
name="headline"
type="string"/><column
name="ucm_vob_object"
type="string"/><column
name="submit_date"
type="timestamp"/><column
name="severity_1"
type="string"/><column
name="targetbuild"
type="string"/><column
name="automatedregression"
type="string"/><column
name="ucm_stream_object"
type="string"/><column
name="description"
type="string"/><column
name="priority"
type="string"/><column
name="component_os"
type="string"/><column
name="dbid"
type="integer"/><column
name="ucm_project"
type="integer"/><column
name="overall_status"
type="string"/><column
name="incident_type"
type="string"/><column
name="publicdescription"
type="string"/><column
name="ucm_view"
type="string"/><column
name="numberoftestvariations"
type="integer"/><column
name="lock_version"
type="integer"/><column
name="build_found"
type="string"/><column
name="unduplicate_state"
type="string"/><column
name="reportedby"
type="string"/><column
name="is_active"
type="integer"/><column
name="userimpact"
type="string"/><column
name="build_fixed"
type="string"/><column
name="reflist"
type="integer"/><column
name="risk_assessment"
type="string"/><column
name="rank"
type="string"/><column
name="oslanguage"

```
type=&quot;string&quot;/&gt;&lt;column
name=&quot;devcurest&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;old_system_id&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;oldstate&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;otherenvironment&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;contactname&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;note_entry&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;contactemail&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;applanguage&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;legacy_id&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;notes_log&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;verification&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;field_history&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;feature&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;documentationfixed&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;enhancement_ind&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;component_project&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;timeestimate&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;devstart&quot;
type=&quot;timestamp&quot;/&gt;&lt;column
name=&quot;version&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;qa_owner&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;fix_decision&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;deflist&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;os&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;targetdate&quot;
type=&quot;timestamp&quot;/&gt;&lt;column
name=&quot;verificationotes&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;attachment_exists&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;symptoms&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;component_suite&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;field_history_1&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;oemcustomer&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;ratl_mastership&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;documentationimpact&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;devorigest&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;devend&quot;
type=&quot;timestamp&quot;/&gt;&lt;column
name=&quot;old_id&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;developmentimpact&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;severity&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;devactual&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;owner&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;testing_blocked_ind&quot;
type=&quot;string&quot;/&gt;&lt;column
name=&quot;component&quot;
type=&quot;integer&quot;/&gt;&lt;column
name=&quot;vendor_failure&quot;
```

```
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;component_feature&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;customer_reference&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;suite&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;targetversion&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;resolution&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;hardware&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;keywords&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;at_field_history&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;fixincurrentiteration&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;contactphone&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;id&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;is_duplicate&quot;
                    type=&quot;integer&quot;/&gt;&lt;column
                    name=&quot;component_deliverable&quot;
                    type=&quot;string&quot;/&gt;&lt;column
                    name=&quot;customerid&quot;
                    type=&quot;string&quot;/&gt;&lt;key
                    name=&quot;fk_16780379_2&quot;
                    isUnique=&quot;true&quot;&gt;&lt;keyColumn
                    name=&quot;deflist&quot;
                    type=&quot;integer&quot;/&gt;&lt;/key&gt;&lt;key
                    name=&quot;fk_16780379_3&quot;
                    isUnique=&quot;true&quot;&gt;&lt;keyColumn
                    name=&quot;release_commitment&quot;
                    type=&quot;integer&quot;/&gt;&lt;/key&gt;&lt;key
                    name=&quot;fk_16779512_1&quot;
                    isUnique=&quot;true&quot;&gt;&lt;keyColumn
                    name=&quot;reflist&quot;
                    type=&quot;integer&quot;/&gt;&lt;/key&gt;&lt;/dataSet&gt;&lt;tableMapping
                    rootDataSet=&quot;Defect&quot;
                    cacheTimeout=&quot;0&quot;&gt;&lt;pevCatalogTable
                    name=&quot;CQdefects&quot;/&gt;&lt;columnMapping
                    sourceColumnName=&quot;component&quot;
                    isCached=&quot;false&quot;&gt;&lt;pevCatalogColumn
                    name=&quot;component&quot;
                    type=&quot;integer&quot;/&gt;&lt;/columnMapping&gt;&lt;columnMapping
                    sourceColumnName=&quot;customerid&quot;
                    isCached=&quot;false&quot;&gt;&lt;pevCatalogColumn
                    name=&quot;customerid&quot;
                    type=&quot;string&quot;/&gt;&lt;/columnMapping&gt;&lt;/tableMapping&gt;
                    &lt;/rtDataProviderDefinition&gt;</dpdXML>
                <tableName>CQdefects</tableName>
                <resultColumnNames>customerid</resultColumnNames>
                <resultColumnNames>component</resultColumnNames>
                <keyValues name="custID">
                    <columnName>customerid</columnName>
                    <rowValues>
                        <value value="19029.00000"/>
                    </rowValues>
                </keyValues>
                <sample>AV</sample>
            </sampleDetails>
        </getSamples>
    </soapenv:Body>
</soapenv:Envelope>
```

SOAP response example

The server responds to a `getSamples` operation call by sending a SOAP response message containing the results. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <getSamplesResponse xmlns="http://xml.spss.com/data/remote">
            <sampleResult name="ResultTable" xmlns="http://xml.spss.com/data">
                <columnName>customerid</columnName>
                <columnName>component</columnName>
                <rowValues>
```

```
                    <value value="19029.00000"/>
                    <value value="0"/>
                </rowValues>
            </sampleResult>
        </getSamplesResponse>
    </soapenv:Body>
</soapenv:Envelope>
```

The getTableMetaData operation

Returns the metadata for tables contained within a specified data source. Supply one or more table types to limit the results to specific types.

The table metadata information returned can be used when calling the `getDataSets` operation.

Input fields

The following table lists the input fields for the `getTableMetaData` operation.

Table 6. Fields for getTableMetaData.

Field	Type/Valid Values	Description
dataSourceURI	string	The data source URI.
credentialsURI	string	The credentials URI.
typeNames	string[]	The table types.

Return information

The following table identifies the information returned by the `getTableMetaData` operation.

Table 7. Return Value.

Type	Description
tableMeta[]	This element is used to describe the table metadata within the data source.

Java example

To access the table metadata for a data source, supply the `getTableMetaData` operation with three strings corresponding to the following:

- Repository uniform resource identifier for the data source
- Repository uniform resource identifier for valid credentials that can access the data source
- Table type(s)

The following sample returns the metadata for all tables of type *TABLE* in the data source.

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
String type = "TABLE";
TableMeta[] meta = stub.getTableMetaData(dsURI, credURI, type);

System.out.println("Table type = " + type);
System.out.println("CATALOG NAME\tSCHEMA NAME\tTABLE NAME\t" +
   "QUALIFIER SEPARATOR\tCATALOG PREFIX\tUSE CATALOG\t" +
   "IDENTIFIER QUOTE CHARACTER\n");
for (int i = 0; i < meta.length; i++) {
   System.out.println(meta[i].getCatalogName() + "\t" +
      meta[i].getSchemaName() + "\t" +
      meta[i].getTableName() + "\t" +
      meta[i].getQualifierSeparator() + "\t" +
```

```
      meta[i].getCatalogPrefixBool() + "\t" +
      meta[i].getUseCatalogBool() + "\t" +
      meta[i].getIdentifierQuoteCharacter());
}
```

For web service clients based on JAX-WS, replace the arrays in the sample with `List` collections and update the array processing accordingly. For example:

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
List<String> typeList = Arrays.asList("TABLE", "VIEW");
List<TableMeta> metaList = stub.getTableMetaData(dsURI, credURI, typeList);

System.out.println("Table type = " + type);
System.out.println("CATALOG NAME\tSCHEMA NAME\tTABLE NAME\t" +
   "QUALIFIER SEPARATOR\tCATALOG PREFIX\tUSE CATALOG\t" +
   "IDENTIFIER QUOTE CHARACTER\n");
for (TableMeta meta : metaList)
{
   System.out.println(meta[i].getCatalogName() + "\t" +
   meta.getSchemaName() + "\t" +
   meta.getTableName() + "\t" +
   meta.getQualifierSeparator() + "\t" +
   meta.getCatalogPrefixBool() + "\t" +
   meta.getUseCatalogBool() + "\t" +
   meta.getIdentifierQuoteCharacter());
}
```

SOAP request example

Client invocation of the `getTableMetaData` operation generates a SOAP request message that is sent to the server for processing. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Header>
        <wsse:Security soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0"
            xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
            <wsse:UsernameToken
                xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
                <wsse:Username>Native//admin</wsse:Username>
                <wsse:Password
                    wsse:Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0
                    #PasswordText"
                    >pass</wsse:Password>
                <wsse:Nonce>ofOShsZMlgHcdD0o6A8PkQ==</wsse:Nonce>
                <wsu:Created
                    xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd"
                    >2009-01-08T20:36:10Z</wsu:Created>
            </wsse:UsernameToken>
        </wsse:Security>
        <ns1:client-accept-language soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0" xmlns:ns1="http://xml.spss.com/ws/headers">en-US;q=1.0,
            en;q=0.8</ns1:client-accept-language>
    </soapenv:Header>
    <soapenv:Body>
        <getTableMetaData xmlns="http://xml.spss.com/data/remote">
            <dataSourceURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080be</dataSourceURI>
            <credentialsURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080c4</credentialsURI>
            <typeNames>TABLE</typeNames>
        </getTableMetaData>
    </soapenv:Body>
</soapenv:Envelope>
```

SOAP response example

The server responds to a `getTableMetaData` operation call by sending a SOAP response message containing the results. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <getTableMetaDataResponse xmlns="http://xml.spss.com/data/remote">
            <tableMeta xmlns="http://xml.spss.com/data">
                <catalogName>cq_ecm_data</catalogName>
                <schemaName>cq</schemaName>
```

```
            <tableName>actiondef</tableName>
            <qualifierSeparator>.</qualifierSeparator>
            <catalogPrefixBool>true</catalogPrefixBool>
            <useCatalogBool>true</useCatalogBool>
            <identifierQuoteCharacter>&quot;</identifierQuoteCharacter>
        </tableMeta>
        <tableMeta xmlns="http://xml.spss.com/data">
            <catalogName>cq_ecm_data</catalogName>
            <schemaName>cq</schemaName>
            <tableName>actiondef_usergroups</tableName>
            <qualifierSeparator>.</qualifierSeparator>
            <catalogPrefixBool>true</catalogPrefixBool>
            <useCatalogBool>true</useCatalogBool>
            <identifierQuoteCharacter>&quot;</identifierQuoteCharacter>
        </tableMeta>
        <tableMeta xmlns="http://xml.spss.com/data">
            <catalogName>cq_ecm_data</catalogName>
            <schemaName>cq</schemaName>
            <tableName>attachments</tableName>
            <qualifierSeparator>.</qualifierSeparator>
            <catalogPrefixBool>true</catalogPrefixBool>
            <useCatalogBool>true</useCatalogBool>
            <identifierQuoteCharacter>&quot;</identifierQuoteCharacter>
        </tableMeta>
        <tableMeta xmlns="http://xml.spss.com/data">
            <catalogName>cq_ecm_data</catalogName>
            <schemaName>cq</schemaName>
            <tableName>Defect</tableName>
            <qualifierSeparator>.</qualifierSeparator>
            <catalogPrefixBool>true</catalogPrefixBool>
            <useCatalogBool>true</useCatalogBool>
            <identifierQuoteCharacter>&quot;</identifierQuoteCharacter>
        </tableMeta>
    </getTableMetaDataResponse>
  </soapenv:Body>
</soapenv:Envelope>
```

The getTableSimpleColumns operation

Returns the names and types for columns in a specified table within a data source. The column information returned can be used when comparing the column definitions for two tables.

Input fields

The following table lists the input fields for the `getTableSimpleColumns` operation.

Table 8. Fields for getTableSimpleColumns.

Field	Type/Valid Values	Description
dataSourceURI	string	The data source URI.
credentialsURI	string	The credentials URI.
tableMeta	tableMeta	This element is used to describe the table metadata within the data source.

Return information

The following table identifies the information returned by the `getTableSimpleColumns` operation.

Table 9. Return Value.

Type	Description
simpleColumn[]	This element is used to describe the column metadata.

Java example

To access the column information for a table in a data source, supply the `getTableSimpleColumns` operation with the following:

- String denoting the repository uniform resource identifier for the data source
- String denoting the repository uniform resource identifier for valid credentials that can access the data source
- `TableMeta` object describing the table

The following sample returns the column information for the table named *Defect* in the data source.

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
TableMeta meta = new TableMeta();
meta.setSchemaName("cq_ecm_data");
meta.setSchemaName("cq");
meta.setTableName("Defect");
meta.setQualifierSeparator(".");
meta.setCatalogPrefixBool("true");
meta.setUseCatalogBool("true");
meta.setIdentifierQuoteCharacter("&quot;");

SimpleColumn[] col = stub.getTableSimpleColumns(dsURI, credURI, meta);

System.out.println("COLUMN NAME\tTYPE\n");
for (int i = 0; i < col.length; i++) {
   System.out.println(col[i].getName() + "\t" +
      col[i].getType().toString());
}
```

For web service clients based on JAX-WS, replace the arrays in the sample with `List` collections and update the array processing accordingly. For example:

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
TableMeta meta = new TableMeta();
meta.setSchemaName("cq_ecm_data");
meta.setSchemaName("cq");
meta.setTableName("Defect");
meta.setQualifierSeparator(".");
meta.setCatalogPrefixBool("true");
meta.setUseCatalogBool("true");
meta.setIdentifierQuoteCharacter("&quot;");

List<SimpleColumn> colList = stub.getTableSimpleColumns(dsURI, credURI, meta);
System.out.println("COLUMN NAME\tTYPE\n");
for (SimpleColumn col : colList)
{
   System.out.println(col.getName() + "\t" +
      col.getType().toString());
}
```

SOAP request example

Client invocation of the `getTableSimpleColumns` operation generates a SOAP request message that is sent to the server for processing. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <soapenv:Header>
    <wsse:Security soapenv:mustUnderstand="0"
      xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
      <wsse:UsernameToken>
        <wsse:Username xsi:type="xsd:string">validUser</wsse:Username>
        <wsse:Password xsi:type="xsd:string">password</wsse:Password>
      </wsse:UsernameToken>
    </wsse:Security>
    <ns1:client-accept-language soapenv:mustUnderstand="0" xsi:type="xsd:string"
      xmlns:ns1="http://xml.spss.com/ws/headers">en-US;q=1.0, en;q=0.8</ns1:client-accept-language>
  </soapenv:Header>
    <soapenv:Body>
        <getTableSimpleColumns xmlns="http://xml.spss.com/data/remote">
            <dataSourceURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080be</dataSourceURI>
            <credentialsURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080c4</credentialsURI>
```

```
            <tableMeta xmlns="http://xml.spss.com/data">
                <catalogName>cq_ecm_data</catalogName>
                <schemaName>cq</schemaName>
                <tableName>Defect</tableName>
                <qualifierSeparator>.</qualifierSeparator>
                <catalogPrefixBool>true</catalogPrefixBool>
                <useCatalogBool>true</useCatalogBool>
                <identifierQuoteCharacter>&quot;</identifierQuoteCharacter>
            </tableMeta>
        </getTableSimpleColumns>
    </soapenv:Body>
</soapenv:Envelope>
```

SOAP response example

The server responds to a `getTableSimpleColumns` operation call by sending a SOAP response message containing the results. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <getTableSimpleColumnsResponse xmlns="http://xml.spss.com/data/remote">
            <simpleColumn xmlns="http://xml.spss.com/data">
                <name>ratl_mastership</name>
                <type>integer</type>
            </simpleColumn>
            <simpleColumn xmlns="http://xml.spss.com/data">
                <name>dbid</name>
                <type>integer</type>
            </simpleColumn>
            <simpleColumn xmlns="http://xml.spss.com/data">
                <name>is_active</name>
                <type>integer</type>
            </simpleColumn>
            <simpleColumn xmlns="http://xml.spss.com/data">
                <name>id</name>
                <type>string</type>
            </simpleColumn>
            <simpleColumn xmlns="http://xml.spss.com/data">
                <name>state</name>
                <type>integer</type>
            </simpleColumn>
            <simpleColumn xmlns="http://xml.spss.com/data">
                <name>version</name>
                <type>integer</type>
            </simpleColumn>
        </getTableSimpleColumnsResponse>
    </soapenv:Body>
</soapenv:Envelope>
```

The getTableTypes operation

Returns the types of tables contained within a specified data source. The information returned can be used to limit the `getTableMetaData` call results to a specific table type.

Input fields

The following table lists the input fields for the `getTableTypes` operation.

Table 10. Fields for getTableTypes.

Field	Type/Valid Values	Description
dataSourceURI	string	The data source URI.
credentialsURI	string	The credentials URI.

Return information

The following table identifies the information returned by the `getTableTypes` operation.

Table 11. Return Value.

Type	Description
string[]	The table types of the data source.

Java example

To access the table types for a data source, supply the `getTableTypes` operation with two strings corresponding to the repository uniform resource identifiers for the data source and valid credentials for accessing the data source.

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
String[] types = stub.getTableTypes(dsURI, credURI);

for (int i = 0; i < types.length; i++) {
   System.out.println(types[i]);
}
```

For web service clients based on JAX-WS, replace the arrays in the sample with `List` collections and update the array processing accordingly. For example:

```
String dsURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080be";
String credURI = "spsscr:///?id=0a010a07e123f4280000011f5babe02080c4";
List<String> typeList = stub.getTableTypes(dsURI, credURI);
for (String type : typeList)
{
    System.out.println(type);
}
```

SOAP request example

Client invocation of the `getTableTypes` operation generates a SOAP request message that is sent to the server for processing. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Header>
        <wsse:Security soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0"
            xmlns:wsse="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
            <wsse:UsernameToken
                xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd">
                <wsse:Username>Native//admin</wsse:Username>
                <wsse:Password
                    wsse:Type="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-username-token-profile-1.0
                    #PasswordText"
                    >pass</wsse:Password>
                <wsse:Nonce>ofOShsZMlgHcdD0o6A8PkQ==</wsse:Nonce>
                <wsu:Created
                    xmlns:wsu="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd"
                    >2009-01-08T20:36:10Z</wsu:Created>
            </wsse:UsernameToken>
        </wsse:Security>
        <ns1:client-accept-language soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next"
            soapenv:mustUnderstand="0" xmlns:ns1="http://xml.spss.com/ws/headers">en-US;q=1.0,
            en;q=0.8</ns1:client-accept-language>
    </soapenv:Header>
    <soapenv:Body>
        <getTableTypes xmlns="http://xml.spss.com/data/remote">
            <dataSourceURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080be</dataSourceURI>
            <credentialsURI>spsscr:///?id=0a010a07e123f4280000011f5babe02080c4</credentialsURI>
        </getTableTypes>
    </soapenv:Body>
</soapenv:Envelope>
```

SOAP response example

The server responds to a `getTableTypes` operation call by sending a SOAP response message containing the results. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <getTableTypesResponse xmlns="http://xml.spss.com/data/remote">
            <typeNames>SYSTEM TABLE</typeNames>
            <typeNames>TABLE</typeNames>
            <typeNames>VIEW</typeNames>
        </getTableTypesResponse>
    </soapenv:Body>
</soapenv:Envelope>
```

The getVersion operation

Returns the version number of the service.

Return information

The following table identifies the information returned by the `getVersion` operation.

Table 12. Return Value.

Type	Description
string	The service version number.

Java example

To access the version number of the service, call the `getVersion` operation from the service stub.

```
System.out.println("Service Version =  " + stub.getVersion());
```

SOAP request example

Client invocation of the `getVersion` operation generates a SOAP request message that is sent to the server for processing. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
    <soapenv:Body>
        <getVersion xmlns="http://xml.spss.com/data/remote"/>
    </soapenv:Body>
</soapenv:Envelope>
```

SOAP response example

The server responds to a `getVersion` operation call by sending a SOAP response message containing the results. An example of such a message follows.

```
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
   xmlns:xsd="http://www.w3.org/2001/XMLSchema"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
   <soapenv:Body>
      <getVersionResponse xmlns="http://xml.spss.com/data/remote">
         <version>4.20.000</version>
      </getVersionResponse>
   </soapenv:Body>
</soapenv:Envelope>
```

Chapter 5. JAX-WS clients

Java developers can create custom web service clients by using JAX-WS.

The discussion here assumes the use of Java 6. In general, the process for accessing IBM SPSS Collaboration and Deployment Services web services involves the following steps:

1. Generate a web service client using wsimport
2. Package the client
3. Programmatically configure the client
4. Exercise the web service

Generating a JAX-WS client

To generate a JAX-WS client, open a command prompt and execute the Java 6 `wsimport` command.

The `wsimport` command creates JAX-WS service classes and JAXB classes that represent the WSDL schema. For example, the following command executes wsimport for the Scoring.HttpV2 service, storing the output in the current directory:

```
"c:\Program Files\IBM\Java60\bin\wsimport.exe" http://localhost:7001/scoring/services/Scoring.HttpV2?wsdl
```

In this example, the command obtained the WSDL from the server by using the endpoint name followed by `?wsdl`. The `wsimport` command requires access to the WSDL in order to generate the files. JAX-WS also requires access to the WSDL file during runtime, so this example hard codes the value provided to `wsimport` in the Java code. The generated client fetches the WSDL from that same location unless otherwise specified. An alternative is to store the WSDL locally and refer to the local copy rather than downloading the WSDL from the server.

Packaging a JAX-WS client

A JAX-WS client must be packaged as a jar file.

The following example command creates a jar file named `scoring.jar`:

```
"c:\Program Files\IBM\Java60\bin\jar.exe" -cvf scoring.jar *
```

This command assumes the command prompt is in the same location in which the client was generated.

If you store the WSDL locally, include the WSDL and XSD files in the jar file. Place the files in the `\META-INF\wsdl` directory within the file. Refer to that directory programmatically when configuring the client.

Configuring a JAX-WS client

JAX-WS clients can obtain the WSDL file remotely from the server or locally from within the jar file.

The following example demonstrates obtaining the WSDL from the server:

```
com.spss.scoring.ws.jaxws.ScoringServices service =
  new com.spss.scoring.ws.jaxws.ScoringServices(
    new URL("http://localhost:7001/scoring/services/Scoring.HttpV2?wsdl"),
    new QName("http://xml.spss.com/scoring/wsdl", "ScoringServices"));
```

The URL includes the host and port for your server.

The following example demonstrates obtaining the WSDL from the within the jar file:

```
com.spss.scoring.ws.jaxws.ScoringServices service =
  new com.spss.scoring.ws.jaxws.ScoringServices(
    DemoClass.class.getResource("/META-INF/wsdl/scoring.wsdl"),
    new QName("http://xml.spss.com/scoring/wsdl", "ScoringServices"));
```

In order to include the required SOAP security headers, create an object that implements `SOAPHandler<SOAPMessageContext>`. See "SOAPHandler example" for an example handler object. The following example shows how this object is used:

```
service.setHandlerResolver(new HandlerResolver()
{
  @Override
    public List<Handler> getHandlerChain(PortInfo portInfo)
    {
      List<Handler> handlerChain = new ArrayList<Handler>();
      handlerChain.add(new SecurityHandler("user", "password", "en-US;q=1.0, en;q=0.8"));
      return handlerChain;
    }
});
```

Next, access the service endpoint:

```
ScoringV2 serviceEndpoint = service.getHttpV2();
```

After obtaining the service endpoint, set the JAX-WS standard endpoint address property, which specifies the URL at which to access the endpoint.

```
Map<String, Object> requestContext = ((BindingProvider)serviceEndpoint).getRequestContext();
requestContext.put(BindingProvider.ENDPOINT_ADDRESS_PROPERTY,
   "http://localhost:7001/scoring/services/Scoring.HttpV2");
```

SOAPHandler example

JAX-WS clients must include an object that implements `SOAPHandler<SOAPMessageContext>`.

The following code provides an example of this object.

```
/*************************************************************
** Licensed Materials - Property of IBM
** IBM SPSS Products: Collaboration and Deployment Services
** © Copyright IBM Corp. 2000, 2013
** US Government Users Restricted Rights - Use, duplication or
** disclosure restricted by GSA ADP Schedule Contract with IBM Corp.
**
*************************************************************/

import java.util.Collections;
import java.util.Set;

import javax.xml.namespace.QName;
import javax.xml.soap.SOAPElement;
import javax.xml.soap.SOAPEnvelope;
import javax.xml.soap.SOAPFactory;
import javax.xml.soap.SOAPHeader;
import javax.xml.soap.SOAPMessage;
import javax.xml.ws.handler.MessageContext;
import javax.xml.ws.handler.soap.SOAPHandler;
import javax.xml.ws.handler.soap.SOAPMessageContext;

/**
 * This is a SOAP handler that applies a security header and a language header to a SOAP message.
 */
public class SecurityHandler implements SOAPHandler<SOAPMessageContext>
{
    // WS-Security header values
    public static final String SECURITY = "Security";
    public static final String USERNAME_TOKEN = "UsernameToken";
    public static final String USERNAME = "Username";
    public static final String PASSWORD = "Password";
    public static final String WS_SECURITY_NAMESPACE =
       "http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd";

    // prefixes
```

```
public static final String WSSE_PREFIX = "wsse"; // ws service security
public static final String SPSS_PREFIX = "spss"; // spss prefix

// SPSS custom language header values
public static final String SPSS_HEADER_NAMESPACE = "http://xml.spss.com/ws/headers";
public static final String CLIENT_ACCEPT_LANGUAGE_HEADER = "client-accept-language";

private String i_username;
private String i_password;
private String i_acceptLanguage;

/**
 * Creates a security and language handler
 * @param username A user name to access the web service. Cannot be null.
 * @param password A password to access the web service. Cannot be null.
 * @param acceptLanguage The language that should be used by the web service.
 * This value should be formatted according to the HTTP specification regarding
 * the Accept-Language HTTP header (e.g. en-US;q=1.0, en;q=0.8)
 * If the value is null, the language header will not be added.
 */
public SecurityHandler(String username, String password, String acceptLanguage)
{
    i_username = username;
    i_password = password;
    i_acceptLanguage = acceptLanguage;
}

@Override
public boolean handleMessage(SOAPMessageContext context)
{
    // Apply this handler to only outbound traffic
    if((Boolean)context.get(SOAPMessageContext.MESSAGE_OUTBOUND_PROPERTY))
    {
        // get the message
        SOAPMessage message = context.getMessage();
        try
        {
            // get the message header
            SOAPEnvelope envelope = message.getSOAPPart().getEnvelope();
            SOAPHeader header = envelope.getHeader();
            if (header == null)
            {
                header = envelope.addHeader();
            }

            // add the UsernameToken header
            header.addChildElement(createUsernameTokenSecurityHeader());
            // assuming the language was provided, apply the custom language header
            if(i_acceptLanguage != null)
            {
                header.addChildElement(createLanguageHeader());
            }
        }
        catch (Exception e)
        {
            e.printStackTrace();
        }
    }
    // allow any other handler to execute
    return true;
}

/**
 * This method creates a custom language header, which allows the scoring service
 * to use the given language if possible.
 * @return A custom language header
 * @throws Exception
 */
private SOAPElement createLanguageHeader() throws Exception
{
    SOAPFactory factory = SOAPFactory.newInstance();

    // create a custom language header
    SOAPElement languageHeader =
       factory.createElement(CLIENT_ACCEPT_LANGUAGE_HEADER,SPSS_PREFIX,SPSS_HEADER_NAMESPACE);

    // include the language text
    languageHeader.addTextNode(i_acceptLanguage);

    return languageHeader;
}

/**
 * Creates the WS-Security SOAP header for UsernameToken as SOAPElement.
```

```
     *
     * @return the WS-Security SOAP header for UsernameToken
     * @throws Exception as appropriate
     */
    private SOAPElement createUsernameTokenSecurityHeader() throws Exception
    {
        SOAPFactory factory = SOAPFactory.newInstance();

        // create a UsernameToken element
        SOAPElement usernameToken =
          factory.createElement(USERNAME_TOKEN, WSSE_PREFIX, WS_SECURITY_NAMESPACE);

        // add the username element
        SOAPElement usernameElement =
          factory.createElement(USERNAME, WSSE_PREFIX, WS_SECURITY_NAMESPACE);
        usernameElement.addTextNode(i_username);
        usernameToken.addChildElement(usernameElement);

        // add the password element
        SOAPElement passwordElement =
          factory.createElement(PASSWORD, WSSE_PREFIX, WS_SECURITY_NAMESPACE);
        passwordElement.addTextNode(i_password);
        usernameToken.addChildElement(passwordElement);

        // create the Security Header
        SOAPElement securityHeader =
          factory.createElement(SECURITY, WSSE_PREFIX, WS_SECURITY_NAMESPACE);
        securityHeader.addChildElement(usernameToken);

        return securityHeader;
    }

    @Override
    public boolean handleFault(SOAPMessageContext context)
    {
        // allow any other handler to execute
        return true;
    }

    @Override
    public void close(MessageContext context)
    {
        // do nothing
    }

    @Override
    public Set<QName> getHeaders()
    {
        return Collections.emptySet();
    }

}
```

Exercising web services from JAX-WS clients

Once properly configured, a JAX-WS client can make calls to IBM SPSS Collaboration and Deployment Services web services.

For example, the following code calls the `getConfigurations` operation of the Scoring Service:

```
serviceEndpoint.getConfigurations();
```

Chapter 6. Microsoft® .NET Framework-based clients

In order to use the web services from a Microsoft Windows Communication Foundation (WCF) client, you will need Visual Studio 2008 or later. The discussion here assumes the use of Visual Studio 2008. In general, the process for accessing IBM SPSS Collaboration and Deployment Services web services involves the following steps:

1. Add a Service Reference. See the topic "Adding a service reference" for more information.
2. Configure the web service endpoint. See the topic "Configuring the web service endpoint" on page 34 for more information.
3. Programmatically configure the necessary endpoint behaviors. See the topic "Configuring endpoint behaviors" on page 35 for more information.
4. Exercise the web service. See the topic "Exercising the service" on page 35 for more information.

Adding a service reference

The first step in using a WCF client to access IBM SPSS Collaboration and Deployment Services web services is to make the service available to the Visual Studio project by adding it as a Service Reference.

1. In Visual Studio, right-click the folder's *References* folder and select **Add Service Reference**.
2. Type the URL of the service WSDL location in the **Address** field, and click **Go**. The value corresponds to the service endpoint appended with `?wsdl`.
3. Specify the namespace in the **Namespace** field.
4. Click **OK**.

Visual Studio adds a new service reference to the Service Reference directory for the project. The name of the reference corresponds to the specified namespace.

Important: If you have a .NET client created by using a version of IBM SPSS Collaboration and Deployment Services before 6.0, you must regenerate your service references from the current WSDL files to allow successful communication between your application and the current server. If you do not regenerate your service references, you may experience a variety of errors that may include incorrect namespace assignments, NullPointerExceptions in the web services being invoked, and data type assignment errors.

Service reference modifications

Due to known compatibility issues between Microsoft tooling and some WSDL files, you need to manually modify some service references before they can be used successfully. For information about the specific issues, see articles 891386 and 326790 on the Microsoft Support site.

To modify a service reference:

1. In Visual Studio, select the project and click **Show All Files** from the Project menu.
2. Expand the service reference that needs to be modified.
3. Expand the **Reference.svcmap** node.
4. Open the `Reference.cs` file.
5. Make the required modifications.
6. Save the file.

For the Content Repository Service , Content Repository URI Service, and Process Management Service, you need to make the following changes to the `RowType` class:

- `private value[][] cellField` should be changed to `private value[] cellField`
- `public value[][] cell` should be changed to `public value[] cell`

For the Scoring Service, you need to make the following changes:

- in the `returnedDPDOutputTable` class, `private returnedDPDOutputValue[][] returnedDPDOutputrowField` should be changed to `private returnedDPDOutputValue[] returnedDPDOutputrowField`
- in the `returnedDPDOutputTable` class, `private returnedDPDOutputValue[][] returnedDPDOutputRow` should be changed to `private returnedDPDOutputValue[] returnedDPDOutputRow`
- in the `returnedRequestInputTable` class, `private returnedRequestInputValue[][] returnedRequestInputRow` should be changed to `private returnedRequestInputValue[] returnedRequestInputRow`
- in the `returnedRequestInputTable` class, `private returnedRequestInputValue[][] returnedRequestInputRowField` should be changed to `private returnedRequestInputValue[] returnedRequestInputRowField`
- in the `requestInputTable` class, `private input1[][] requestInputRowField` should be changed to `private input1[] requestInputRowField`
- in the `requestInputTable` class, `private input1[][] requestInputRow` should be changed to `private input1[] requestInputRow`

For the PevServices Service, you need to make the following changes:

- in the `avTableConflict` class, `private avColumnMeta[][] avColumnConflictField` should be changed to `private avColumnMeta[] avColumnConflictField`
- in the `avTableConflict` class, `private avColumnMeta[][] avColumnConflict` should be changed to `private avColumnMeta[] avColumnConflict`
- in the `evTableConflict` class, `private evColumnMeta[][] evColumnConflictField` should be changed to `private evColumnMeta[] evColumnConflictField`
- in the `evTableConflict` class, `private evColumnMeta[][] evColumnConflict` should be changed to `private evColumnMeta[] evColumnConflict`

Configuring the web service endpoint

In WCF, you can configure a service endpoint either declaratively using an *app.config* file, or programmatically using the WCF APIs. The following steps describe the creation of a basic configuration within an *app.config* file.

1. In Visual Studio, double-click the *app.config* file for the application (or *web.config* for a web-application).
2. Find the `system.serviceModel` element. Create it if it does not already exist.
3. Find the `client` element. Create it if it does not already exist.
4. Create a new `endpoint` element as a child of the `client` element.
5. Specify the appropriate service endpoint URL as the value of the *address* attribute.
6. Specify *basicHttpBinding* as the value of the *binding* attribute.
7. Specify the appropriate service contract as the value of the *contract* attribute. The service contract is the value of the service reference namespace appended with the service name.
8. Optionally specify a value for the *name* attribute that identifies a name for the endpoint configuration. If the *name* is blank, the configuration is used as the default for the service.

The resulting *app.config* file should be similar to the following example:

```
<system.serviceModel>
   <client>
      <endpoint
         address="http://cads_server:8080/cr-ws/services/ContentRepository"
```

```
        binding="basicHttpBinding"
        bindingConfiguration=""
        contract="IBM.SPSS.ContentRepository"
        name=""/>
   </client>
</system.serviceModel>
```

Configuring endpoint behaviors

The following two issues complicate the use of IBM SPSS Collaboration and Deployment Services web services by WCF clients:

- WCF does not allow the username and password to be transmitted over HTTP
- WCF does not correctly understand the SOAP Fault format returned by the services

To address these problems, a sample Visual Studio project is available that contains classes adding endpoint behaviors that resolve both issues. The IBM SPSS Collaboration and Deployment Services installation media includes this project.

To use these classes, ensure that the *IBM.SPSS.WCF.Utilities* project containing these classes has been compiled and added as a referenced DLL to the Visual Studio project that exercises the web services. When constructing a new service client instance, ensure that the behaviors are added as follows:

```
ContentRepositoryClient serviceClient = new ContentRepositoryClient();
serviceClient.Endpoint.Behaviors.Add(
    new ApplyClientInspectorsBehavior(
    new HeaderInjectionMessageInspector(
        new UsernameTokenSecurityHeader("admin", "Abcdefg1")
    ),
    new SOAPFaultFormatMessageInspector())
);
```

This adds two message inspectors to the behaviors for the endpoint. The first allows message headers to be injected, permitting a `UsernameToken` security header containing the username and password to be transmitted over HTTP. The second message inspector intercepts SOAP Faults, ensuring that they are formatted for proper WCF processing.

Exercising the service

After adding the service reference to the project, configuring the endpoint, and adding the necessary endpoint behaviors, the WCF-based web service client is ready. Add the .NET source code to the project to exercise the web service as needed.

There may be instances in which the .NET client proxies are generated incorrectly, leading to unexpected missing results at runtime. If a web service call returns no results when results are expected, the generated .NET types associated with the request and response should be examined. Specifically, members of the types may have two .NET attributes assigned. The first, `MessageBodyMemberAttribute`, will often include the proper namespace for the member type. The second, `XmlElementAttribute`, should have the same namespace as `MessageBodyMemberAttribute`. If this is not the case, add the namespace to `XmlElementAttribute`. Moreover, the addition of XML serialization attributes, such as `System.XML.Serialization.XmlElementAttribute`, may be necessary to correctly name the expected namespace or element. For example, the following generated client code would need to be modified:

```
public partial class getUsersResponse {
   System.ServiceModel.MessageBodyMemberAttribute(Namespace =
      "http://xml.spss.com/pes/userPref/remote", Order = 0)]
   public IBM.SPSS.ManagerUserPref.usersResponse usersResponse;
```

The corrected code is as follows:

```
public partial class getUsersResponse {
   [System.ServiceModel.MessageBodyMemberAttribute(Namespace =
      "http://xml.spss.com/pes/userPref/remote", Order = 0)]
   [System.Xml.Serialization.XmlElementAttribute(ElementName="usersRequestResponse")]
   public IBM.SPSS.ManagerUserPref.usersResponse usersResponse;
```

Single sign-on authentication

You can use single sign-on authentication for web service calls by obtaining a service ticket that you include in your SOAP requests.

The general process of using single sign-on authentication for WCF clients includes the following steps:

1. Obtain a ticket-grating ticket (TGT) using .NET or WCF code.
2. Send the TGT to the IBM SPSS Collaboration and Deployment Services Repository server using the SSO Authentication Service `getToken` operation to obtain a service ticket. This ensures that single sign-on authentication occurs on the repository server.
3. Send the service ticket in the SOAP header for all subsequent web services calls from your client application.

Chapter 7. Message header reference

The headers for the transport and packaging layers contain vital information for processing a web service call.

For IBM SPSS Collaboration and Deployment Services, the SOAP headers contain the security information under which the web service call is processed. In addition, the HTTP headers contain information about the client that initiated the web service request.

Security headers

Most IBM SPSS Collaboration and Deployment Services web service calls require security information in the request message.

In general, the structure of this content follows the `WS-Security` extension to the SOAP 1.1 standard. This documentation provides details on the XML elements and attributes that are recognized by IBM SPSS Collaboration and Deployment Services. Some of the elements and attributes are required, some are optional, and some are ignored. Refer to the following official specifications for details, but IBM SPSS Collaboration and Deployment Services requires some special values not referenced in the official specifications.

- http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-os-SOAPMessageSecurity.pdf
- http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-os-UsernameTokenProfile.pdf
- http://docs.oasis-open.org/wss/v1.1/wss-v1.1-spec-os-KerberosTokenProfile.pdf

The following table defines the values of namespaces that are used for the SOAP header elements.

Table 13. SOAP header namespaces

Namespace prefix	Namespace value
wsse	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd
wsu	http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-utility-1.0.xsd
soapenv	http://schemas.xmlsoap.org/soap/envelope/
spsssec	http://xml.spss.com/security

Security element

The `wsse:Security` element is the main security header element included in a `soapenv:Header` element.

Table 14. Attributes of `wsse:Security`

Attribute	Description	Example
`soapenv:actor`	Targets a given endpoint along the message path. This value is ignored.	http://schemas.xmlsoap.org/soap/actor/next
`soapenv:mustUnderstand`	Clients can specify if the server must process this element. This value is ignored.	0

UsernameToken element

Use the wsse:UsernameToken element when a traditional user and password combination is required.

Table 15. Attributes of wsse:UsernameToken

Attribute	Description
wsu:Id	An optional string label for the security token. This value is ignored.

Table 16. Child elements of wsse:UsernameToken

Attribute	Description	Example
wsse:Username	The xml value represents the identity of the user.	a_user
wsse:Password	The attribute Type specifies the type of password. PasswordText is currently the only supported type. The xml value can handle plain text passwords and encrypted data.	myPassword [{AES}KrY+KLlOYo4O6545tgGsYQ==]
wsse:Nonce	The xml value represents a cryptographically random nonce encoded as base64 data. This is currently ignored.	RUx1ugQo0o3g0Xyl+sUEsA==
wsu:Created	The xml value represents the creation time as a timestamp conforming to wsu:Timestamp. This is currently ignored.	2013-10-08T02:09:20Z

BinarySecurityToken and BinarySecuritySSOToken elements

Binary security tokens may be used when IBM SPSS Collaboration and Deployment Services communicates with itself or when single sign-on (SSO) is used. Customer usage of these token types is limited to SSO.

The wsse:BinarySecurityToken and wsse:BinarySecuritySSOToken elements have the same format, but only wsse:BinarySecurityToken is recognized in the official WS-Security standard. The element wsse:BinarySecuritySSOToken was added as a nonstandard element when used in SSO.

Of these two elements, you should use wsse:BinarySecurityToken and you must supply the correct attributes for proper handling. The most critical attribute is the wsu:Id value which is used during web service request processing to handle the security token correctly.

Table 17. Attributes of wsse:BinarySecurityToken

Attribute	Description	Example
ValueType	Indicates the type of the security token. IBM SPSS Collaboration and Deployment Services always writes these values when creating its own XML, but this value is currently ignored during processing. You should use spsssec:BinarySecuritySSOToken.	spsssec:BinarySecurityToken spsssec:BinarySecuritySSOToken

Table 17. Attributes of wsse:BinarySecurityToken (continued)

Attribute	Description	Example
EncodingType	Indicates the encoding type for the token. The only currently supported type is base64, so this value should always be wsse:Base64Binary. IBM SPSS Collaboration and Deployment Services always writes these values when creating its own XML, but this value is currently ignored during processing.	wsse:Base64Binary
wsu:Id	An identifier for the token. This value must be correctly provided. You should always provide spssSSOToken. The only valid case for using spssToken is for internal web service calls, which use an internal token format.	spssToken spssSSOToken
anyAttribute	An extension mechanism to allow any arbitrary attribute in other namespaces. These extensions are ignored.	

The XML value for wsse:BinarySecurityToken and wsse:BinarySecuritySSOToken is string data in base64 format.

The client-accept-language element

This element restricts the set of natural languages that are preferred as a response to the request.

This element is inserted into a soapenv:Header element and is not related to WS-Security in any way. This is the same value found in the HTTP header named Accept-Language as defined in RFC2068. The xml value for this element might look like the following:

```
en-US;q=1.0, en;q=0.8
```

The namespace for this element could be any allowed value, such as ns1, which has an associated value of http://xml.spss.com/ws/headers.

HTTP headers

In addition to SOAP headers, it is possible to apply HTTP headers as well. None of the HTTP headers is required.

Table 18. HTTP headers

HTTP header	Description
Accept-Language	The accept language header value, as defined in RFC2068 (e.g. en-US;q=1.0, en;q=0.8). If not supplied the server language setting is used as a default.
CLIENT_ADDR	The client IP address that ultimately initiated the request.
CLIENT_HOSTNAME	The client host name that ultimately initiated the request.
X-FORWARDED-FOR	The client IP address that ultimately initiated the request. This is standard for determining the originating IP address.

The CLIENT_ADDR, CLIENT_HOSTNAME, and X-FORWARDED-FOR values are useful when a client application makes a call through an HTTP proxy, load balancer, or when IBM SPSS Collaboration and Deployment Services components make internal calls. The CLIENT_ADDR and CLIENT_HOSTNAME entries are specific HTTP headers that can be set by IBM SPSS Collaboration and Deployment Services itself. The X-FORWARDED-FOR header is a standard that some load balancers understand. These headers are used to make a best-effort attempt in determining the originating client for a given call, allowing information to be used for auditing purposes. The headers may not work as intended, but IBM SPSS Collaboration and Deployment Services will fall back to reasonable defaults in those situations.

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