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Web Services Data Access and Integration – The Relational Realisation (WS-DAIR) Specification, Version 1.0

Status of This Memo

This document obsoletes GFD-R-P.076 providing information regarding the specification of service-based interfaces to relational data resources. Distribution is unlimited.

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Abstract

Data resources play a significant role in many applications across multiple domains. Web services provide implementation neutral facilities for describing, invoking and orchestrating collections of networked resources. The OGF (Open Grid Forum) Open Grid Services Architecture (OGSA), and its associated specifications, defines consistent interfaces through web services to components of the grid infrastructure. Both the web and grid communities stand to benefit from the provision of consistent and agreed web service interfaces for data resources and the systems that manage them.

This document presents a specification for a collection of data access interfaces for relational data resources, which extends interfaces defined in the "Web Services Data Access and Integration" document [WS-DAI]. The specification can be applied in regular web service environments or as part of a grid fabric.

Contents

1. Introduction

Data access plays a central role for many types of grid applications. Data access generally involves the retrieval, manipulation and insertion of data, which may be stored using a range of different formats and infrastructures.

This document presents a specification for a collection of data access interfaces for relational data resources. A relational data resource is a data source/sink that is characteristic of relational database systems, e.g., can be queried or updated using SQL.

This document should be read in conjunction with the "Web Services Data Access and Integration" document [WS-DAI]. These specifications have been developed for representing data resources as web services, and form part of a broader activity within the Open Grid Forum to develop the Open Grid Services Architecture (OGSA) [OGSA].

1.1   Specification Scope

The base interfaces and properties for data access services are described in the *Web Services Data Access and Integration* specification [WS-DAI]. This specification extends these interfaces to allow access to and provide descriptions of relational data resources. Relational data resources are assumed to be composed of tabular data structures such as relations and result sets which are typically accessed either using SQL queries or by row iteration, respectively.

1.2   Specification Organisation

This specification separates the function of a data access service from its operational representation as expressed in WSDL.

The specification is described using the notational conventions and terminology defined in Sections 2 and 3, and employs the concepts described in Section 4. Sections 5, 6 and 7 describe the interfaces for executing SQL statements, accessing the results of SQL queries and for iterating through result sets, respectively. A mapping to WSDL is described in Section 8, Section 9 discusses security, and Section 10 draws conclusions. The WSDL and XML Schema included in the document appendices should be taken as the normative interface and property descriptions of this specification.

1.3   Interface Composition

This specification does not mandate how interfaces are composed into services; the proposed interfaces may be used in isolation or in conjunction with others. Viable compositions of interfaces will, initially, follow established patterns for data access.

1.4   Changes since GFD-R.076

Since the publication of GFD-R.076 various changes have been made to this document, most of them as a result of feedback from the interoperability testing process described in [INTEROP], which contains a list of proposed changes, all of which were made. The majority of the changes consist of typo corrections, clarifications, and improvements made to diagrams and example XML messages. Changes to the WS-DAI interfaces are as follows:
  • A new optional fault type, DatasetTooLargeFault, was added to operations with the potential to return large amounts of data.
  • Fixed inconsistency with the capitalization of "s" in type/interface definitions containing "rowset"/"rowSet". All occurrences now changed to a lower-case "s" for consistency.
  • Removed abstract="true" from the definition of the SQLResponseItem type.
  • SQLRowsetFactory operation now supports the InvalidPortTypeQNameFault and the InvalidConfigurationDocumentFault faults.

- InvalidGetTuplesRequestFault removed.
- SQLCommunicationArea changed to SQLCommunicationsArea in the WSDL.
- The "name" attribute was removed from the GetSQLPropertyDocument operation.
- The URI for SQL 92 changed to http://www.sql.org/sql-92.
- The <DatasetData> element of SQL query response messages is now optional.
- Additional schema import definitions added to the SQLAccess and SQLResponse WSDL.

2. Notational Conventions

The key words "MUST," "MUST NOT," "REQUIRED," "SHALL," "SHALL NOT," "SHOULD,"
"SHOULD NOT," "RECOMMENDED," "MAY," and "OPTIONAL" are to be interpreted as
described in RFC-2119 [RFC2119].

When describing concrete XML Schemas and XML instance fragments, this specification uses
the notational convention of [WS-Security]. Specifically, each member of an element's children or
attributes property is described using an XPath-like notation (e.g.,
/x:MyHeader/x:SomeProperty/@value1 indicates that namespace *x* is being used, the root
element *MyHeader* and a child element *SomeProperty* with an attribute *value1*). The use of {any}
indicates the presence of an element wildcard (<xsd:any/>). The use of @{any} indicates the
presence of an attribute wildcard (<xsd:anyAttribute/>).

In the body of the specification, when patterns of messages are described, the layout of the XML
of each message is presented, as opposed to the XML schema; the XML Schema is provided in
Appendix A. The following notation is used to indicate cardinality of XML elements in the XML
fragments:
- *   zero or more
- +   one or more
- ?   zero or one

Where no notation is added to an element, one instance of the element is expected.

This specification generally adopts the terminology defined in the Open Grid Services
Architecture Glossary of Terms [OGSA Glossary]. This terminology is extended in Section 3.

This specification uses namespace prefixes throughout; these are listed in the table below. Note
that the choice of any namespace prefix is arbitrary and is not semantically significant.

Prefix	Namespace
xsd	http://www.w3.org/2001/XMLSchema
wsdai	http://www.ggf.org/namespaces/2005/12/WS-DAI
wsdair	http://www.ggf.org/namespaces/2005/12/WS-DAIR
wsa	http://www.w3.org/2005/08/addressing
wrs	http://java.sun.com/xml/ns/jdbc

3. Terminology

Model-independent terminology, i.e., data resource, data access service, consumer and data set,
is given in the Web Services Data Access and Integration specification [WS-DAI], henceforth
referred to as the WS-DAI specification.

3.1   Relational Data Resource

A relational data resource is a data source/sink that is characteristic of relational database
systems, i.e., can be queried or updated using SQL.

3.2   SQLResponse Data Resource

A SQLResponse data resource encapsulates the result of an SQL statement executed by a relational data resource. A SQLResponse data resource is created as the result of an interaction with a relational data resource.

3.3   SQLRowset Data Resource

A SQLRowset data resource represents a particular result, in the form of one or more rowsets. A SQLRowset data resource is created as the result of an interaction with a SQLResponse data resource.

4. Concepts

This section assumes familiarity with the concepts section in the WS-DAI specification.

4.1   Relational interfaces

The word interface refers to the collections of messages and XML structures that describe the ways in which a consumer can interact with a data access service. It is not intended to refer specifically to the proposed use of the word interface found in the candidate recommendation of the WSDL 2.0 specification, although this may be an appropriate mapping in the future.

This specification extends the base interfaces and corresponding properties defined in the WS-DAI specification to provide access to relational data resources. Direct access allows the results to be delivered to the consumer in the response message. To cater for this mode of operation the following interfaces are defined:

- *SQLAccessDescription*: extends the properties enumerated in the WS-DAI specification to provide information about access properties and capabilities of a relational data resource.
- *SQLAccess*: provides access to a relational data resource.

In addition, indirect access is supported through the use of the factory pattern. This allows data, usually the result of a query, to be accessed by way of a new service managed data resource, and thus the data is not returned directly to the consumer. To cater for this mode of operation the following interfaces are defined:

- *SQLAccessFactory*: provides access to results derived from a relational data resource.
- *SQLResponseFactory*: provides access to a SQL response, usually the result of a SQL SELECT statement.

To support access to the data resources resulting from the use of the factory pattern, additional interfaces and properties are defined, in particular:

- *SQLResponseDescription*: extends the properties enumerated in the WS-DAI specification to provide information on the result of an interaction with a relational data resource.
- *SQLResponseAccess*: provides access to each type of response that can result from the execution of a SQL statement.

To support access to a data resource resulting from the use of the factory pattern that contains a row set, the following interfaces and properties are defined:

- *SQLRowsetDescription*: provides information about a particular instance of a query result that a data access service may represent. This interface makes information about the schema for representing the query result and the number of rows within the SQLRowset available.
- *SQLRowsetAccess*: provides access to a set of rows, which are usually the result of a SQL SELECT statement.

These interfaces, and their corresponding properties, are specified in Sections 5 to 7.

4.2   Relationships with other specifications

WS-DAIR does not specify its own query/update languages for relational data resources. It acts as a channel for existing relational query and update languages to be conveyed to relational data resources or data resources that support relational capabilities. As such, WS-DAIR relies on existing relational query and update languages. In this specification, interface support is provided for languages based on the following standards:

- SQL [SQL]: an ISO standard defining a language for querying and updating relational data resources. The relational realization does not mandate any particular version of SQL and MAY accommodate vendor specific extensions.
- WebRowset: a Java Community Process standard for relational results is one of the valid *ResponseTypes* for responses from SQLAccess operations
- CIM [CIM]: is the Common Information Model, a DMTF standard for describing distributed resources; an XML version of the CIM model is used to describe relational data resources.

5. SQLAccess

This section describes the interfaces, message patterns and properties provided by WS-DAIR to support access to relational data resources.

5.1   Static SQLAccess Description

The elements described in this section extend those define in the WS-DAI specification. They are contained within a SQLPropertyDocument element that extends the PropertyDocument type defined in the WS-DAI specification.

5.1.1   SchemaDescription

This property contains an XML document that describes the schema of the database. This document MAY conform to a schema defined as part of the Common Information Model (CIM) of the DMTF (http://www.dmtf.org).

```
<xsd:element name="SchemaDescription">
  <xsd:complexType>
    <xsd:sequence>
      <xsd:any maxOccurs="unbounded" minOccurs="0" namespace="##any"
               processContents="lax"/>
    </xsd:sequence>
  </xsd:complexType>
</xsd:element>
```

/wsdair:SchemaDescription
> Allows content from the database schema to be exposed through the data access service.

5.1.2   DatasetMap

The DatasetMap property is defined in the core specification [WS-DAI] to describe the valid dataset formats that may be requested. All services that have the SQLAccess interface MUST provide support to return rowset-compliant databases in WebRowset [JSR114] format. As a consequence of this statement they MUST also state that rowset-compliant databases can be returned in WebRowset format.

```
<wsdai:DatasetMap>
```

```
   <wsdai:MessageQName>wsdair:SQLExecute</wsdai:MessageQName>
   <wsdai:DatasetFormatURI>
     http://java.sun.com/xml/ns/jdbc
   </wsdai:DatasetFormatURI>
</wsdai:DatasetMap>
```

Other valid dataset formats to be used in the response MAY be specified by implementers.

5.1.3   SQLPropertyDocument

This element extends the base properties defined in the WS-DAI specification to include the SchemaDescription element.

```
<xsd:complexType name="SQLPropertyDocumentType">
     <xsd:complexContent>
        <xsd:extension base="wsdai:PropertyDocumentType">
           <xsd:sequence>
                <xsd:element ref="wsdair:SchemaDescription" />
           </xsd:sequence>
        </xsd:extension>
     </xsd:complexContent>
</xsd:complexType>

<xsd:element name="SQLPropertyDocument" type="wsdair:SQLPropertyDocumentType"/>
```

/wsdair:SQLPropertyDocument
         Describes the overall properties of a SQLAccess interface.

5.2   Configurable SQLAccess Description

No additional configurable properties are defined by SQLAccess.

5.3   Example SQLPropertyDocument

 A non-normative example of a SQLPropertyDocument is shown below.

```
<wsdair:SQLPropertyDocument xmlns:...>
  <wsdai:DataResourceAbstractName>urn:dais:ds:1</wsdai:DataResourceAbstractName>
  <wsdai:DataResourceManagement>ExternallyManaged</wsdai:DataResourceManagement>
  <wsdai:DatasetMap>
    <wsdai:MessageQName>wsdair:SQLExecute</wsdai:MessageQName>
    <wsdai:DatasetFormatURI>http://java.sun.com/xml/ns/jdbc</wsdai:DatasetFormatURI>
    <wsdai:MessageQName>wsdai:GenericQuery</wsdai:MessageQName>
    <wsdai:DatasetFormatURI>http://ogsadai.org.uk/genericql</wsdai:DatasetFormatURI>
</wsdai:DatasetMap>
  <wsdai:ConfigurationMap>
    <wsdai:MessageQName>wsdair:SQLExecuteFactory</wsdai:MessageQName>
    <wsdai:PortTypeQName>wsdair:SQLResponsePT</wsdai:PortTypeQName>
    <wsdai:ConfigurationDocumentQName>wsdai:ConfigurationDocumentType
    </wsdai:ConfigurationDocumentQName>
    <DefaultConfigurationDocument>
      <wsdai:ConfigurationDocument>
        <wsdai:DataResourceDescription>
         Data description of the data resource goes here.
        </wsdai:DataResourceDescription>
        <wsdai:Readable>true</wsdai:Readable>
        <wsdai:Writeable>true</wsdai:Writeable>
        <wsdai:TransactionInitiation>NotSupported</wsdai:TransactionInitiation>
        <wsdai:TransactionIsolation>NotSupported</wsdai:TransactionIsolation>
        <wsdai:ChildSensitiveToParent>Insensitive</wsdai:ChildSensitiveToParent>
        <wsdai:ParentSensitiveToChild>Insensitive</wsdai:ParentSensitiveToChild>
      </wsdai:ConfigurationDocument>
    </DefaultConfigurationDocument>
  </wsdai:ConfigurationMap>
  <wsdai:LanguageMap>
```

```
      <wsdai:MessageQName>wsdair:SQLExecute</wsdai:MessageQName>
      <wsdai:LanguageURI>http://www.sql.org/sql-92</wsdai:LanguageURI>
   </wsdai:LanguageMap>
   <wsdai:LanguageMap>
      <wsdai:MessageQName>wsdair:SQLExecute</wsdai:MessageQName>
      <wsdai:LanguageURI> http://www.sql.org/sql-99</wsdai:LanguageURI>
   </wsdai:LanguageMap>
   <wsdai:LanguageMap>
      <wsdai:MessageQName>wsdair:SQLExecute</wsdai:MessageQName>
      <wsdai:LanguageURI> http://www.sql.org/sql-03</wsdai:LanguageURI>
   </wsdai:LanguageMap>
   <wsdai:LanguageMap>
      <wsdai:MessageQName>wsdai:GenericQuery</wsdai:MessageQName>
      <wsdai:LanguageURI>http://ogsadai.org.uk/namespaces/2005/03/types>
   </wsdai:LanguageURI>
   </wsdai:LanguageMap>
   <wsdai:DataResourceDescription>My DB</wsdai:DataResourceDescription>
   <wsdai:Readable>true</wsdai:Readable>
   <wsdai:Writeable>true</wsdai:Writeable>
   <wsdai:ConcurrentAccess>true</wsdai:ConcurrentAccess>
   <wsdai:TransactionInitiation>NotSupported</wsdai:TransactionInitiation>
   <wsdai:TransactionIsolation>NotSupported</wsdai:TransactionIsolation>
   <wsdai:ChildSensitiveToParent>Insensitive</wsdai:ChildSensitiveToParent>
   <wsdai:ParentSensitiveToChild>Insensitive</wsdai:ParentSensitiveToChild>
<SchemaDescription>
      <databaseSchema xmlns="http://ogsadai.org.uk/namespaces/2005/10/properties"
               xmlns:ns22="http://ogsadai.org.uk/namespaces/2005/10/properties">
         <logicalSchema>
            <table name="person" schema="null">
               <column default="0" fullName="id" length="10" name="id" nullable="false"
                                                            position="1">
                  <sqlTypeName>INT</sqlTypeName>
                  <sqlJavaTypeID>4</sqlJavaTypeID>
               </column>
               <column default="null" fullName="age" length="10" name="age"
                                          nullable="true" position="2">
                  <sqlTypeName>INT</sqlTypeName>
                  <sqlJavaTypeID>4</sqlJavaTypeID>
               </column>
            </table>
         </logicalSchema>
      </databaseSchema>
   </SchemaDescription>

</wsdair:SQLPropertyDocument>
```

5.4   SQLAccess Messages

This SQLAccess interface provides access to an underlying relational data resource by means of SQL statements. These are defined according to the message patterns from the WS-DAI specification.

Data access collects together messages that directly access or modify the data represented by a data access service along with the properties that describe the behaviour of these access messages, as, for example, illustrated in Figure 1. In this example, a relational data access service implements the SQLAccess operations and exposes the SQLAccessDescription properties. A consumer uses the SQLExecute message to submit a SQLExpression. The associated SQLExecuteResponse message is formatted according to the value specified in the ResponseType. The actual contents returned in the response depend on the type of SQLExpression used, for example:

- SELECT produces an SQLExecuteResponse with:
     - *(SQLRowset, SQLCommunicationsArea*)
- INSERT, UPDATE, DELETE produces an SQLExecuteResponse with:
     - *(SQLUpdateCount+, SQLCommunicationsArea*)

- A StoredProcedure produces an SQLExecuteResponse with:
  - o (SQLRowset*,SQLReturnValue?,SQLOutputParameter*,SQLCommunicationsArea*)
- A UserDefinedFunction produces an SQLExecuteResponse with:
  - o *(SQLReturnValue?, SQLCommunicationsArea*)*
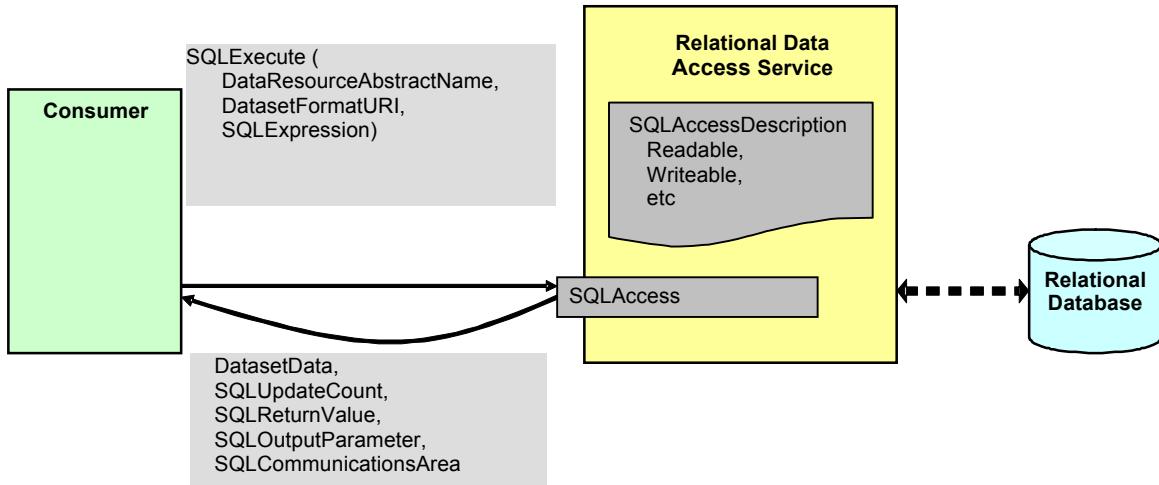
Figure 1 – Overview – SQLAccess

5.4.1   SQLAccess::GetSQLPropertyDocument

Provides a mechanism for obtaining a copy of the SQLAccessDescription.

Input
- GetSQLPropertyDocumentRequest
  - o DataResourceAbstractName – the abstract name of the resource for which properties are required.

Output
- GetSQLPropertyDocumentResponse
  - o SQLPropertyDocument – the properties described in the data description section.

Faults
- InvalidResourceNameFault – the supplied resource name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

5.4.2   SQLAccess::SQLExecute

Directs a SQLExpression and optional SQLParameter to a relational data resource. The SQLParameter are used for passing values to Stored Procedures and User Defined Functions.

The SQLExecuteResponse combines statically typed and dynamically typed structures. Static typing is used for the status values and for single value outputs. The tabular output of the rowset is provided in a format dynamically determined by the input DatasetFormatURI.

Input

- SQLExecuteRequest
    - o DataResourceAbstractName – the abstract name of the resource the message is targeted at.
    - o DatasetFormatURI? – the format used to represent a SQLRowset in the corresponding SQLExecuteResponse.
    - o SQLExpression
        - SQLExpression – any SQL statement.
        - SQLParameter* – any SQL parameters that need to be substituted into the supplied SQLExpression. These parameters are bound by the position in which they appear in the SQLExecuteRequest.
            - Value – the value to be used for the parameter.
            - Type – the data type.
            - Mode - specify whether the parameter is in, out or inout according to the parameter.

Output
- SQLExecuteResponse
    - o SQLDataset
        - DatasetFormatURI - the URI of the dataset format being returned as defined in the DatasetMap.
        - DatasetData – any data returned in response to a query.
        - SQLUpdateCount* – the number of rows that were affected by an SQL update if this was the type of SQL statement used.
        - SQLOutputParameter* – where any output from a SQL stored procedure output parameter goes.
            - index – index of the parameter.
            - value – the value of the parameter.
        - SQLReturnValue? – the return value from a SQL stored procedure.
        - SQLCommunicationsArea* – exposes any output from the SQL Communications Area.
            - SQLState – an XOPEN or SQL code identifying the Exception, Warning or Message.
            - VendorCode – a database vendor-specific code for the Exception, Warning or Message.
            - MessageText – a text description of the Exception, Warning or Message.

Faults
- InvalidResourceNameFault – the supplied resource name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidDatasetFormatFault – the supplied dataset format is not known to the service.
- InvalidExpressionFault – the supplied expression is not of a form known to the service.
- InvalidLanguageFault – the supplied expression language is not known to the service.
- InvalidSQLExpressionParametersFault – parameters do not match SQLExpression.
- DatasetTooLargeFault - the dataset produced by the query is too large.
- NotAuthorizedFault– the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

5.5   SQLAccessFactory Messages

The SQLExecuteFactory operation is used to create a relationship between a data resource representing the result of a request and the service by which it is accessed. Once again the message patterns defined in the WS-DAI specification for these types of messages are followed.

Figure 2 illustrates the SQLAccessFactory interface. The SQLExecuteFactory operation is used to construct the derived SQLResponse data access service. This service provides access to the SQLRowset resulting from a SQLExpression against the relational database, assuming that the

expression contains a SELECT statement. The SQLRowset is the result of a SQL query over the database. The SQLRowset could be stored as a table in a relational database or decoupled from the database, but the important distinction here is that the data is accessed as a collection of rows that does not implement the SQLAccess portType. Instead, the SQLResponse data access service allows the SQLRowset to be retrieved through the operations of the SQLResponseAccess interface.
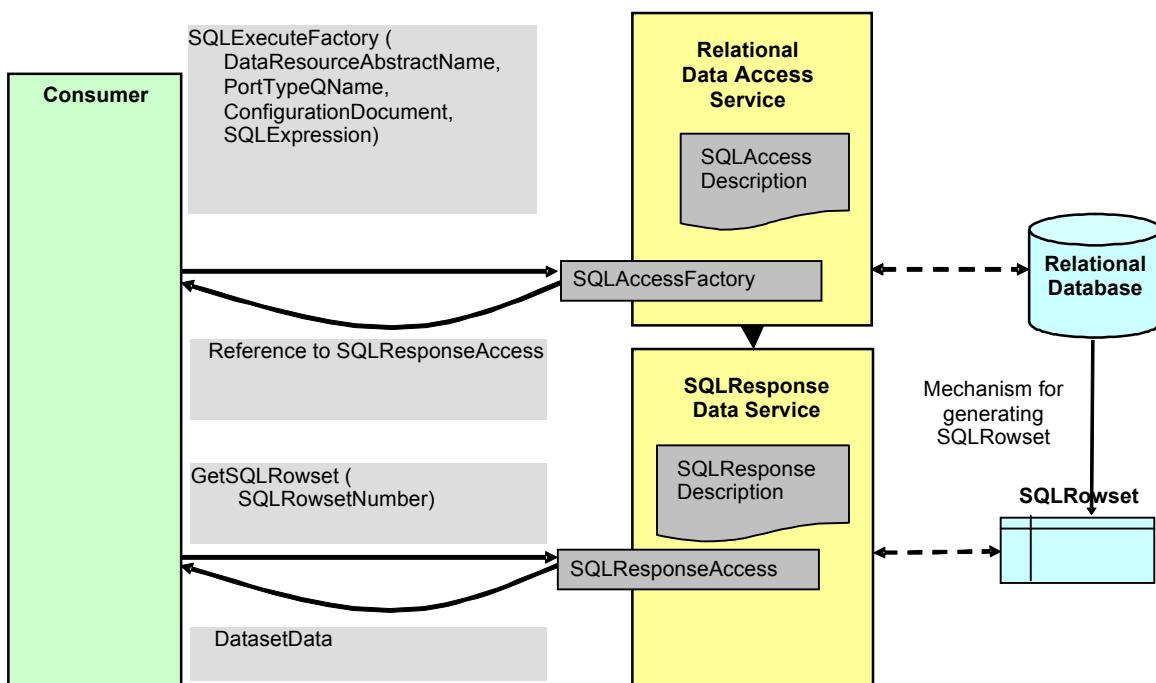
Figure 2 – Overview – SQLAccessFactory

5.5.1   SQLAccessFactory::SQLExecuteFactory
Create a new data access service that corresponds to the results of a SQL Query.

Input
- SQLExecuteFactoryRequest
    - DataResourceAbstractName – the abstract name of the resource the message is targeted at.
    - PortTypeQName? – the QName of the portType through which the resulting data should be accessed.
    - ConfigurationDocument? – a document that specifies the properties of the data resource that is to be used to hold the resulting data. The properties contained in this document are defined in the WS-DAI specification.
    - PreferredTargetService? – the EPR of the preferred service that is to act as the host for the new data resource.
    - SQLExpression:
        - SQLExpression – any SQL statement.
        - SQLExpressionParameters* – any SQL parameters that need to be substituted into the supplied SQLExpression.
            - Value – the value to be used for the parameter.
            - Type – the data type.
            - Mode - specify whether the parameter is in, out or inout according to the parameter.

Output
- SQLExecuteFactoryResponse
  - DataResourceAddress+ – a list of data resource address.

Faults
- InvalidResourceNameFault – the supplied resource name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidPortTypeQName – the PortTypeQName specified is not in the collection defined by the ConfigurationMap property.
- InvalidConfigurationDocumentFault – the ConfigurationDocument specified is not valid according to the ConfigurationDocumentQName when the ConfigurationMap is indexed by the specified PortTypeQName.
- InvalidExpressionFault – the supplied expression is not of a form known to the service.
- InvalidLanguageFault – the supplied expression language is not known to the service.
- InvalidSQLExpressionParametersFault – parameters do not match SQLExpression.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

A wsdai:ConfigurationMap provides a mapping between the QName of a factory message and various properties of the factory, as defined in [WS-DAI], including a default configuration document. The following non-normative XML fragment is an example for a SQLAccess factory that is configured to produce a data access service exposing an SQL response via the SQLResponseAccess interface.

```
<wsdai:ConfigurationMap>
  <wsdai:MessageQName>wsdair:SQLExecuteFactory</wsdai:MessageQName>
  <wsdai:PortTypeQName>wsdai:ResponseAccessPT</wsdai:PortTypeQName>
  <wsdai:ConfigurationDocumentQName>
    wsdai:ConfigurationDocumentType
  </wsdai:ConfigurationDocumentQName>
  <wsdai:DefaultConfigurationDocument>
    <wsdai:ConfigurationDocument>
      <wsdai:DataResourceDescription>
        A description of the data resource would go here.
      </wsdai:DataResourceDescription>
      <wsdai:Readable>true</wsdai:Readable>
      <wsdai:Writeable>true</wsdai:Writeable>
      <wsdai:ConcurrentAccess>true</wsdai:ConcurrentAccess>
      <wsdai:TransactionInitiation>NotSupported</wsdai:TransactionInitiation>
      <wsdai:TransactionIsolation>NotSupported</wsdai:TransactionIsolation>
      <wsdai:ChildSensitiveToParent>Insensitive</wsdai:ChildSensitiveToParent>
      <wsdai:ParentSensitiveToChild>Insensitive</wsdai:ParentSensitiveToChild>
    </wsdai:ConfigurationDocument>
  </wsdai:DefaultConfigurationDocument>
</wsdai:ConfigurationMap>
```

6. SQLResponse

This section describes the interfaces, message patterns and properties provided by WS-DAIR to support access to SQLResponse data resources.

6.1 Static SQLResponse Description

The elements defined in this section live under a SQLResponsePropertyDocument that extends the PropertyDocument defined in the WS-DAI specification.

6.1.1 SQLResponseItem
```
<xsd:complexType name="SQLResponseItemType">
```

```
  <xsd:sequence>
    <xsd:element name="SequenceNumber" type="xsd:unsignedInt"/>
    <xsd:element name="Name">
      <xsd:simpleType>
        <xsd:restriction base="xsd:token">
              <xsd:enumeration value="Rowset"/>
              <xsd:enumeration value="UpdateCount"/>
              <xsd:enumeration value="ReturnValue"/>
              <xsd:enumeration value="OutputParameter"/>
              <xsd:enumeration value="CommunicationsArea"/>
        </xsd:restriction>
      </xsd:simpleType>
    </xsd:element>
  </xsd:sequence>
</xsd:complexType>

<xsd:element name="SQLResponseItem" type="wsdair:SQLResponseItemType"/>
```

/wsdair:SQLResponseItem
> A structure holding information about a response item resulting from the execution of a SQL request. There will be an instance of this structure for each response item returned.

/wsdair:SQLResponseItem/wsdair:SequenceNumber
> The sequence number of the response item in the full list of response items.

/wsdair:SQLResponseItem/wsdair:Name
> The type of the response item.

6.1.2   NumberOfSQLRowsets

```
<xsd:element name="NumberOfSQLRowsets" type="xsd:unsignedInt" />
```

/wsdair:SQLResponsePropertyDocument/wsdair:NumberOfSQLRowsets
> The total number of *SQLRowsets* in the *SQLExecuteResponse.*

6.1.3   NumberOfSQLUpdateCounts

```
<xsd:element name="NumberOfSQLUpdateCounts" type="xsd:unsignedInt" />
```

/wsdair:SQLResponsePropertyDocument/wsdair:NumberOfSQLUpdateCounts
> The total number of *SQLUpdateCounts* in the *SQLExecuteResponse.*

6.1.4   NumberOfSQLReturnValues

```
<xsd:element name="NumberOfSQLReturnValues" type="xsd:unsignedInt" />
```

/wsdair:SQLResponsePropertyDocument/wsdair:NumberOfSQLReturnValues
> The total number of *SQLReturnValues* in the *SQLExecuteResponse.*

6.1.5   NumberOfSQLOutputParameters

```
<xsd:element name="NumberOfSQLOutputParameters" type="xsd:unsignedInt" />
```

/wsdair:SQLResponsePropertyDocument/wsdair:NumberOfSQLOutputParameters
> The total number of *SQLOutputParameters* in the *SQLResponse.*

6.1.6   NumberOfSQLCommunicationsAreas

```
<xsd:element name="NumberOfSQLCommunicationsAreas" type="xsd:unsignedInt" />
```

/wsdair:SQLResponsePropertyDocument/wsdair:NumberOfSQLCommunicationsAreas
> The total number of *SQLCommunicationsAreas* in the *SQLExecuteResponse.*

6.1.7   SQLResponsePropertyDocument

```
<xsd:complexType name="SQLResponsePropertyDocumentType">
  <xsd:complexContent>
    <xsd:extension base="wsdai:PropertyDocumentType">
      <xsd:sequence>
        <xsd:element ref="wsdair:SQLResponseItem" minOccurs="0"
                                               maxOccurs="unbounded"/>
       <xsd:element ref="wsdair:NumberOfSQLRowsets"/>
       <xsd:element ref="wsdair:NumberOfSQLUpdateCounts"/>
       <xsd:element ref="wsdair:NumberOfSQLReturnValues"/>
        <xsd:element ref="wsdair:NumberOfSQLOutputParameters"/>
        <xsd:element ref="wsdair:NumberOfSQLCommunicationsAreas"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<xsd:element name="SQLResponsePropertyDocument"
             type="wsdair:SQLResponsePropertyDocumentType"/>
```

/wsdair:SQLResponsePropertyDocument
> A structure that describes a SQLResponse data resource, combining the properties
> defined in the WS-DAI specification with those defined earlier in this section.

6.2   Configurable SQLResponse Description

No extra configurable properties are defined by SQLResponseAccess.

6.3   Example SQLResponsePropertyDocument

A non-normative example of a SQLResponsePropertyDocument follows.

```
<wsdair:SQLResponsePropertyDocument xmlns:...>
 <wsdai:DataResourceAbstractName>
   urn:dais:ds2
 </wsdai:DataResourceAbstractName>
 <wsdai:DataResourceManagement>ExternallyManaged</wsdai:DataResourceManagement>
 <wsdai:ParentDataResource>
   <wsa:Address>http://www.ggf.org/services/daissqlservice</wsa:Address>
   <wsa:ReferenceParameters>
     <DataResourceAbstractName>urn:dais:ds:1</DataResourceAbstractName>
   </wsa:ReferenceParameters>
   <wsa:Metadata/>
 </wsdai:ParentDataResource>
 <wsdai:DatasetMap>
   <wsdai:MessageQName>wsdair:GetSQLRowset</wsdai:MessageQName>
   <wsdai:DatasetFormatURI>http://java.sun.com/xml/ns/jdbc</wsdai:DatasetFormatURI>
 </wsdai:DatasetMap>
 <wsdai:ConfigurationMap>
   <wsdai:MessageQName>wsdair:GetSQLRowset</wsdai:MessageQName>
   <wsdai:PortTypeQName>wsdair:SQLRowsetPT</wsdai:PortTypeQName>
   <wsdai:ConfigurationDocumentQName>
        wsdair:SQLRowsetPTConfigurationDocumentType
   </wsdai:ConfigurationDocumentQName>
   <DefaultConfigurationDocument>
     <wsdai:ConfigurationDocument>
       <wsdai:DataResourceDescription/>
       <wsdai:Readable>true</wsdai:Readable>
       <wsdai:Writeable>true</wsdai:Writeable>
       <wsdai:TransactionInitiation>NotSupported</wsdai:TransactionInitiation>
       <wsdai:TransactionIsolation>NotSupported</wsdai:TransactionIsolation>
```

```
           <wsdai:ChildSensitiveToParent>Insensitive</wsdai:ChildSensitiveToParent>
           <wsdai:ParentSensitiveToChild>Insensitive</wsdai:ParentSensitiveToChild>
       </wsdai:ConfigurationDocument>
     </DefaultConfigurationDocument>
   </wsdai:ConfigurationMap>
   <wsdai:DataResourceDescription/>
   <wsdai:Readable>true</wsdai:Readable>
   <wsdai:Writeable>true</wsdai:Writeable>
   <wsdai:ConcurrentAccess>true</wsdai:ConcurrentAccess>
   <wsdai:TransactionInitiation>NotSupported</wsdai:TransactionInitiation>
   <wsdai:TransactionIsolation>NotSupported</wsdai:TransactionIsolation>
   <wsdai:ChildSensitiveToParent>Insensitive</wsdai:ChildSensitiveToParent>
   <wsdai:ParentSensitiveToChild>Insensitive</wsdai:ParentSensitiveToChild>
   <wsdair:SQLResponseItem>
     <SequenceNumber>0</SequenceNumber>
     <Name>Rowset</Name>
   </wsdair:SQLResponseItem>
   <wsdair:SQLResponseItem>
     <SequenceNumber>1</SequenceNumber>
     <Name>CommunicationsArea</Name>
   </wsdair:SQLResponseItem>
   <wsdair:NumberOfSQLRowsets>1</wsdair:NumberOfSQLRowsets>
   <wsdair:NumberOfSQLUpdateCounts>0</wsdair:NumberOfSQLUpdateCounts>
   <wsdair:NumberOfSQLReturnValues>0</wsdair:NumberOfSQLReturnValues>
   <wsdair:NumberOfSQLOutputParameters>0</wsdair:NumberOfSQLOutputParameters>
   <wsdair:NumberOfSQLCommunicationsAreas>
       1
   </wsdair:NumberOfSQLCommunicationsAreas>
</wsdair:SQLResponsePropertyDocument>
```

6.4   SQLResponseAccess Messages
This allows access to each element in a SQLExecuteResponse providing indirect access to an SQLResponse resource created via a SQLAccessFactory interface.

6.4.1   SQLResponseAccess::GetSQLResponsePropertyDocument
Allows a copy of the SQLResponsePropertyDocument document to be retrieved.

Input
- GetSQLResponsePropertyDocumentRequest
    - o DataResourceAbstractName – the abstract name of the resource from which the properties are to be obtained.

Output
- GetSQLResponsePropertyDocumentResponse
    - o SQLResponsePropertyDocument – the properties described in the data description section.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

6.4.2   SQLResponseAccess::GetSQLResponseItem
Return a specified number of Items from a service that represents a SQLResponse. This provides an alternative way to access SQL Response Items to the operations (GetSQLRowset,

GetSQLUpdateCount, etc) for SQLResponseAccess. The response type for each Item is obtained from the associated SQLResponseItem property.

Input
- GetSQLResponseItemRequest
    - o DataResourceAbstractName – the abstract name of the resource from which the number of items is to be obtained.
    - o DatasetFormatURI? – the format used to represent any SQLRowsets in the corresponding GetSQLResponseItemResponse.
    - o Position – the position of the first item to be returned (first item is position 0).
    - o Count? – the number of items to be returned. This is an OPTIONAL element. If the element is not present then 1 item will be returned. If the element is present and has the value 0 all items will be returned.

Output
- GetSQLResponseItemResponse
- SQLDataset+ (this element is described in Section 5.4.2).

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidDatasetFormatFault – the supplied dataset format is not known to the service.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- DatasetTooLargeFault - the size of the dataset retrieved by the operation is too large.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

In the GetSQLResponseItemResponse the response items where appropriate SHOULD be ordered as follows:
- SQLRowsets
- SQLUpdateCounts
- SQLOutputParameters
- SQLReturnValue
- SQLCommunicationsArea

as this is the order in which they are listed in the specification document. When retrieving a specific response item type (e.g. using GetSQLRowset, GetSQLUpdateCount etc.), the position and count parameters MUST use relative ordering with respect to items of that type, for example if there are the following items [Rowset1, Rowset2, UpdateCount1, UpdateCount2], the consumer should use GetUpdateCount with position=0 and count=1 to get UpdateCount1, i.e. not position=2.

6.4.3   SQLResponseAccess::GetSQLRowset

Get one or more SQLRowsets from the GetSQLRowsetResponse.

Input
- GetSQLRowsetRequest
    - o DataResourceAbstractName – abstract name of the resource from which the data is to be obtained.
    - o DatasetFormatURI? – the URI of the format of the rowset returned.
    - o Position – the position of the first item to be returned (first item is position 0).

- Count? – the number of items to be returned. This is an OPTIONAL element. If the element is not present then one item will be returned. If the element is present and has the value 0 all items will be returned.

Output
- GetSQLRowsetResponse
  - Dataset+
    - DatasetFormatURI – the URI of the format of the return rowset.
    - DatasetData – the requested SQLRowsets, e.g. WebRowset see [JSR114].

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidDatasetFormatFault – the supplied dataset format is not known to the service.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- DatasetTooLargeFault - the dataset retrieved by the operation is too large.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

6.4.4   SQLResponseAccess::GetSQLUpdateCount
Get one or more SQLUpdateCounts from the GetSQLUpdateCountResponse.

Input
- GetSQLUpdateCountRequest
  - DataResourceAbstractName – the abstract name of the resource from which the data is to be obtained.
  - Position – the position of the first item to be returned. The first item is position 0.
  - Count? – the number of items to be returned. This is an OPTIONAL element. If the element is not present then one item will be returned. If the element is present and has the value 0 all items will be returned.

Output
- GetSQLUpdateCountResponse
  - SQLUpdateCount+ – the requested SQLUpdateCounts.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

6.4.5   SQLResponseAccess::GetSQLReturnValue
Get a SQLReturnValue from the GetSQLReturnValueResponse.

Input
- GetSQLReturnValueRequest
  - Request a SQL return value.

Output
- GetSQLReturnValueResponse

    o   SQLReturnValue? – the requested SQLReturnValue.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

6.4.6 SQLResponseAccess::GetSQLOutputParameter
Get one or more SQLOutputParameters from the GetSQLOutputParameterResponse.

Input
- GetSQLOutputParameterRequest
  - DataResourceAbstractName – the abstract name of the resource from which the data is to be obtained.
  - Position – the position of the first item to be returned. The first item is position 0.
  - Count? – the number of items to be returned. This is an OPTIONAL element. If the element is not present then one item will be returned. If the element is present and has the value 0 all items will be returned.

Output
- GetSQLOutputParameterResponse
  - SQLOutputParameter+ – the requested SQLOutputParameter.
    - index – index of the parameter.
    - value – the value of the parameter.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

6.4.7 SQLResponseAccess::GetSQLCommunicationsArea
Get a SQLCommunicationsArea from the GetSQLCommunicationsAreaResponse.

Input
- GetSQLCommunicationsAreaRequest
  - DataResourceAbstractName – the abstract name of the resource from which the data is to be obtained.
  - Position – the position of the first item to be returned. The first item is position 0.
  - Count? – the number of items to be returned. This is an OPTIONAL element. If the element is not present then one item will be returned. If the element is present and has the value 0 all items will be returned.

Output
- GetSQLCommunicationsAreaResponse
  - SQLCommunicationsArea* – the requested SQLCommunicationsArea.

- SQLState – an XOPEN or SQL99 code identifying the Exception, Warning or Message.
- VendorCode – a database vendor-specific code for the Exception, Warning or Message.
- MessageText – a text description of the Exception, Warning or Message.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

6.5   SQLResponseFactory Messages

The SQLResponseFactory is used to provide access to a row set as a data resource, by way of a data access service. Again the message exchange patterns specified in the WS-DAI specification are followed. The example in **Error! Reference source not found.** presents a SQLResponseFactory interface.
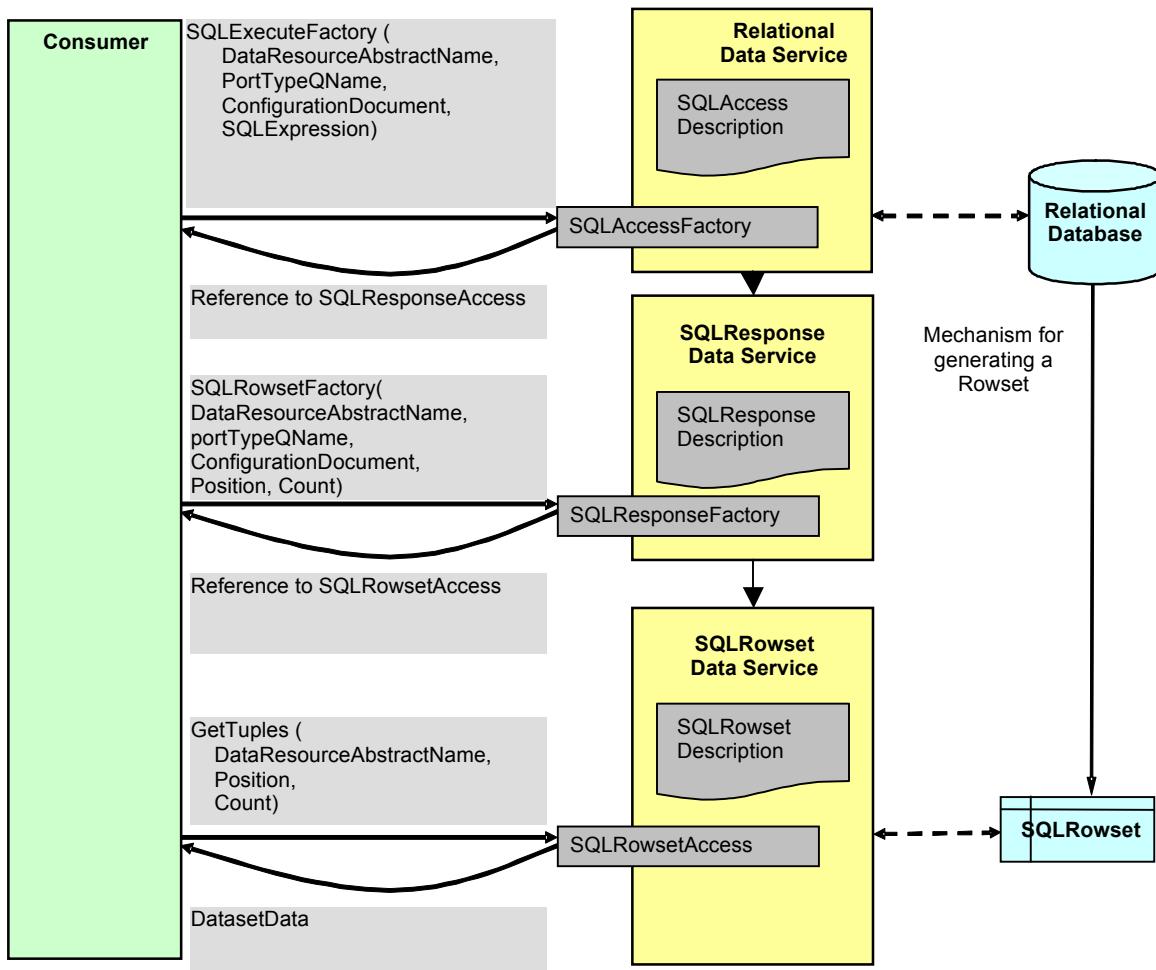
Figure 3 – Overview – SQLResponseFactory

The SQLExecuteFactory operation is used to construct the derived SQLResponse data access service, the SQLResponseFactory operation of which is in turn used to construct the derived SQLRowset data access service. This service provides access to tuples in the SQLRowset resulting from a SQLExpression against the Relational Database.

6.5.1   SQLResponseFactory::GetSQLRowsetFactory
Get a reference to a data access service that provides access to a specific rowset.

Input
- GetSQLRowsetFactoryRequest
    - DataResourceAbstractName – the abstract name of the resource the message is targeted at.
    - PortTypeQName? – the QName of the portType through which the resulting data should be accessed.
    - ConfigurationDocument? – a document that specifies the properties of the data resource that is to be used to access the data.
    - PreferredTargetService? – the EPR of the preferred service that is to act as the host for the new data resource

      o   Position – the position of the first item to be returned (first item is position 0).
      o   Count? – the number of data access service references that will be returned. This is an OPTIONAL element. If the element is not present then one reference will have been returned. If the element is present and has the value 0 all items will be returned.

Output
- GetSQLRowsetFactoryResponse
  - DataResourceAddress+ – a list of references to data access service(s) that provide access to the individual rowsets.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- InvalidPositionFault – the Position does not identify a valid item of this type.
- InvalidCountFault – the Count extends beyond the list of items of this type.
- InvalidPortTypeQName – the PortTypeQNname specified is not in the collection defined by the ConfigurationMap property.
- InvalidConfigurationDocumentFault – the ConfigurationDocument specified is not valid according to the ConfigurationDocumentQName when the ConfigurationMap is indexed by the specified PortTypeQName.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

7. SQLRowset

This section describes the messages and properties provided by WS-DAIR to support access to SQLRowset data resources.

7.1   Static SQLRowset Description

The elements defined in this section live under a SQLRowsetPropertyDocument that extends the PropertyDocument defined in the WS-DAI specification.

7.1.1   RowSchema

```
<xsd:complexType name="RowSchemaType">
  <xsd:sequence>
    <xsd:element ref="wrs:metadata"/>
  </xsd:sequence>
</xsd:complexType>

<xsd:element name="RowSchema" type="wsdairs:RowSchemaType" />
```

/wsdair: RowsetPropertyDocument/wsdair:RowSchema
      The schema of the rowset using the WebRowSet representation [JSR114].

7.1.2   NoOfRows

```
<xsd:element name="NoOfRows" type="xsd:int" />
```

/wsdair:NoOfRows
      The total number of rows in the result set.

7.2   Configurable SQLRowset Description

7.2.1   AccessMode

```
<xsd:element name="AccessMode">
  <xsd:simpleType>
    <xsd:restriction base="xsd:token">
        <xsd:enumeration value="Forward"/>
        <xsd:enumeration value="Random"/>
    </xsd:restriction>
  </xsd:simpleType>
</xsd:element>
```

/wsdair:AccessMode
   Describes whether the SQLRowset can be navigated only in a forward direction or if random
   access is supported as well.

7.3   SQLRowsetPropertyDocument

```
<xsd:complexType name="SQLRowsetPropertyDocumentType">
  <xsd:complexContent>
    <xsd:extension base="wsdai:PropertyDocumentType">
      <xsd:sequence>
        <xsd:element ref="wsdair:RowSchema" minOccurs="1" maxOccurs="1"/>
        <xsd:element ref="wsdair:NoOfRows" minOccurs="1" maxOccurs="1" />
        <xsd:element ref="wsdair:AccessMode" minOccurs="1" maxOccurs="1"/>
      </xsd:sequence>
    </xsd:extension>
  </xsd:complexContent>
</xsd:complexType>

<xsd:element name="SQLRowsetPropertyDocument"
            type="wsdair:SQLRowsetPropertyDocumentType"/>
```

/wsdair:RowsetPropertyDocument
       A structure that desribes a SQLRowset data resource, combining the properties defined
       in the WS-DAI specification with those defined earlier in this section.

7.4   Example SQLRowsetPropertyDocument

A non-normative example of a SQLRowsetPropertyDocument is shown below.

```
<wsdair:SQLRowsetPropertyDocument xmlns:...>
  <wsdai:DataResourceAbstractName>
      urn:dais:ds3
  </wsdai:DataResourceAbstractName>
  <wsdai:DataResourceManagement>ExternallyManaged</wsdai:DataResourceManagement>
  <wsdai:ParentDataResource>
    <wsa:Address>http://www.ggf.org/services/daisresponseservice</wsa:Address>
    <wsa:ReferenceParameters>
      <DataResourceAbstractName>urn:dais:ds2</DataResourceAbstractName>
    </wsa:ReferenceParameters>
  </wsdai:ParentDataResource>
  <wsdai:DatasetMap>
    <wsdai:MessageQName>wsdair:GetTuples</wsdai:MessageQName>
    <wsdai:DatasetFormatURI>http://java.sun.com/xml/ns/jdbc</wsdai:DatasetFormatURI>
  </wsdai:DatasetMap>
  <wsdai:DataResourceDescription/>
  <wsdai:Readable>true</wsdai:Readable>
  <wsdai:Writeable>true</wsdai:Writeable>
  <wsdai:ConcurrentAccess>true</wsdai:ConcurrentAccess>
  <wsdai:TransactionInitiation>NotSupported</wsdai:TransactionInitiation>
  <wsdai:TransactionIsolation>NotSupported</wsdai:TransactionIsolation>
  <wsdai:ChildSensitiveToParent>Insensitive</wsdai:ChildSensitiveToParent>
```

```
  <wsdai:ParentSensitiveToChild>Insensitive</wsdai:ParentSensitiveToChild>
  <wsdair:RowSchema>
    <wrs:metadata>
      <wrs:column-count>wrs:column-count</wrs:column-count>
      <wrs:column-definition>
        <wrs:column-index>wrs:column-index</wrs:column-index>
        <wrs:auto-increment>wrs:auto-increment</wrs:auto-increment>
        <wrs:case-sensitive>wrs:case-sensitive</wrs:case-sensitive>
        <wrs:currency>wrs:currency</wrs:currency>
        <wrs:nullable>wrs:nullable</wrs:nullable>
        <wrs:signed>wrs:signed</wrs:signed>
        <wrs:searchable>wrs:searchable</wrs:searchable>
        <wrs:column-display-size>wrs:column-display-size
        </wrs:column-display-size>
        <wrs:column-label>wrs:column-label</wrs:column-label>
        <wrs:column-name>wrs:column-name</wrs:column-name>
        <wrs:schema-name>wrs:schema-name</wrs:schema-name>
        <wrs:column-precision>wrs:column-precision</wrs:column-precision>
        <wrs:column-scale>wrs:column-scale</wrs:column-scale>
        <wrs:table-name>wrs:table-name</wrs:table-name>
        <wrs:catalog-name>wrs:catalog-name</wrs:catalog-name>
        <wrs:column-type>wrs:column-type</wrs:column-type>
        <wrs:column-type-name>wrs:column-type-name</wrs:column-type-name>
      </wrs:column-definition>
    </wrs:metadata>
  </wsdair:RowSchema>
  <wsdair:NoOfRows>10</wsdair:NoOfRows>
  <wsdair:AccessMode>Forward</wsdair:AccessMode>
</wsdair:SQLRowsetPropertyDocument>
```

7.5   SQLRowsetAccess Messages

This allows access to the underlying data row by row.

7.5.1   SQLRowsetAccess::GetSQLRowsetPropertyDocument

Allows a copy of the SQLRowsetPropertyDocument document to be retrieved.

Input
- GetSQLRowsetPropertyDocumentRequest
    - o   DataResourceAbstractName – the abstract name of the resource from which the properties are to be obtained.

Output
- GeSQLRowsetPropertyDocumentResponse
    - o   SQLRowsetPropertyDocument – the properties described in the data description section.

Faults
- InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- DataResourceUnavailableFault – the specified data resource is unavailable.
- NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

7.5.2   SQLRowsetAccess::GetTuples

Return a specified number of tuples from a service that represents a result set.

Input
- GetTuplesRequest

- o DataResourceAbstractName – the abstract name of the resource from which the data is to be obtained.
- o DatasetFormatURI? – the URI of the format of the return rowset.
- o Position – the position of the first tuple to be returned (first tuple is position 0).
- o Count? – the number of tuples. This is an OPTIONAL element. If the element is not present then a single tuple will have been returned. If the element is present and has the value 0 all items will be returned.

Output
- • GetTuplesResponse
    - o Dataset
        - ▪ DatasetFormatURI – the URI of the format of the return data.
        - ▪ DatasetData – the data to be returned, e.g. WebRowset see [JSR114].

Faults
- • InvalidResourceNameFault – the supplied data resource abstract name is not known to the service.
- • DataResourceUnavailableFault – the specified data resource is unavailable.
- • InvalidDatasetFormatFault – the supplied dataset format is not known to the service.
- • InvalidPositionFault – not a valid StartPosition; cannot start with tuple specified (out of bounds value).
- • InvalidCountFault – not a valid Count; cannot return that number of tuples.
- • DatasetTooLargeFault - the dataset retrieved by this operation is too large.
- • NotAuthorizedFault – the service-level authorization was unsuccessful, indicating that the consumer is not authorized to perform this operation at this time.
- • ServiceBusyFault – the service is already processing a request and ConcurrentAccess is false.

8. Mapping to WSDL

For a mapping to the WSDL proposal see the following sections:

- • SQLAccess
    - o XML Schema – Appendix A.1.
    - o WSDL – Appendix A.2.
- • SQLResponseAccess
    - o XML Schema – Appendix B.1.
    - o WSDL – Appendix B.2.
- • SQLRowsetAccess
    - o XML Schema – Appendix C.1.
    - o WSDL – Appendix C.2.

9. Security Considerations

The realizations of a grid data access service will use standard web service security mechanisms as specified by other standards bodies. The assumption is that these standards will also indicate how to make information related to authentication, authorization security, etc., available.

10. Conclusion

This document has provided a specialization of the interfaces defined in the *Web Services Data Access and Integration* specification [WS-DAI] to include the additional capabilities required to address relational data resources.

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[WS-DAI]
M. Antonioletti, M. Atkinson, S. Laws, S. Malaika, N. W. Paton, D. Pearson and G. Riccardi. *Web Services Data Access and Integration – The Core (WS-DAI) Specification, Version 1.0.* Proposed Recommendation, Global Grid Forum, 2006.

[WS-Security]
OASIS Web Services Security 1.0 (WS-Security 2004) standard as of April 6th 2004, http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=wss.

[OGSA Glossary]
J. Treadwell, *Open Grid Services Architecture Glossary of Terms*, Informational Document, Global Grid Forum. GFD-I.044, January 25th 2005. http://www.ggf.org/documents/GFD.44.pdf.

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[1] The JDBC™ Rowset schema can be obtained by following the URL in the reference, scrolling down on this page, selecting the "Reference Implementation" link and on this next page scrolling down to to the "JDBC Rowset Implementations 1.0.1 - Maintenance Release (July 16, 2004)", select download, download, unzip the bundle, unzip the `rowset.jar` in the bundle and the XSD file is in: `jdbc_rowset_tiger1.0.1mrel-ri/javax/sql/rowset/webrowset.xsd`.

Appendix A.1 – SQLAccess XML Schema

```xml
<?xml version="1.0" encoding="UTF-8" ?>
<xsd:schema xmlns:wrs="http://java.sun.com/xml/ns/jdbc" xmlns:wsdai="http://www.ggf.org/namespaces/2005/12/WS-DAI"
    xmlns:wsdair="http://www.ggf.org/namespaces/2005/12/WS-DAIR" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR"
    elementFormDefault="qualified">
    <xsd:import namespace="http://java.sun.com/xml/ns/jdbc" schemaLocation="webrowset-jdbc150.xsd" />
    <xsd:import namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI" schemaLocation="wsdai_core_types.xsd" />
    <!-- static properties -->
    <xsd:element name="SchemaDescription">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:any maxOccurs="unbounded" minOccurs="0" namespace="##any" processContents="lax" />
            </xsd:sequence>
        </xsd:complexType>
    </xsd:element>
    <!-- sql access -->
    <!-- general response types -->
    <xsd:element name="SQLUpdateCount" type="xsd:int" />
    <xsd:element name="SQLReturnValue" type="xsd:string" />
    <xsd:complexType name="SQLOutputParameterType">
        <xsd:sequence>
            <xsd:element name="index" type="xsd:int" />
            <xsd:element name="value" type="xsd:string" />
        </xsd:sequence>
    </xsd:complexType>
    <xsd:element name="SQLOutputParameter" type="wsdair:SQLOutputParameterType" />
    <xsd:complexType name="SQLCommunicationsAreaType">
        <xsd:sequence>
            <xsd:element name="SQLState" type="xsd:string" minOccurs="0" />
            <xsd:element name="VendorCode" type="xsd:string" minOccurs="0" />
            <xsd:element name="MessageText" type="xsd:string" minOccurs="0" />
        </xsd:sequence>
    </xsd:complexType>
    <xsd:element name="SQLCommunicationsArea" type="wsdair:SQLCommunicationsAreaType" />
    <!-- the data returned after running a SQL command -->
    <!-- any rowset data is held in the generic DatasetType base type -->
    <!-- in the format indicated by the DatasetFormatURI input parameter -->
    <xsd:complexType name="SQLDatasetType">
        <xsd:complexContent>
            <xsd:extension base="wsdai:DatasetType">
                <xsd:sequence>
                    <xsd:element ref="wsdair:SQLUpdateCount" minOccurs="0" maxOccurs="unbounded" />
                    <xsd:element ref="wsdair:SQLOutputParameter" minOccurs="0" maxOccurs="unbounded" />
                    <xsd:element ref="wsdair:SQLReturnValue" minOccurs="0" maxOccurs="1" />
                    <xsd:element ref="wsdair:SQLCommunicationsArea" minOccurs="0" maxOccurs="unbounded" />
                </xsd:sequence>
            </xsd:extension>
        </xsd:complexContent>
    </xsd:complexType>
    <xsd:element name="SQLDataset" substitutionGroup="wsdai:Dataset" type="wsdair:SQLDatasetType" />
```

```
        <!-- property and configuration documents -->
        <xsd:complexType name="SQLPropertyDocumentType">
            <xsd:complexContent>
                <xsd:extension base="wsdai:PropertyDocumentType">
                    <xsd:sequence>
                        <xsd:element ref="wsdair:SchemaDescription" />
                    </xsd:sequence>
                </xsd:extension>
            </xsd:complexContent>
        </xsd:complexType>
        <xsd:element name="SQLPropertyDocument" type="wsdair:SQLPropertyDocumentType" />
        <!-- the core configuration document is used as no extra configuration  -->
        <!-- properties are defined for SQL access -->
</xsd:schema>
```

Appendix A.2 – SQLAccess WSDL

```
<?xml version="1.0" encoding="UTF-8"?>
<wsdl:definitions xmlns:wsdai="http://www.ggf.org/namespaces/2005/12/WS-DAI"
                  xmlns:wsdair="http://www.ggf.org/namespaces/2005/12/WS-DAIR"
                  xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
                  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                  name="wsdair"
                  targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR">

<!-- XSD IMPORTS  ############################################## -->
    <xsd:include schemaLocation="wsdair_sqlresponse_types.xsd"/>
    <xsd:include schemaLocation="wsdair_sqlrowset_types.xsd"/>

<!-- WSDL IMPORTS ############################################## -->
    <wsdl:import location="wsdai_core_porttypes.wsdl" namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI"/>

<!-- WSDL TYPES ############################################## -->
    <wsdl:types>
      <xsd:schema elementFormDefault="qualified" targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR">
        <xsd:import namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI" schemaLocation="wsdai_core_types.xsd"/>
        <xsd:include schemaLocation="wsdair_sqlaccess_types.xsd"/>


    <!-- ########################### -->
    <!-- ### Common Message Types ### -->
    <!-- ########################### -->

        <!-- general request types -->
        <xsd:complexType name="SQLParameterType">
          <xsd:sequence>
            <xsd:element name="Value" type="xsd:string"/>
            <xsd:element name="Type">
              <xsd:simpleType>
                <xsd:restriction base="xsd:token">
                  <xsd:enumeration value="BIT"/>
                  <xsd:enumeration value="TINYINT"/>
                  <xsd:enumeration value="SMALLINT"/>
```

```
                <xsd:enumeration value="INTEGER"/>
                <xsd:enumeration value="BIGINT"/>
                <xsd:enumeration value="FLOAT"/>
                <xsd:enumeration value="REAL"/>
                <xsd:enumeration value="DOUBLE"/>
                <xsd:enumeration value="NUMERIC"/>
                <xsd:enumeration value="DECIMAL"/>
                <xsd:enumeration value="CHAR"/>
                <xsd:enumeration value="VARCHAR"/>
                <xsd:enumeration value="LONGVARCHAR"/>
                <xsd:enumeration value="DATE"/>
                <xsd:enumeration value="TIME"/>
                <xsd:enumeration value="TIMESTAMP"/>
                <xsd:enumeration value="BINARY"/>
                <xsd:enumeration value="VARBINARY"/>
                <xsd:enumeration value="LONGVARBINARY"/>
                <xsd:enumeration value="NULL"/>
                <xsd:enumeration value="DISTINCT"/>
                <xsd:enumeration value="STRUCT"/>
                <xsd:enumeration value="ARRAY"/>
                <xsd:enumeration value="BLOB"/>
                <xsd:enumeration value="CLOB"/>
                <xsd:enumeration value="REF"/>
                <xsd:enumeration value="DATALINK"/>
                <xsd:enumeration value="BOOLEAN"/>
              </xsd:restriction>
            </xsd:simpleType>
          </xsd:element>
          <xsd:element name="Mode">
            <xsd:simpleType>
              <xsd:restriction base="xsd:token">
                <xsd:enumeration value="IN"/>
                <xsd:enumeration value="OUT"/>
                <xsd:enumeration value="INOUT"/>
              </xsd:restriction>
            </xsd:simpleType>
          </xsd:element>
        </xsd:sequence>
    </xsd:complexType>

    <xsd:complexType name="SQLExpressionType">
      <xsd:complexContent>
        <xsd:extension base="wsdai:ExpressionType">
          <xsd:sequence>
            <xsd:element name="Expression" type="xsd:string"/>
            <xsd:element maxOccurs="unbounded" minOccurs="0" name="SQLParameter" type="wsdair:SQLParameterType"/>
          </xsd:sequence>
        </xsd:extension>
      </xsd:complexContent>
    </xsd:complexType>
    <xsd:element name="SQLExpression" type="wsdair:SQLExpressionType"/>

    <xsd:complexType name="InvalidSQLExpressionParameterFaultType"/>
```

```xml
        <xsd:element name="InvalidSQLExpressionParameterFault" type="wsdair:InvalidSQLExpressionParameterFaultType"/>

    <!-- ############################## -->
    <!-- ### sqlExecute Message Types ### -->
    <!-- ############################## -->

        <xsd:element name="SQLExecuteRequest">
          <xsd:complexType>
            <xsd:complexContent>
              <xsd:extension base="wsdai:RequestType">
                <xsd:sequence>
                  <xsd:element ref="wsdair:SQLExpression"/>
                </xsd:sequence>
              </xsd:extension>
            </xsd:complexContent>
          </xsd:complexType>
        </xsd:element>

        <xsd:element name="SQLExecuteResponse">
            <xsd:complexType>
                <xsd:sequence>
                    <xsd:element ref="wsdair:SQLDataset"/>
                </xsd:sequence>
            </xsd:complexType>
        </xsd:element>

    <!-- ################################### -->
    <!-- ### sqlExecuteFactory Message Types ### -->
    <!-- ################################### -->
        <xsd:element name="SQLExecuteFactoryRequest">
          <xsd:complexType>
            <xsd:complexContent>
              <xsd:extension base="wsdai:FactoryRequestType">
                <xsd:sequence>
                  <xsd:element ref="wsdair:SQLExpression"/>
                </xsd:sequence>
              </xsd:extension>
            </xsd:complexContent>
          </xsd:complexType>
        </xsd:element>

        <!-- assumes that these messages result in a service/resource that contains all of -->
        <!-- the possible responses from a SQL execute (rowset, count, value, parameter etc) -->
        <xsd:element name="SQLExecuteFactoryResponse" type="wsdai:DataResourceAddressListType"/>
      </xsd:schema>
  </wsdl:types>

<!-- WSDL MESSAGES ############################################### -->

    <wsdl:message name="InvalidSQLExpressionParameterFault">
    <wsdl:part name="InvalidSQLExpressionParameterFault" element="wsdair:InvalidSQLExpressionParameterFault"/>
    </wsdl:message>
```

```
    <!-- ##################################### -->
    <!-- ### GetSQLPropertyDocument Messages ### -->
    <!-- ##################################### -->
    <wsdl:message name="GetSQLPropertyDocumentRequest">
      <wsdl:part element="wsdai:GetDataResourcePropertyDocumentRequest" name="GetSQLPropertyDocumentRequest"/>
    </wsdl:message>

    <wsdl:message name="GetSQLPropertyDocumentResponse">
      <wsdl:part element="wsdair:SQLPropertyDocument" name="GetSQLPropertyDocumentResponse"/>
    </wsdl:message>

    <!-- ########################### -->
    <!-- ### sqlExecute Messages ### -->
    <!-- ########################### -->
    <wsdl:message name="SQLExecuteRequest">
        <wsdl:part element="wsdair:SQLExecuteRequest" name="SQLExecuteRequest"/>
    </wsdl:message>

    <wsdl:message name="SQLExecuteResponse">
        <wsdl:part element="wsdair:SQLExecuteResponse" name="SQLExecuteResponse"/>
    </wsdl:message>

    <!-- ################################## -->
    <!-- ### sqlExecuteFactory Messages ### -->
    <!-- ################################## -->
    <wsdl:message name="SQLExecuteFactoryRequest">
        <wsdl:part element="wsdair:SQLExecuteFactoryRequest" name="SQLExecuteFactoryRequest"/>
    </wsdl:message>

    <wsdl:message name="SQLExecuteFactoryResponse">
        <wsdl:part element="wsdair:SQLExecuteFactoryResponse" name="SQLExecuteFactoryResponse"/>
    </wsdl:message>

<!-- WSDL PORT TYPES ############################################### -->
    <wsdl:portType name="SQLAccessPT">

        <wsdl:operation name="GetSQLPropertyDocument">
          <wsdl:input message="wsdair:GetSQLPropertyDocumentRequest"/>
          <wsdl:output message="wsdair:GetSQLPropertyDocumentResponse"/>
          <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
          <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
        </wsdl:operation>

        <wsdl:operation name="SQLExecute">
            <wsdl:input message="wsdair:SQLExecuteRequest"/>
            <wsdl:output message="wsdair:SQLExecuteResponse"/>
            <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
            <wsdl:fault message="wsdai:InvalidExpressionFault" name="InvalidExpressionFault"/>
            <wsdl:fault message="wsdai:InvalidLanguageFault" name="InvalidLanguageFault" />
            <wsdl:fault message="wsdai:InvalidDatasetFormatFault" name="InvalidDatasetFormatFault"/>
            <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
```

```
            <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault" />
            <wsdl:fault message="wsdair:InvalidSQLExpressionParameterFault" name="InvalidSQLExpressionParameterFault"/>
            <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
            <wsdl:fault message="wsdai:DatasetTooLargeFault" name="DatasetTooLargeFault"/>
        </wsdl:operation>

    </wsdl:portType>


    <wsdl:portType name="SQLAccessFactoryPT">

        <wsdl:operation name="SQLExecuteFactory">
            <wsdl:input message="wsdair:SQLExecuteFactoryRequest"/>
            <wsdl:output message="wsdair:SQLExecuteFactoryResponse"/>
            <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
            <wsdl:fault message="wsdai:InvalidExpressionFault" name="InvalidExpressionFault"/>
            <wsdl:fault message="wsdai:InvalidLanguageFault" name="InvalidLanguageFault" />
            <wsdl:fault message="wsdai:InvalidPortTypeQNameFault" name="InvalidPortTypeQNameFault"/>
            <wsdl:fault message="wsdai:InvalidConfigurationDocumentFault" name="InvalidConfigurationDocumentFault"/>
            <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
            <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault" />
            <wsdl:fault message="wsdair:InvalidSQLExpressionParameterFault" name="InvalidSQLExpressionParameterFault"/>
            <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>

        </wsdl:operation>

    </wsdl:portType>
</wsdl:definitions>
```

Appendix B.1 – SQLResponse XML Schema

```
<?xml version="1.0" encoding="UTF-8" ?>
<xsd:schema xmlns:wrs="http://java.sun.com/xml/ns/jdbc" xmlns:wsdai="http://www.ggf.org/namespaces/2005/12/WS-DAI"
    xmlns:wsdair="http://www.ggf.org/namespaces/2005/12/WS-DAIR" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
    targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR"
    elementFormDefault="qualified">

    <xsd:import namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI" schemaLocation="wsdai_core_types.xsd" />
    <!-- sql response description -->
    <xsd:complexType name="SQLResponseItemType">
        <xsd:sequence>
            <xsd:element name="SequenceNumber" type="xsd:unsignedInt" />
            <xsd:element name="Name">
                <xsd:simpleType>
                    <xsd:restriction base="xsd:token">
                        <xsd:enumeration value="Rowset" />
                        <xsd:enumeration value="UpdateCount" />
                        <xsd:enumeration value="ReturnValue" />
                        <xsd:enumeration value="OutputParameter" />
                        <xsd:enumeration value="CommunicationsArea" />
                    </xsd:restriction>
                </xsd:simpleType>
            </xsd:element>
        </xsd:sequence>
```

```
            </xsd:complexType>
            <xsd:element name="SQLResponseItem" type="wsdair:SQLResponseItemType" />
            <xsd:element name="NumberOfSQLRowsets" type="xsd:unsignedInt" />
            <xsd:element name="NumberOfSQLUpdateCounts" type="xsd:unsignedInt" />
            <xsd:element name="NumberOfSQLReturnValues" type="xsd:unsignedInt" />
            <xsd:element name="NumberOfSQLOutputParameters" type="xsd:unsignedInt" />
            <xsd:element name="NumberOfSQLCommunicationsAreas" type="xsd:unsignedInt" />
            <!-- properties that describe a SQL response data service -->
            <xsd:complexType name="SQLResponsePropertyDocumentType">
                <xsd:complexContent>
                    <xsd:extension base="wsdai:PropertyDocumentType">
                        <xsd:sequence>
                            <xsd:element ref="wsdair:SQLResponseItem" minOccurs="0" maxOccurs="unbounded" />
                            <xsd:element ref="wsdair:NumberOfSQLRowsets" />
                            <xsd:element ref="wsdair:NumberOfSQLUpdateCounts" />
                            <xsd:element ref="wsdair:NumberOfSQLReturnValues" />
                            <xsd:element ref="wsdair:NumberOfSQLOutputParameters" />
                            <xsd:element ref="wsdair:NumberOfSQLCommunicationsAreas" />
                        </xsd:sequence>
                    </xsd:extension>
                </xsd:complexContent>
            </xsd:complexType>
            <xsd:element name="SQLResponsePropertyDocument" type="wsdair:SQLResponsePropertyDocumentType" />
            <!-- the core configuration document is used as no extra configuration  -->
            <!-- properties are defined for SQL response -->
</xsd:schema>
```

Appendix B.2 – SQLResponse WSDL

```
<?xml version="1.0" encoding="UTF-8"?>
<wsdl:definitions xmlns:wsdai="http://www.ggf.org/namespaces/2005/12/WS-DAI"
                  xmlns:wsdair="http://www.ggf.org/namespaces/2005/12/WS-DAIR"
                  xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
                  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                  name="wsdair"
                  targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR">

<!-- XSD IMPORTS  ############################################## -->
    <xsd:include schemaLocation="wsdair_sqlrowset_types.xsd"/>

<!-- WSDL IMPORTS ############################################## -->
    <wsdl:import location="wsdai_core_porttypes.wsdl" namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI"/>

<!-- WSDL TYPES ############################################## -->
    <wsdl:types>

      <xsd:schema elementFormDefault="qualified" targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR">
        <xsd:import namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI" schemaLocation="wsdai_core_types.xsd"/>
        <xsd:include schemaLocation="./wsdair_sqlaccess_types.xsd"/>
        <xsd:include schemaLocation="./wsdair_sqlresponse_types.xsd"/>

        <xsd:complexType name="InvalidPositionFaultType"/>
        <xsd:element name="InvalidPositionFault" type="wsdair:InvalidPositionFaultType"/>
```

```xml
    <xsd:complexType name="InvalidCountFaultType"/>
    <xsd:element name="InvalidCountFault" type="wsdair:InvalidCountFaultType"/>

<!-- ####################################### -->
<!-- ### GetSQLResponseItem Message Types ### -->
<!-- ####################################### -->
    <xsd:element name="GetSQLResponseItemRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:RequestType">
            <xsd:sequence>
              <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
              <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
            </xsd:sequence>
          </xsd:extension>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLResponseItemResponse">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element maxOccurs="unbounded" minOccurs="1" ref="wsdair:SQLDataset"/>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>

<!-- ################################## -->
<!-- ### GetSQLRowset Message Types ### -->
<!-- ################################## -->
    <xsd:element name="GetSQLRowsetRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:RequestType">
            <xsd:sequence>
              <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
              <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
            </xsd:sequence>
          </xsd:extension>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLRowsetResponse">
      <xsd:complexType>
        <xsd:sequence>
          <xsd:element maxOccurs="unbounded" minOccurs="1" ref="wsdai:Dataset"/>
        </xsd:sequence>
      </xsd:complexType>
    </xsd:element>

<!-- ####################################### -->
```

```
<!-- ### GetSQLRowsetFactory Message Types ### -->
<!-- #################################### -->
    <xsd:element name="GetSQLRowsetFactoryRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:FactoryRequestType">
            <xsd:sequence>
              <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
              <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
            </xsd:sequence>
          </xsd:extension>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLRowsetFactoryResponse" type="wsdai:DataResourceAddressListType"/>

<!-- #################################### -->
<!-- ### GetSQLUpdateCount Message Types ### -->
<!-- #################################### -->
    <xsd:element name="GetSQLUpdateCountRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:BaseRequestType">
            <xsd:sequence>
              <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
              <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
            </xsd:sequence>
          </xsd:extension>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLUpdateCountResponse">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element maxOccurs="unbounded" minOccurs="1" name="UpdateCount" type="xsd:int"/>
            </xsd:sequence>
        </xsd:complexType>
    </xsd:element>

<!-- #################################### -->
<!-- ### GetSQLReturnValue Message Types ### -->
<!-- #################################### -->
    <xsd:element name="GetSQLReturnValueRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:BaseRequestType"/>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLReturnValueResponse">
```

```
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element maxOccurs="1" minOccurs="0" name="ReturnValue" type="xsd:string"/>
            </xsd:sequence>
        </xsd:complexType>
    </xsd:element>

<!-- ######################################### -->
<!-- ### GetSQLOutputParameter Message Types ### -->
<!-- ######################################### -->
    <xsd:element name="GetSQLOutputParameterRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:BaseRequestType">
            <xsd:sequence>
              <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
              <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
            </xsd:sequence>
          </xsd:extension>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLOutputParameterResponse">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element maxOccurs="unbounded" minOccurs="1" ref="wsdair:SQLOutputParameter"/>
            </xsd:sequence>
        </xsd:complexType>
    </xsd:element>

<!-- ############################################# -->
<!-- ### GetSQLCommunicationsArea Message Types ### -->
<!-- ############################################# -->
    <xsd:element name="GetSQLCommunicationsAreaRequest">
      <xsd:complexType>
        <xsd:complexContent>
          <xsd:extension base="wsdai:BaseRequestType">
            <xsd:sequence>
              <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
              <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
            </xsd:sequence>
          </xsd:extension>
        </xsd:complexContent>
      </xsd:complexType>
    </xsd:element>

    <xsd:element name="GetSQLCommunicationsAreaResponse">
        <xsd:complexType>
            <xsd:sequence>
                <xsd:element maxOccurs="unbounded" minOccurs="0" ref="wsdair:SQLCommunicationsArea"/>
            </xsd:sequence>
        </xsd:complexType>
```

```
        </xsd:element>

      </xsd:schema>
    </wsdl:types>

<!-- WSDL MESSAGES ########################################### -->

    <wsdl:message name="InvalidPositionFault">
      <wsdl:part name="InvalidPositionFault"
                 element="wsdair:InvalidPositionFault"/>
    </wsdl:message>

    <wsdl:message name="InvalidCountFault">
      <wsdl:part name="InvalidCountFault"
                 element="wsdair:InvalidCountFault"/>
    </wsdl:message>

    <!-- ############################################# -->
    <!-- ### GetSQLResponsePropertyDocument Messages ### -->
    <!-- ############################################# -->
    <wsdl:message name="GetSQLResponsePropertyDocumentRequest">
      <wsdl:part element="wsdai:GetDataResourcePropertyDocumentRequest" name="GetSQLResponsePropertyDocumentRequest"/>
    </wsdl:message>

    <wsdl:message name="GetSQLResponsePropertyDocumentResponse">
      <wsdl:part element="wsdair:SQLResponsePropertyDocument" name="GetSQLResponsePropertyDocumentResponse"/>
    </wsdl:message>

    <!-- ################################## -->
    <!-- ### GetSQLResponseItem Messages ### -->
    <!-- ################################## -->
    <wsdl:message name="GetSQLResponseItemRequest">
        <wsdl:part element="wsdair:GetSQLResponseItemRequest" name="GetSQLResponseItemRequest"/>
    </wsdl:message>

    <wsdl:message name="GetSQLResponseItemResponse">
        <wsdl:part element="wsdair:GetSQLResponseItemResponse" name="GetSQLResponseItemResponse"/>
    </wsdl:message>

    <!-- ############################ -->
    <!-- ### GetSQLRowset Messages ### -->
    <!-- ############################ -->
    <wsdl:message name="GetSQLRowsetRequest">
        <wsdl:part element="wsdair:GetSQLRowsetRequest" name="GetSQLRowsetRequest"/>
    </wsdl:message>

    <wsdl:message name="GetSQLRowsetResponse">
        <wsdl:part element="wsdair:GetSQLRowsetResponse" name="GetSQLRowsetResponse"/>
    </wsdl:message>

    <!-- ################################### -->
    <!-- ### GetSQLRowsetFactory Messages ### -->
    <!-- ################################### -->
```

```
<wsdl:message name="GetSQLRowsetFactoryRequest">
    <wsdl:part element="wsdair:GetSQLRowsetFactoryRequest" name="GetSQLRowsetFactoryRequest"/>
</wsdl:message>

<wsdl:message name="GetSQLRowsetFactoryResponse">
    <wsdl:part element="wsdair:GetSQLRowsetFactoryResponse" name="GetSQLRowsetFactoryResponse"/>
</wsdl:message>

<!-- ################################### -->
<!-- ### GetSQLUpdateCount Messages   ### -->
<!-- ################################### -->
<wsdl:message name="GetSQLUpdateCountRequest">
    <wsdl:part element="wsdair:GetSQLUpdateCountRequest" name="GetSQLUpdateCountRequest"/>
</wsdl:message>

<wsdl:message name="GetSQLUpdateCountResponse">
    <wsdl:part element="wsdair:GetSQLUpdateCountResponse" name="GetSQLUpdateCountResponse"/>
</wsdl:message>

<!-- ################################### -->
<!-- ### GetSQLReturnValue Messages   ### -->
<!-- ################################### -->
<wsdl:message name="GetSQLReturnValueRequest">
    <wsdl:part element="wsdair:GetSQLReturnValueRequest" name="GetSQLReturnValueRequest"/>
</wsdl:message>

<wsdl:message name="GetSQLReturnValueResponse">
    <wsdl:part element="wsdair:GetSQLReturnValueResponse" name="GetSQLReturnValueResponse"/>
</wsdl:message>

<!-- ###################################### -->
<!-- ### GetSQLOutputParameter Messages   ### -->
<!-- ###################################### -->
<wsdl:message name="GetSQLOutputParameterRequest">
    <wsdl:part element="wsdair:GetSQLOutputParameterRequest" name="GetSQLOutputParameterRequest"/>
</wsdl:message>

<wsdl:message name="GetSQLOutputParameterResponse">
    <wsdl:part element="wsdair:GetSQLOutputParameterResponse" name="GetSQLOutputParameterResponse"/>
</wsdl:message>

<!-- ########################################## -->
<!-- ### GetSQLCommunicationsArea Messages   ### -->
<!-- ########################################## -->
<wsdl:message name="GetSQLCommunicationsAreaRequest">
    <wsdl:part element="wsdair:GetSQLCommunicationsAreaRequest" name="GetSQLCommunicationsAreaRequest"/>
</wsdl:message>

<wsdl:message name="GetSQLCommunicationsAreaResponse">
    <wsdl:part element="wsdair:GetSQLCommunicationsAreaResponse" name="GetSQLCommunicationsAreaResponse"/>
</wsdl:message>

<!-- WSDL PORT TYPES ############################################### -->
```

```
<wsdl:portType name="SQLResponsePT">

    <wsdl:operation name="GetSQLResponsePropertyDocument">
      <wsdl:input message="wsdair:GetSQLResponsePropertyDocumentRequest"/>
      <wsdl:output message="wsdair:GetSQLResponsePropertyDocumentResponse"/>
      <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
      <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
      <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
      <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
    </wsdl:operation>

    <wsdl:operation name="GetSQLResponseItem">
      <wsdl:input message="wsdair:GetSQLResponseItemRequest"/>
      <wsdl:output message="wsdair:GetSQLResponseItemResponse"/>
      <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
      <wsdl:fault message="wsdai:InvalidDatasetFormatFault" name="InvalidDatasetFormatFault"/>
      <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
      <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
      <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
      <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
      <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
      <wsdl:fault message="wsdai:DatasetTooLargeFault" name="DatasetTooLargeFault"/>
    </wsdl:operation>

    <wsdl:operation name="GetSQLRowset">
      <wsdl:input message="wsdair:GetSQLRowsetRequest"/>
      <wsdl:output message="wsdair:GetSQLRowsetResponse"/>
      <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
      <wsdl:fault message="wsdai:InvalidDatasetFormatFault" name="InvalidDatasetFormatFault"/>
      <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
      <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
      <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
      <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
      <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
      <wsdl:fault message="wsdai:DatasetTooLargeFault" name="DatasetTooLargeFault"/>          </wsdl:operation>

    <wsdl:operation name="GetSQLUpdateCount">
      <wsdl:input message="wsdair:GetSQLUpdateCountRequest"/>
      <wsdl:output message="wsdair:GetSQLUpdateCountResponse"/>
      <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
      <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
      <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
      <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
      <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
      <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
    </wsdl:operation>

    <wsdl:operation name="GetSQLReturnValue">
      <wsdl:input message="wsdair:GetSQLReturnValueRequest"/>
      <wsdl:output message="wsdair:GetSQLReturnValueResponse"/>
      <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
      <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
      <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
```

```
          <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
      </wsdl:operation>

      <wsdl:operation name="GetSQLOutputParameter">
          <wsdl:input message="wsdair:GetSQLOutputParameterRequest"/>
          <wsdl:output message="wsdair:GetSQLOutputParameterResponse"/>
          <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
          <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
          <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
          <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
      </wsdl:operation>

      <wsdl:operation name="GetSQLCommunicationsArea">
          <wsdl:input message="wsdair:GetSQLCommunicationsAreaRequest"/>
          <wsdl:output message="wsdair:GetSQLCommunicationsAreaResponse"/>
          <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
          <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
          <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
          <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
      </wsdl:operation>

   </wsdl:portType>

   <wsdl:portType name="SQLResponseFactoryPT">

      <wsdl:operation name="GetSQLRowsetFactory">
          <wsdl:input message="wsdair:GetSQLRowsetFactoryRequest"/>
          <wsdl:output message="wsdair:GetSQLRowsetFactoryResponse"/>
          <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
          <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
          <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
          <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
          <wsdl:fault message="wsdai:InvalidPortTypeQNameFault" name="InvalidPortTypeQNameFault"/>
          <wsdl:fault message="wsdai:InvalidConfigurationDocumentFault" name="InvalidConfigurationDocumentFault"/>
      </wsdl:operation>

   </wsdl:portType>

</wsdl:definitions>
```

Appendix C.1 – SQLRowsetAccess XML Schema

```
<?xml version="1.0" encoding="UTF-8" ?>
<xsd:schema xmlns:wrs="http://java.sun.com/xml/ns/jdbc" xmlns:wsdai="http://www.ggf.org/namespaces/2005/12/WS-DAI"
    xmlns:wsdair="http://www.ggf.org/namespaces/2005/12/WS-DAIR" xmlns:xsd="http://www.w3.org/2001/XMLSchema"
```

```
        targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR"
        elementFormDefault="qualified">

    <xsd:import namespace="http://java.sun.com/xml/ns/jdbc" schemaLocation="webrowset-jdbc150.xsd" />
    <xsd:import namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI" schemaLocation="wsdai_core_types.xsd" />
    <!-- rowset description -->
    <xsd:complexType name="RowSchemaType">
        <xsd:sequence>
            <xsd:element ref="wrs:metadata" />
        </xsd:sequence>
    </xsd:complexType>
    <xsd:element name="RowSchema" type="wsdair:RowSchemaType" />
    <xsd:element name="NoOfRows" type="xsd:int" />
    <!-- rowset access -->
    <xsd:element name="AccessMode">
        <xsd:simpleType>
            <xsd:restriction base="xsd:token">
                <xsd:enumeration value="Forward" />
                <xsd:enumeration value="Random" />
            </xsd:restriction>
        </xsd:simpleType>
    </xsd:element>
    <!-- the properties that describe a rowsetservice -->
    <xsd:complexType name="SQLRowsetPropertyDocumentType">
        <xsd:complexContent>
            <xsd:extension base="wsdai:PropertyDocumentType">
                <xsd:sequence>
                    <xsd:element maxOccurs="1" minOccurs="1" ref="wsdair:RowSchema" />
                    <xsd:element maxOccurs="1" minOccurs="1" ref="wsdair:NoOfRows" />
                    <xsd:element maxOccurs="1" minOccurs="1" ref="wsdair:AccessMode" />
                </xsd:sequence>
            </xsd:extension>
        </xsd:complexContent>
    </xsd:complexType>
    <xsd:element name="SQLRowsetPropertyDocument" type="wsdair:SQLRowsetPropertyDocumentType" />
    <!-- the properties used to configure a sql rowset data resource -->
    <xsd:complexType name="SQLRowsetConfigurationDocumentType">
        <xsd:complexContent>
            <xsd:extension base="wsdai:ConfigurationDocumentType">
                <xsd:sequence>
                    <xsd:element maxOccurs="1" minOccurs="0" ref="wsdair:AccessMode" />
                </xsd:sequence>
            </xsd:extension>
        </xsd:complexContent>
    </xsd:complexType>
    <xsd:element name="SQLRowsetConfigurationDocument" substitutionGroup="wsdai:ConfigurationDocument"
        type="wsdair:SQLRowsetConfigurationDocumentType" />
</xsd:schema>
```

Appendix C.2 – SQLRowsetAccess WSDL

```
<?xml version="1.0" encoding="UTF-8"?>
<wsdl:definitions xmlns:wsdai="http://www.ggf.org/namespaces/2005/12/WS-DAI"
```

```
                    xmlns:wsdair="http://www.ggf.org/namespaces/2005/12/WS-DAIR"
                    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/"
                    xmlns:xsd="http://www.w3.org/2001/XMLSchema"
                    name="wsdair"
                    targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR">

<!-- WSDL IMPORTS ############################################# -->
    <wsdl:import location="wsdai_core_porttypes.wsdl" namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI"/>

<!-- WSDL TYPES ############################################### -->
    <wsdl:types>
      <xsd:schema elementFormDefault="qualified" targetNamespace="http://www.ggf.org/namespaces/2005/12/WS-DAIR">
        <xsd:import namespace="http://www.ggf.org/namespaces/2005/12/WS-DAI" schemaLocation="wsdai_core_types.xsd"/>
        <xsd:include schemaLocation="./wsdair_sqlaccess_types.xsd"/>
        <xsd:include schemaLocation="wsdair_sqlrowset_types.xsd"/>

        <xsd:complexType name="InvalidPositionFaultType"/>
        <xsd:element name="InvalidPositionFault" type="wsdair:InvalidPositionFaultType"/>

        <xsd:complexType name="InvalidCountFaultType"/>
        <xsd:element name="InvalidCountFault" type="wsdair:InvalidCountFaultType"/>

    <!-- ############################### -->
    <!-- ### GetTuples Message Types ### -->
    <!-- ############################### -->
        <xsd:element name="GetTuplesRequest">
          <xsd:complexType>
            <xsd:complexContent>
              <xsd:extension base="wsdai:RequestType">
                <xsd:sequence>
                  <xsd:element maxOccurs="1" minOccurs="1" name="Position" type="xsd:unsignedInt"/>
                  <xsd:element maxOccurs="1" minOccurs="0" name="Count" type="xsd:unsignedInt"/>
                </xsd:sequence>
              </xsd:extension>
            </xsd:complexContent>
          </xsd:complexType>
        </xsd:element>

        <xsd:element name="GetTuplesResponse">
            <xsd:complexType>
                <xsd:sequence>
                    <xsd:element maxOccurs="1" minOccurs="1" ref="wsdai:Dataset"/>
                </xsd:sequence>
            </xsd:complexType>
        </xsd:element>

      </xsd:schema>
    </wsdl:types>

<!-- WSDL MESSAGES ############################################# -->
```

```
    <wsdl:message name="InvalidPositionFault">
      <wsdl:part name="InvalidPositionFault"
                 element="wsdair:InvalidPositionFault"/>
    </wsdl:message>

    <wsdl:message name="InvalidCountFault">
      <wsdl:part name="InvalidCountFault"
                 element="wsdair:InvalidCountFault"/>
    </wsdl:message>

    <!-- ###################################### -->
    <!-- ### GetRowsetPropertyDocument Messages ### -->
    <!-- ###################################### -->
    <wsdl:message name="GetSQLRowsetPropertyDocumentRequest">
      <wsdl:part element="wsdai:GetDataResourcePropertyDocumentRequest" name="GetSQLRowsetPropertyDocumentRequest"/>
    </wsdl:message>

    <wsdl:message name="GetSQLRowsetPropertyDocumentResponse">
      <wsdl:part element="wsdair:SQLRowsetPropertyDocument" name="GetSQLRowsetPropertyDocumentResponse"/>
    </wsdl:message>

    <!-- ######################### -->
    <!-- ### GetTuples Messages ### -->
    <!-- ######################### -->
    <wsdl:message name="GetTuplesRequest">
        <wsdl:part element="wsdair:GetTuplesRequest" name="GetTuplesRequest"/>
    </wsdl:message>

    <wsdl:message name="GetTuplesResponse">
        <wsdl:part element="wsdair:GetTuplesResponse" name="GetTuplesResponse"/>
    </wsdl:message>

<!-- WSDL PORT TYPES ############################################# -->
    <wsdl:portType name="SQLRowsetPT">

        <wsdl:operation name="GetSQLRowsetPropertyDocument">
          <wsdl:input message="wsdair:GetSQLRowsetPropertyDocumentRequest"/>
          <wsdl:output message="wsdair:GetSQLRowsetPropertyDocumentResponse"/>
          <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
          <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
        </wsdl:operation>

        <wsdl:operation name="GetTuples">
          <wsdl:input message="wsdair:GetTuplesRequest"/>
          <wsdl:output message="wsdair:GetTuplesResponse"/>
          <wsdl:fault message="wsdai:InvalidResourceNameFault" name="InvalidResourceNameFault"/>
          <wsdl:fault message="wsdai:NotAuthorizedFault" name="NotAuthorizedFault"/>
          <wsdl:fault message="wsdai:ServiceBusyFault" name="ServiceBusyFault"/>
          <wsdl:fault message="wsdai:DataResourceUnavailableFault" name="DataResourceUnavailableFault"/>
          <wsdl:fault message="wsdair:InvalidPositionFault" name="InvalidPositionFault"/>
          <wsdl:fault message="wsdair:InvalidCountFault" name="InvalidCountFault"/>
```

```
            <wsdl:fault message="wsdai:InvalidDatasetFormatFault" name="InvalidDatasetFormatFault"/>
            <wsdl:fault message="wsdai:DatasetTooLargeFault" name="DatasetTooLargeFault"/>
        </wsdl:operation>

    </wsdl:portType>

</wsdl:definitions>
```