Teiid - Scalable Information Integration

1

Teiid Client Developer's Guide

7.7

Connecting to Teiid Server

The Teiid JDBC API provides Java Database Connectivity (JDBC) access to any Virtual Database (VDB) deployed on a Teiid Server. The Teiid JDBC API is compatible with the JDBC 4.0 specification; however, it does not fully support all *methods*. Advanced features, such as updatable result sets or SQL3 data types, are not supported.

Java client applications connecting to a Teiid Server will need to use Java 1.6 JDK. Previous versions of Java are not supported.

Before you can connect to the Teiid Server using the Teiid JDBC API, please do following tasks first.

1. Install the Teiid Server. See the "Admin Guide" for instructions.
2. Build a Virtual Database (VDB). You can either build a "Dynamic VDB" (Designer not required), or you can use the Eclipse based GUI tool *Designer* [http://www.jboss.org/teiiddesigner.html]. Check the "Reference Guide" for instructions on how to build a VDB. If you do not know what VDB is, then start with this *document* [http://www.jboss.org/teiid/basics/virtualdatabases.html].
3. Deploy the VDB into Teiid Server. Check "Admin Guide" for instructions.
4. Start the Teiid Server (JBoss AS), if it is not already running.

Now that you have the VDB deployed in the Teiid Server, client applications can connect to the Teiid Server and issue SQL queries against deployed VDB using Teiid's JDBC API. If you are new to JDBC, see Java's documentation about *JDBC* [http://java.sun.com/docs/books/tutorial/jdbc/index.html]. Teiid ships with `teiid-7.7-client.jar` in the `"jboss-install/server/<profile>/lib"` directory.

Main classes in the client JAR:

- `org.teiid.jdbc.TeiidDriver` - allows JDBC connections using the *DriverManager* [http://java.sun.com/javase/6/docs/api/java/sql/DriverManager.html] class.
- `org.teiid.jdbc.TeiidDatasource` - allows JDBC connections using the *DataSource* [http://java.sun.com/javase/6/docs/api/javax/sql/DataSource.html] or *XADataSource* [http://java.sun.com/javase/6/docs/api/javax/sql/XADataSource.html] class. You should use this class to create managed or XA connections.

Once you have established a connection with the Teiid Server, you can use standard JDBC API classes to interrogate metadata and execute queries.

1.1. Driver Connection

Use `org.teiid.jdbc.TeiidDriver` as the driver class.

Use the following URL format for JDBC connections:

```
jdbc:teiid:<vdb-name>@mm[s]://<host>:<port>;[prop-name=prop-value;]*
```

URL Components

1. <vdb-name> - Name of the VDB you are connecting to. Optionally VDB name can also contain version information inside it. For example: "myvdb.2", this is equivalent to supplying the "version=2" connection property defined below. However, use of vdb name in this format and the "version" property at the same time is not allowed.

2. mm - defines Teiid JDBC protocol, mms defines a secure channel (see the *SSL chapter* for more)

3. <host> - defines the server where the Teiid Server is installed. If you are using IPv6 binding address as the host name, place it in square brackets. ex:[::1]

4. <port> - defines the port on which the Teiid Server is listening for incoming JDBC connections.

5. [prop-name=prop-value] - additionally you can supply any number of name value pairs separated by semi-colon [;]. All supported URL properties are defined in the *connection properties section*. Property values should be URL encoded if they contain reserved characters, e.g. ('?', '=', ';', etc.)

1.1.1. URL Connection Properties

The following table shows all the supported connection properties that can used with Teiid JDBC Driver URL connection string, or on the Teiid JDBC Data Source class.

Table 1.1. Connection Properties

Property Name	Type	Description
`ApplicationName`	`String`	Name of the client application; allows the administrator to identify the connections
`FetchSize`	`int`	Size of the resultset; The default size if 500. <=0 indicates that the default should be used.
`partialResultsMode`	`boolean`	Enable/disable support partial results mode. Default false. See the *partial results* section.
`autoCommitTxn`	`String`	Only applies only when "autoCommit" is set to "true". This determines how a executed command needs to be transactionally wrapped inside the Teiid engine to maintain the data integrity. • ON - Always wrap command in distributed transaction • OFF - Never wrap command in distributed transaction

Property Name	Type	Description
		• DETECT (default)- If the executed command is spanning more than one source it automatically uses distributed transaction. *Transactions with JDBC* for more information.
`disableLocalTxn`	`boolean`	If "true", the autoCommit setting, commit and rollback will be ignored for local transactions. Default false.
`user`	`String`	User name
`Password`	`String`	Credential for user
`ansiQuotedIdentifiers`	`boolean`	Sets the parsing behavior for double quoted entries in SQL. The default, true, parses dobuled quoted entries as identifiers. If set to false, then double quoted values that are valid string literals will be parsed as string literals.
`version`	`integer`	Version number of the VDB
`resultSetCacheMode`	`boolean`	ResultSet caching is turned on/off. Default false.
`autoFailover`	`boolean`	If true, will automatically select a new server instance after a communication exception. Default false. This is typically not needed when connections are managed, as the connection can be purged from the pool.
`SHOWPLAN`	`String`	(typically not set as a connection property) Can be ON|OFF|DEBUG; ON returns the query plan along with the results and DEBUG additionally prints the query planner debug information in the log and returns it with the results. Both the plan and the log are available through JDBC API extensions. Default OFF.
`NoExec`	`String`	(typically not set as a connection property) Can be ON|OFF; ON prevents query execution, but parsing and planning will still occur. Default OFF.
`PassthroughAuthentication`	`boolean`	Only applies to "local" connections. When this option is set to "true", then Teiid looks for already authenticated security context on the calling thread. If one found it uses that users credentials to create session. Teiid also verifies that the same user is using this connection during the life of the connection. if it finds a different security context on the calling thread, it switches the identity on the connection, if the new user is also eligible to log in to Teiid otherwise connection fails to execute.
`useCallingThread`	`boolean`	Only applies to "local" connections. When this option is set to "true" (the default), then the calling thread will be

Property Name	Type	Description
		used to process the query. If false, then an engine thread will be used.
`QueryTimeout`	`integer`	Default query timeout in seconds. Must be >= 0. 0 indicates no timeout. Can be overriden by `Statement.setQueryTimeout`. Default 0.
`useJDBC4ColumnNameAndLabelSemantics`	`boolean`	A change was made in JDBC4 to return unaliased column names as the ResultSetMetadata column name. Prior to this, if a column alias were used it was returned as the column name. Setting this property to false will enable backwards compatibility when JDBC3 and older support is still required. Defaults to true.
`jaasName`	`String`	JAAS configuration name. Only applies when configuring a GSS authentication. See the Admin Guide for configuration required for GSS.
`kerberosServicePrincipleName`	`String`	Kerberos authenticated principle name. Only applies when configuring a GSS authentication. See the Admin Guide for configuration required for GSS

1.2. Datasource Connection

To use a data source based connection, use `org.teiid.jdbc.TeiidDataSource` as the data source class. The `TeiidDataSource` is also an XADatasource. Teiid DataSource class is also Serializable, so it possible for it to be used with JNDI naming services.

Note

Teiid supports the XA protocol, XA transactions will be extended to Teiid sources that also support XA.

All the properties (except for version, which is known on TeiidDataSource as DatabaseVersion) defined in the *connection properties*have corresponding "set" methods on the `org.teiid.jdbc.TeiidDataSource`. Properties that are assumed from the URL string have addtional "set" methods, which are described in the following table.

Table 1.2. Datasource Properties

Property Name	Type	Description
`DatabaseName`	`String`	The name of a virtual database (VDB) deployed to Teiid. Optionally Database name can also contain "DatabaseVersion" information inside it. For example: "myvdb.2", this is equivalent to supplying the

Property Name	Type	Description
		"DatabaseVersion" property set to value of 2. However, use of Database name in this format and use of DatabaseVersion property at the same time is not allowed.
`ServerName`	`String`	Server hostname where the Teiid runtime installed. If you are using IPv6 binding address as the host name, place it in square brackets. ex:[::1]
`AlternateServers`	`String`	Optional delimited list of host:port entries. See the *multiple hosts* section for more information. If you are using IPv6 binding address as the host name, place them in square brackets. ex:[::1]
`AdditionalProperties`	`String`	Optional setting of properties that has the same format as the property string in a connection URL.
`PortNumber`	`integer`	Port number on which the Server process is listening on.
`secure`	`boolean`	Secure connection. Flag to indicate to use SSL (mms) based connection between client and server
`DatabaseVersion`	`integer`	VDB version
`DataSourceName`	`String`	Name given to this data source

1.3. Standalone Application

To use either Driver or DataSource based connections, add the client JAR to your Java client application's classpath. See the simple client example in the kit for a full Java sample of the following.

1.3.1. Driver Connection

Sample Code:

```
public class TeiidClient {
    public Connection getConnection(String user, String password) throws Exception {
        String url = "jdbc:teiid:myVDB@mm://localhost:31000;ApplicationName=myApp";
        return DriverManager.getConnection(url, user, password);
    }
}
```

1.3.2. Datasource Connection

Sample Code:

```
public class TeiidClient {
    public Connection getConnection(String user, String password) throws Exception {
        TeiidDataSource ds = new TeiidDataSource();
        ds.setUser(user);
        ds.setPassword(password);
        ds.setServerName("localhost");
        ds.setPortNumber(31000);
        ds.setDatabaseName("myVDB");
        return ds.getConnection();
    }
}
```

1.4. JBoss AS Data Source

Teiid can be configured as a JDBC data source in the JBoss Application Server to be accessed from JNDI or injected into your JEE applications. Deploying Teiid as data source in JBoss AS is exactly same as deploying any other RDBMS resources like Oracle or DB2.

Defining as data source is not limited to JBoss AS, you can also deploy as data source in Glassfish, Tomcat, Websphere, Weblogic etc servers, however their configuration files are different than JBoss AS. Consult the respective documentation of the environment in which you are deploying.

A special case is if the Teiid instance you are connecting to is in the same VM as the JBoss AS instance. If that matches you deployment, then follow the *Section 1.4.3, “Local JDBC Connection”* instructions

Installation Steps

1. If Teiid is not installed in the AS instance, copy the `teiid-7.7-client.jar` into `<jboss-install>/server/<profile>/lib` directory.
2. Create a "<datasource name>-ds.xml" file in `<jboss-install>/server/<profile>/deploy` directory. Based on the type of deployment (XA, driver, or local), the contents of the file will be different. See the following sections for more.

The data source will then be accessable through the JNDI name specified in the -ds.xml file.

1.4.1. DataSource Connection

Make sure you know the correct DatabaseName, ServerName, Port number and credentials that are specific to your deployment environment.

Example 1.1. Sample XADataSource in the JBoss AS using the Teiid DataSource class `org.teiid.jdbc.TeiidDataSource`

```
<datasources>
  <xa-datasource>
    <jndi-name>TEIID-DS</jndi-name>
    <xa-datasource-class>org.teiid.jdbc.TeiidDataSource</xa-datasource-class>
    <xa-datasource-property name="DatabaseName">myVDB</xa-datasource-property>
    <xa-datasource-property name="serverName">localhost</xa-datasource-property>
    <xa-datasource-property name="portNumber">31000</xa-datasource-property>
    <xa-datasource-property name="user">admin</xa-datasource-property>
    <xa-datasource-property name="password">password</xa-datasource-property>

    <!-- pool and other JBoss datasource properties -->
    <check-valid-connection-sql>SELECT 1</check-valid-connection-sql>
    <min-pool-size>5</min-pool-size>
    <max-pool-size>10</max-pool-size>
  </xa-datasource>
</datasources>
```

1.4.2. Driver based connection

You can also use Teiid's JDBC driver class `org.teiid.jdbc.TeiidDriver` to create a data source

```
<datasources>
  <local-tx-datasource>
    <jndi-name>TEIID-DS</jndi-name>
    <connection-url>jdbc:teiid:myVDB@mm://localhost:31000</connection-url>
    <driver-class>org.teiid.jdbc.TeiidDriver</driver-class>
    <user-name>admin</user-name>
    <password>teiid</password>

    <!-- pool and other JBoss datasource properties -->
    <check-valid-connection-sql>SELECT 1</check-valid-connection-sql>
    <min-pool-size>5</min-pool-size>
    <max-pool-size>10</max-pool-size>
  </local-tx-datasource>
</datasources>
```

1.4.3. Local JDBC Connection

If you are deploying your client application on the same JBoss AS instance as the Teiid runtime is installed, then there is a way to make connections that by-pass making a socket based JDBC connection. You can use slightly modified data source configuration to make a "local" connection, where the JDBC API will lookup a local Teiid runtime in the same VM.

Warning

Since DataSources start before before Teiid VDBs are deployed, leave the min pool size of local connections as the default of 0. Otherwise errors will occur on the startup of the Teiid DataSource.

Note

By default local connections use their calling thread to perform processing operations rather than using an engine thread while the calling thread is blocked. To disable this behavior set the connection property useCallingThreads=false.

Example 1.2. Local data source

```
<datasources>
  <xa-datasource>
    <jndi-name>TEIID-DS</jndi-name>
    <xa-datasource-class>org.teiid.jdbc.TeiidDataSource</xa-datasource-class>
    <xa-datasource-property name="DatabaseName">myVDB</xa-datasource-property>
    <xa-datasource-property name="user">admin</xa-datasource-property>
    <xa-datasource-property name="password">password</xa-datasource-property>

    <!-- pool and other JBoss datasource properties -->
    <max-pool-size>10</max-pool-size>
  </xa-datasource>
</datasources>
```

This is essentially the same as the XA configuration, but "ServerName" and "PortNumber" are not specified. Local connections have additional features such as using ???

1.5. Using Multiple Hosts

A group of Teiid Servers in the same JBoss AS cluster may be connected using failover and load-balancing features. To enable theses features in their simplest form, the client needs to specify multiple host name and port number combinations on the URL connection string.

Example 1.3. Example URL connection string

```
jdbc:teiid:&lt;vdb-name&gt;@mm://host1:31000,host1:31001,host2:31000;version=2
```

If you are using a DataSource to connect to Teiid Server, use the "AlternateServers" property/ method to define the failover servers. The format is also a comma separated list of host:port combinations.

The client will randomly pick one the Teiid server from the list and establish a session with that server. If that server cannot be contacted, then a connection will be attempted to each of the remaining servers in random order. This allows for both connection time fail-over and random server selection load balancing.

1.5.1. Fail Over

Post connection fail over will be used, if you're using an admin connection (such as what is used by AdminShell) or if the *autoFailover* connection property on JDBC URL is set to true. Post connection failover works by sending a ping, at most every second, to test the connection prior to use. If the ping fails, a new instance will be selected prior to the operation being attempted. This is not true "transparent application failover" as the client will not restart the transaction/query/ recreate session scoped temp tables, etc. So this feature should be used with caution by non-admin connections.

1.5.2. Load Balancing

Post connection load balancing can be utilized in one of two ways. First if you are using `TeiidDataSource` and the Connections returned by Teiid `PooledConnections` have their `close` method called, then a new server instance will be selected automatically. However when using driver based connections or even when using `TeiidDataSource` in a connection pool (such as JBoss AS), the automatic load balancing will not happen. Second you can explicitly trigger load balancing through the use of the set statement:

```
SET NEWINSTANCE TRUE
```

Typically you will not need want to issue this statement manually, but instead use it as the connection test query on your DataSource configuration.

Example 1.4. JBoss AS DataSource With Post Connection Load Balancing

```
<datasources>
  <local-tx-datasource>
    <jndi-name>TEIID-DS</jndi-name>
    <connection-url>jdbc:teiid:myVDB@mm://localhost:31000,mm://localhost:32000</connection-
url>
    <driver-class>org.teiid.jdbc.TeiidDriver</driver-class>
    <user-name>admin</user-name>
    <password>teiid</password>

    <!-- pool and other JBoss datasource properties -->
    <check-valid-connection-sql>SET NEWINSTANCE TRUE</check-valid-connection-sql>
    <min-pool-size>5</min-pool-size>
    <max-pool-size>10</max-pool-size>
  </local-tx-datasource>
</datasources>
```

Teiid by default maintians a pool of extra socket connections that are reused. For load balancing, this reduces the potential cost of switching a connection to another server instance. The default setting is to maintain 16 connections (see `org.teiid.sockets.maxCachedInstances` in the client jar's teiid-client-settings.properties file. If you're client is connecting to large numbers of Teiid instances and you're using post connection time load balancing, then consider increasing the number of cached instances. You may either set an analogous system property or create another version of teiid-client-settings.properties file and place it into the classpath ahead of the client jar.

Note

Session level temporary tables, currently running transactions, session level cache entries, and PreparedPlans for a given session will not be available on other cluster members. Therefore, it is recommended that post connection time load balancing is only used when the logical connection could have been closed, but the actual connection is reused (the typical connection pool pattern).

1.5.3. Advanced Configuration

Server discovery, load balancing, fail over, retry, retry delay, etc. may be customize if the default policy is not sufficient. See the `org.teiid.net.socket.ServerDiscovery` interface and default implementaion `org.teiid.net.socket.UrlServerDiscovery` for how to start with your customization. The `UrlServerDiscovery` implemenation provides the following: discovery of servers from the URL hosts (DataSource server/alternativeServers), random selection for load balancing and failover, 1 connection attempt per host, no biasing, black listing, or other advanced features. Typically you'll want to extend the `UrlServerDiscovery` so that it can be used as the fallback strategy and to only implement the necessary changed methods. It's important to consider that 1 `ServerDiscovery` instance will be created for each connection. Any sharing of information between instances should be done through static state or some other shared lookup.

Your customized server discovery class will then need to be referenced by the discoveryStategy connection/DataSource property by its full class name.

You may also choose to use an external tcp load balancer, such as *haproxy* [http://haproxy.1wt.eu/]. The Teiid driver/DataSource should then typically be configured to just use the single host/port of your load balancer.

1.6. Reauthentication

Teiid connections (defined by the `org.teiid.jdbc.TeiidConnection` interface) support the changeUser method to reauthenticate a given connection. If the reauthentication is successful the current connection my be used with the given identity. Existing statements/result sets are still available for use under the old identity. See the JBossAS issue *JBAS-1429* [https://issues.jboss.org/browse/JBAS-1429] for more on using reauthentication support with JCA.

Prepared Statements

Teiid provides a standard implementation of `java.sql.PreparedStatement`. PreparedStatements can be very important in speeding up common statement execution, since they allow the server to skip parsing, resolving, and planning of the statement. See the Java documentation for more information on *PreparedStatement usage* [http://download.oracle.com/javase/6/docs/technotes/guides/jdbc/getstart/preparedstatement.html#1000039].

`PreparedStatement` Considerations

- It is not necessary to pool client side Teiid `PreparedStatements`, since Teiid performs plan caching on the server side.
- The number of cached plans is configurable (see the Admin Guide), and are purged by the least recently used (LRU).
- Cached plans are not distributed through a cluster. A new plan must be created for each cluster member.
- Plans are cached for the entire VDB or for just a particular session. The scope of a plan is detected automatically based upon the functions evaluated during it's planning process.
- Stored procedures executed through a `CallableStatement` have their plans cached just as a `PreparedStatement`.
- Bind variable types in function signatures, e.g. "where t.col = abs(?)" can be determined if the function has only one signature or if the function is used in a predicate where the return type can be determined. In more complex situations it may be necessary to add a type hint with a cast or convert, e.g. upper(convert(?, string)).

Teiid extensions to the JDBC API

3.1. Statement Extensions

The Teiid statement extension interface, `org.teiid.jdbc.TeiidStatement`, provides functionality beyond the JDBC standard. To use the extension interface, simply cast or unwap the statement returned by the Connection. The following methods are provided on the extension interface:

Table 3.1. Connection Properties

Method Name	Description
`getAnnotations`	Get the query engine annotations if the statement was last executed with SHOWPLAN ON|DEBUG. Each `org.teiid.client.plan.Annotation` contains a description, a category, a severity, and possibly a resolution of notes recorded during query planning that can be used to understand choices made by the query planner.
`getDebugLog`	Get the debug log if the statement was last executed with SHOWPLAN DEBUG.
`getExecutionProperty`	Get the current value of an execution property on this statement object.
`getPlanDescription`	Get the query plan description if the statement was last executed with SHOWPLAN ON|DEBUG. The plan is a tree made up of `org.teiid.client.plan.PlanNode` objects. Typically `PlanNode.toString()` or `PlanNode.toXml()` will be used to convert the plan into a textual form.
`getRequestIdentifier`	Get an identifier for the last command executed on this statement. If no command has been executed yet, null is returned.
`setExecutionProperty`	Set the execution property on this statement. See the *execution properties* section for more information. It is generally preferable to use the *SET statement* unless the execution property applies only to the statement being executed.
`setPayload`	Set a per-command payload to pass to translators. Currently the only built-in use is for sending hints for Oracle data source.

3.2. Execution Properties

Execution properties may be set on a per statement basis through the `TeiidStatement` interface or on the connection via the *SET statement*. For convenience, the property keys are defined by constants on the `org.teiid.jdbc.ExecutionProperties` interface.

Table 3.2. Execution Properties

Property Name/String Constant	Description
`PROP_TXN_AUTO_WRAP / autoCommitTxn`	Same as the connection property.
`PROP_PARTIAL_RESULTS_MODE / partialResultsMode`	See the *partial results* section.
`PROP_XML_FORMAT / XMLFormat`	Determines the formatting of XML documents returned by XML document models. See the *document formatting* section.
`PROP_XML_VALIDATION / XMLValidation`	Determines whether XML documents returned by XML document models will be validated against their schema after processing. See the Reference Guide's "XML SELECT Command" chapter and "document validation" section.
`RESULT_SET_CACHE_MODE / resultSetCacheMode`	Same as the connection property.
`SQL_OPTION_SHOWPLAN / SHOWPLAN`	Same as the connection property.
`NOEXEC / NOEXEC`	Same as the connection property.
`JDBC4COLUMNNAMEANDLABELSEMANTICS / useJDBC4ColumnNameAndLabelSemantics`	Same as the connection property.

3.3. SET Statement

Execution properties may also be set on the connection by using the SET statement. The SET statement is not yet a language feature of Teiid and is handled only in the JDBC client.

SET Syntax:

- SET (parameter|SESSION AUTHORIZATION) value

Syntax Rules:

- The parameter must be a non-quoted identifier - it cannot contain spaces.
- The value may be either a non-quoted identifier or a quoted string literal value.

The SET statement is most commonly used to control planning and execution.

- SET SHOWPLAN (ON|DEBUG|OFF)

- SET NOEXEC (ON|OFF)

Example 3.1. Enabling Plan Debug

```
Statement s = connection.createStatement();
s.execute("SET SHOWPLAN DEBUG");
...
Statement s1 = connection.createStatement();
ResultSet rs = s1.executeQuery("select col from table");

ResultSet planRs = s1.exeuteQuery("SHOW PLAN");
planRs.next();
String debugLog = planRs.getString("DEBUG_LOG");
```

The SET statement may also be used to control authorization. A SET SESSION AUTHORIZATION statement will perform a *Section 1.6, “Reauthentication”* given the credentials currently set on the connection. The connection credentials may be changed by issuing a SET PASSWORD statement. A SET PASSWORD statement does not perform a reauthentication.

Example 3.2. Changing Session Authorization

```
Statement s = connection.createStatement();
s.execute("SET PASSWORD 'someval'");
s.execute("SET SESSION AUTHORIZATION 'newuser'");
```

3.4. SHOW Statement

The SHOW statement can be used to see a varitey of information. The SHOW statement is not yet a language feature of Teiid and is handled only in the JDBC client.

SHOW Usage:

- SHOW *PLAN* - returns a resultset with a clob column PLAN_TEXT, an xml column PLAN_XML, and a clob column DEBUG_LOG with a row containing the values from the previously executed query. If SHOWPLAN is OFF or no plan is available, no rows are returned. If SHOWPLAN is not set to DEBUG, then DEBUG_LOG will return a null value.
- SHOW *ANNOTATIONS* - returns a resultset with string columns CATEGORY, PRIORITY, ANNOTATION, RESOLUTION and a row for each annotation on the previously executed query. If SHOWPLAN is OFF or no plan is available, no rows are returned.

- SHOW property - the inverse of SET, shows the property value for the given property, returns a resultset with a single string column with a name matching the property key.
- SHOW *ALL* - returns a resultset with a NAME string column and a VALUE string column with a row entry for every property value.

The SHOW statement is most commonly used to retrieve the query plan, see the plan *debug example*.

3.5. Transaction Statements

In situations where the direct use of the JDBC connection is not possible, transaction statements can be used to control a local transaction.

- *START TRANSACTION* - synonym for `connection.setAutoCommit(false)`
- *COMMIT* - synonym for `connection.setAutoCommit(true)`
- *ROLLBACK* - synonym for `connection.rollback()` and returning to auto commit mode.

3.6. Partial Results Mode

The Teiid Server supports a "partial results" query mode. This mode changes the behavior of the query processor so the server returns results even when some data sources are unavailable.

For example, suppose that two data sources exist for different suppliers and your data Designers have created a virtual group that creates a union between the information from the two suppliers. If your application submits a query without using partial results query mode and one of the suppliers' databases is down, the query against the virtual group returns an exception. However, if your application runs the same query in “partial results” query mode, the server returns data from the running data source and no data from the data source that is down.

When using "partial results" mode, if a source throws an exception during processing it does not cause the user’s query to fail. Rather, that source is treated as returning no more rows after the failure point. Most commonly, that source will return 0 rows.

This behavior is most useful when using `UNION` or `OUTER JOIN` queries as these operations handle missing information in a useful way. Most other kinds of queries will simply return 0 rows to the user when used in partial results mode and the source is unavailable.

For each source that is excluded from the query, a warning will be generated describing the source and the failure. These warnings can be obtained from the `Statement.getWarnings()` method. This method returns a `SQLWarning` object but in the case of "partial results" warnings, this will be an object of type `org.teiid.jdbc.PartialResultsWarning` class. This class can be used to obtain a list of all the failed sources by name and to obtain the specific exception thrown by each resource adaptor.

Note

Since Teiid supports cursoring before the entire result is formed, it is possible that a data source failure will not be determined until after the first batch of results have been returned to the client. This can happen in the case of unions, but not joins. To ensure that all warnings have been accumulated, the statement should be checked after the entire result set has been read.

Partial results mode is off by default but can be turned on for all queries in a Connection with either setPartialResultsMode("true") on a DataSource or partialResultsMode=true on a JDBC URL. In either case, partial results mode may be toggled later with a *set statement*.

Example 3.3. Setting Partial Results Mode

```
Statement statement = ...obtain statement from Connection...
statement.execute("set partialResultsMode true");
```

Example 3.4. Getting Partial Results Warnings

```
statement.execute("set partialResultsMode true");
ResultSet results = statement.executeQuery("SELECT Name FROM Accounts");
while (results.next()) {
  ... //process the result set
}
SQLWarning warning = statement.getWarnings();
if(warning instanceof PartialResultsWarning) {
  PartialResultsWarning partialWarning = (PartialResultsWarning)warning;
  Collection failedConnectors = partialWarning.getFailedConnectors();
  Iterator iter = failedConnectors.iterator();
  while(iter.hasNext()) {
    String connectorName = (String) iter.next();
   SQLException connectorException = partialWarning.getConnectorException(connectorName);
    System.out.println(connectorName + ": " + ConnectorException.getMessage();
  }
}
```

3.7. XML extensions

The XML extensions apply on to XML resutls from queries to XML document models, and not to XML produced by SQL/XML or read from some other source.

3.7.1. Document formatting

The PROP_XML_FORMAT execution property can be set to modify the way that XML documents are formatted from XML document models. Valid values for the constant are defined in the same ExecutionProperties interface:

1. `XML_TREE_FORMAT` - Returns a version of the XML formatted for display. The XML will use line breaks and tabs as appropriate to format the XML as a tree. This format is slower due to the formatting time and the larger document size.
2. `XML_COMPACT_FORMAT` - Returns a version of the XML formatted for optimal performance. The XML is a single long string without any unnecessary white space.
3. Not Set - If no format is set, the formatting flag on the XML document in the original model is honored. This may produce either the “tree” or “compact” form of the document depending on the document setting.

3.7.2. Schema validation

The `PROP_XML_VALIDATION` execution property can be set to indicate that the server should validate XML document model documents against their schema before returning them to the client. If schema validation is on, then the server send a SQLWarning if the document does not conform to the schema it is associated with. Using schema validation will reduce the performance of your XML queries.

3.8. Non-blocking Statement Execution

JDBC query execution can indefinitely block the calling thread when a statement is executed or a resultset is being iterated. In some situations you may wish to have your calling threads held in these blocked states. When using embedded connections, you may optionally use the `org.teiid.jdbc.TeiidStatement` and `org.teiid.jdbc.TeiidPreparedStatement` interfaces to execute queries with a callback `org.teiid.jdbc.StatementCallback` that will be notified of statement events, such as an available row, an exception, or completion. Your calling thread will be free to perform other work. The callback will be executed by an engine processing thread as needed. If your results processing is itself blocking and you want query processing to be concurrent with results processing, then your callback should implement onRow handling in a multi-threaded manner to allow the engine thread to continue.

Example 3.5. Non-blocking Prepared Statement Execution

```
PreparedStatemnt stmt = connection.prepareStatement(sql);
TeiidPreparedStatement tStmt = stmt.unwrap(TeiidPreparedStatement.class);
tStmt.submitExecute(new StatementCallback() {
   @Override
   public void onRow(Statement s, ResultSet rs) {
    //any logic that accesses the current row ...
       System.out.println(rs.getString(1));
   }

   @Override
   public void onException(Statement s, Exception e) throws Exception {
       s.close();
   }

   @Override
   public void onComplete(Statement s) throws Exception {
       s.close();
   }
);
```

Note

The non-blocking logic is limited to statement execution only. Other JDBC operations, such as connection creation or batched executions do not yet have non-blocking options.

Transactions with JDBC

The Teiid JDBC API supports three types of transactions from a client perspective – global, local, and request level. All are implemented by the Teiid Server as XA transactions. See the *JTA specification* [http://java.sun.com/javaee/technologies/jta/index.jsp] for more on XA Transactions.

4.1. Local Transactions

The Connection class uses the "autoCommit" flag to explicitly control local transactions. By default, autoCommit is set to "true", which indicates request level or implicit transaction control. example of how to use local transactions by setting the autoCommit flag to false.

Example 4.1. Local transaction control using autoCommit

```
// Set auto commit to false and start a transaction
connection.setAutoCommit(false);

try {
    // Execute multiple updates
    Statement statement = connection.createStatement();
    statement.executeUpdate(“INSERT INTO Accounts (ID, Name) VALUES (10, ‘Mike’)”);
    statement.executeUpdate(“INSERT INTO Accounts (ID, Name) VALUES (15, ‘John’)”);
    statement.close();

    // Commit the transaction
    connection.commit();

} catch(SQLException e) {
    // If an error occurs, rollback the transaction
    connection.rollback();
}
```

This example demonstrates several things:

1. Setting autoCommit flag to false. This will start a transaction bound to the connection.
2. Executing multiple updates within the context of the transaction.
3. When the statements are complete, the transaction is committed by calling commit().
4. If an error occurs, the transaction is rolled back using the rollback() method.

Any of the following operations will end a local transaction:

1. Connection.setAutoCommit(true) – if previously set to false

2. Connection.commit()

3. Connection.rollback()

4. A transaction will be rolled back automatically if it times out.

4.1.1. Turning Off Local Transactions

In some cases, tools or frameworks above Teiid will call setAutoCommit(false), commit() and rollback() even when all access is read-only and no transactions are necessary. In the scope of a local transaction Teiid will start and attempt to commit an XA transaction, possibly complicating configuration or causing performance degradation.

In these cases, you can override the default JDBC behavior to indicate that these methods should perform no action regardless of the commands being executed. To turn off the use of local transactions, add this property to the JDBC connection URL

```
disableLocalTxn=true
```

Warning

Turning off local transactions can be dangerous and can result in inconsistent results (if reading data) or inconsistent data in data stores (if writing data). For safety, this mode should be used only if you are certain that the calling application does not need local transactions.

4.2. Request Level Transactions

Request level transactions are used when the request is not in the scope of a global or local transaction, which implies "autoCommit" is "true". In a request level transaction, your application does not need to explicitly call commit or rollback, rather every command is assumed to be its own transaction that will automatically be committed or rolled back by the server.

The Teiid Server can perform updates through virtual tables. These updates might result in an update against multiple physical systems, even though the application issues the update command against a single virtual table. Often, a user might not know whether the queried tables actually update multiple sources and require a transaction.

For that reason, the Teiid Server allows your application to automatically wrap commands in transactions when necessary. Because this wrapping incurs a performance penalty for your queries, you can choose from a number of available wrapping modes to suit your environment. You need to choose between the highest degree of integrity and performance your application needs. For example, if your data sources are not transaction-compliant, you might turn the transaction wrapping off (completely) to maximize performance.

You can set your transaction wrapping to one of the following modes:

1. *ON*: This mode always wraps every command in a transaction without checking whether it is required. This is the safest mode.
2. *OFF*: This mode never automatically wraps a command in a transaction or check whether it needs to wrap a command. This mode can be dangerous as it will allow multiple source updates outside of a transaction without an error. This mode has best performance for applications that do not use updates or transactions.
3. *DETECT*: This mode assumes that the user does not know to execute multiple source updates in a transaction. The Teiid Server checks every command to see whether it is a multiple source update and wraps it in a transaction. If it is single source then uses the source level command transaction.

You can set the transaction mode as a property when you establish the Connection or on a per-query basis using the execution properties. For more information on execution properties, see the section *"Execution Properties"*

4.2.1. Multiple Insert Batches

When issuing an INSERT with a query expression (or the deprecated SELECT INTO), multiple insert batches handled by separate source INSERTS may be processed by the Teiid server. Care should be taken to ensure that targeted sources support XA or that compensating actions are taken in the event of a failure.

4.3. Using Global Transactions

Global or client XA transactions allow the Teiid JDBC API to participate in transactions that are beyond the scope of a single client resource. For this use the Teiid DataSource Class for establishing connections.

When the DataSource is used in the context of a UserTransaction in an application server, such as JBoss, WebSphere, or Weblogic, the resulting connection will already be associated with the current XA transaction. No additional client JDBC code is necessary to interact with the XA transaction.

Example 4.2. >Manual Usage of XA transactions

```
XAConnection xaConn = null;
XAResource xaRes = null;
Connection conn = null;
Statement stmt = null;

try {
  xaConn = <XADataSource instance>.getXAConnection();
  xaRes = xaConn.getXAResource();
  Xid xid = <new Xid instance>;
  conn = xaConn.getConnection();
  stmt = conn.createStatement();

  xaRes.start(xid, XAResource.TMNOFLAGS);
  stmt.executeUpdate("insert into …");
  <other statements on this connection or other resources enlisted in this transaction>
  xaRes.end(xid, XAResource.TMSUCCESS);

  if (xaRes.prepare(xid) == XAResource.XA_OK) {
    xaRes.commit(xid, false);
  }
}
catch (XAException e) {
  xaRes.rollback(xid);
}
finally {
  <clean up>
}
```

With the use of global transactions multiple Teiid XAConnections may participate in the same transaction. It is important to note that the Teiid JDBC XAResource "isSameRM" method only returns "true", if connections are made to the same server instance in a cluster. If the Teiid connections are to different server instances then transactional behavior may not be the same as if they were to the same cluster member. For example, if the client transaction manager uses the same XID for each connection, duplicate XID exceptions may arise from the same physical source accessed through different cluster members. If the client transaction manager uses a different branch identifier for each connection, issues may arise with sources that lock or isolate changes based upon branch identifiers.

4.4. Restrictions

4.4.1. Application Restrictions

The use of global, local, and request level transactions are all mutually exclusive. Request level transactions only apply when not in a global or local transaction. Any attempt to mix global and local transactions concurrently will result in an exception.

4.4.2. Enterprise Information System Support

The underlying resource adaptors that represent the EIS system and the EIS system itself must support XA transactions if they want to participate in distributed XA transaction thru Teiid. If source system do not support the XA, then it can not particilate in the distributed transaction. However, the source is still eligible to participate in data integration with out the XA support

The participation in the XA transaction is automatically determined based on the resource adaptors XA capability. It is user's repsonsiblity to make sure that they configure a XA resource when they require them to participate in distributed transaction.

SSL Client Connections

This chapter will shows you various security configurations that can be used with Teiid in securing your data access. Note that data level security called as "data roles" are explained in Reference Guide. This chapter pertains to transport level security.

5.1. Default Security

By default all JDBC/Admin sensitive (non-data) messages between client and server are encrypted using a *Diffy-Hellman* [http://en.wikipedia.org/wiki/Diffie-Hellman_key_exchange] key that is negotiated per connection. This encryption is controlled by `clientEncryptionEnabled` property in `JdbcSslConfiguration` and `AdminSslConfiguration` sections in the `<jboss-install>/server/<profile>/deploy/teiid/teiid-jboss-beans.xml` file.

If you are using a socket connection, then you may need to secure the channel more completely - especially if using ODBC, which currently only supports plain text authentication.

5.2. SSL Modes

Teiid supports SSL based channel between the client JDBC application and Teiid Server. Teiid supports the following SSL modes.

1. Anonymous – No certificates are required, but all communications are still encrypted using the TLS_DH_anon_WITH_AES_128_CBC_SHA SSL suite.
2. 1-way – Only authenticates the server to the client traffic. Requires a private key keystore to be created for the server and a truststore at the client that authenticates that key. The SSL suite is negotiated.
3. 2-way – Mutual client and server authentication. The server and client applications each have a keystore for their private keys and each has a truststore that authenticates the other.

Depending upon the SSL mode, follow the guidelines of your organization around creating/obtaining private keys. If you have no organizational requirements, then follow this guide to create *self-signed certificates* with their respective keystores and truststores.

The following keystore and truststore combinations are required for different SSL modes. The names of the files can be chosen by the user. The following files are shown for example purposes only.

1-way

1. server.keystore - has server's private key
2. server.truststore - has server's public key

2-way

1. server.keystore - has server's private key
2. server.truststore - has server's public key
3. client.keystore - client's private key
4. client.truststore - has client's public key

5.3. Client SSL Settings

The following sections define the properties required for each SSL mode. Note that when connecting to Teiid Server with SSL enabled, you *MUST* use the *"mms"* protocol, instead of "mm" in the JDBC connection URL, for example

jdbc:teiid:<myVdb>@*mms*://<host>:<port>

There are two different sets of properties that a client can configure to enable 1-way or 2-way SSL.

5.3.1. Option 1: Java SSL properties

These are standard Java defined system properties to configure the SSL under any JVM, Teiid is not unique in its use of SSL. Provide the following system properties to the client VM process.

Example 5.1. 1-way SSL

```
-Djavax.net.ssl.trustStore=<dir>/server.truststore (required)
-Djavax.net.ssl.trustStorePassword=<password> (optional)
-Djavax.net.ssl.keyStoreType (optional)
```

Example 5.2. 2-way SSL

```
-Djavax.net.ssl.keyStore=<dir>/client.keystore (required)
-Djavax.net.ssl.keyStrorePassword=<password> (optional)
-Djavax.net.ssl.trustStore=<dir>/server.truststore (required)
-Djavax.net.ssl.trustStorePassword=<password> (optioanl)
-Djavax.net.ssl.keyStroreType=<keystore type> (optional)
```

5.3.2. Option 2: Teiid Specific Properties

Use this option for *anonymous* mode or when the above "javax" based properties are already in use by the host process. For example if your client application is a Tomcat process that is configured for https protocol and the above Java based properties are already in use, and importing Teiid-specific certificate keys into those https certificate keystores is not allowed.

In this scenario, a different set of Teiid-specific SSL properties can be set as system properties or defined inside the "teiid-client-settings.properties" file. The "teiid-client-settings.properties" file can be found inside the "teiid-7.7-client.jar" file at the root. Extract this file, or make a copy, change the property values required for the chosen SSL mode, and place this file in the client application's classpath before the "teiid-7.7-client.jar" file.

SSL properties and definitions inside the "teiid-client-settings.properties" are shown below.

```
########################################
# SSL Settings
########################################

#
# The key store type.  Defaults to JKS
#

org.teiid.ssl.keyStoreType=JKS

#
# The key store algorithm, defaults to
# the system property "ssl.TrustManagerFactory.algorithm"
#

#org.teiid.ssl.algorithm=

#
# The classpath or filesystem location of the
# key store.
#
# This property is required only if performing 2-way
# authentication that requires a specific private
# key.
#

#org.teiid.ssl.keyStore=

#
# The key store password (not required)
#

#org.teiid.ssl.keyStorePassword=

#
# The classpath or filesystem location of the
# trust store.
#
# This property is required if performing 1-way
# authentication that requires trust not provided
# by the system defaults.
#

#org.teiid.ssl.trustStore=

#
# The trust store password (not required)
#

#org.teiid.ssl.trustStorePassword=

#
# The cipher protocol, defaults to SSLv3
#

org.teiid.ssl.protocol=SSLv3

#
# Whether to allow anonymous SSL
# (the TLS_DH_anon_WITH_AES_128_CBC_SHA cipher suite)
# defaults to true
#

org.teiid.ssl.allowAnon=true
```

Example 5.3. 1-way SSL

```
org.teiid.ssl.trustStore=<dir>/server.truststore (required)
```

Example 5.4. 2-way SSL

```
org.teiid.ssl.keyStore=<dir>/client.keystore (required)
org.teiid.ssl.trustStore=<dir>/server.truststore (required)
```

Example 5.5. Anonymous

```
org.teiid.ssl.trustStore=NONE
```

Using Teiid with Hibernate

6.1. Limitations

- Many Hibernate use cases assume a data source has the ability (with proper user permissions) to process Data Definition Language (DDL) statements like CREATE TABLE and DROP TABLE as well as Data Manipulation Language (DML) statements like SELECT, UPDATE, INSERT and DELETE. Teiid can handle a broad range of DML, but does not support directly support DDL against a particular source.
- Sequence and Identity generation are not supported. Identifier generation based upon table values, such as the hilo generator, require that the identifier table(s) be exposed through Teiid. The GUID identifier generation strategy is directly supported.

6.2. Configuration

For the most part, interacting with Teiid VDBs (Virtual Databases) from Hibernate is no different from working with any other type of data source. First you must place Teiid JDBC API client JAR file and Teiid's hibernate dialect JAR in Hibernate’s classpath. These files can be found in `<jboss-install>/server/<profile>/lib` directory.

- teiid-7.7-client.jar
- teiid-hibernate-dialect-7.7.jar

These JAR files have the `org.teiid.dialect.TeiidDialect` and `org.teiid.jdbc.TeiidDriver` and `org.teiid.jdbc.TeiidDataSource` classes.

You then configure Hibernate (via hibernate.cfg.xml) as follows:

1. Specify the Teiid driver class in the "connection.driver_class" property:

```
<property name="connection.driver_class">
    org.teiid.jdbc.TeiidDriver
</property>
```

2. Specify the URL for the VDB in the "connection.url" property (replacing terms in angle brackets with the appropriate values):

```
<property name="connection.url">
 jdbc:teiid:<vdb-name>@mm://<host>:<port>;user=<user-name>;password=<password>
```

```
</property>
```

> **Note**
>
> Be sure to use a *Section 1.4.3, “Local JDBC Connection”* if Hibernate is in the same VM as the application server.

3. Specify the Teiid dialect class in the “dialect” property:

```
<property name="dialect">
 org.teiid.dialect.TeiidDialect
</property>
```

Alternatively, if you put your connection properties in `hibernate.properties` instead of `hibernate.cfg.xml`, they would look like this:

```
hibernate.connection.driver_class=org.teiid.jdbc.TeiidDriver
hibernate.connection.url=jdbc:teiid:<vdb-name>@mm://<host>:<port>
hibernate.connection.username=<user-name>
hibernate.connection.password=<password>
hibernate.dialect=org.teiid.dialect.TeiidDialect
```

Note also that since your VDBs will likely contain multiple source and view models with identical table names, you will need to fully qualify table names specified in Hibernate mapping files:

```
<class name="<Class name>" table="<Source/view model name>.[<schema name>.]<Table
 name>">
 ...
</class>
```

Example 6.1. Example Mapping

```
<class name="org.teiid.example.Publisher" table="BOOKS.BOOKS.PUBLISHERS">
 ...
</class>
```

ODBC Support

Open DataBase Connectivity (ODBC) is a standard database access method developed by the SQL Access group in 1992. ODBC, just like JDBC in Java, allows consistent client access regardless of which database management system (DBMS) is handling the data. ODBC uses a driver to translate the application's data queries into commands that the DBMS understands. For this to work, both the application and the DBMS must be ODBC-compliant -- that is, the application must be capable of issuing ODBC commands and the DBMS must be capable of responding to them.

Teiid can provide ODBC access to deployed VDBs in the Teiid runtime through *PostgreSQL* [http://www.postgresql.org/]'s ODBC driver. This is possible because Teiid has specialized handling that allows it emulate a PostgreSQL server and respond appropriate to expected metadata queries.

Note

By default, ODBC on the Teiid is enabled and running on on port *35432*.

Before an application can use ODBC, you must first install the ODBC driver on same machine that the application is running on and then create Data Source Name (DSN) that represents a connection profile for your Teiid VDB.

Warning

Teiid currently only supports plain text passward authentication for ODBC. If the client/server are not configured to use SSL, the password will be sent in plain text over the network. If you need secure passwords in transit and are not using SSL, then consider installing a security domain that will accept safe password values from the client (for example encrypted or hashed).

7.1. Installing the ODBC Driver Client

A PostgreSQL ODBC driver needed to make the ODBC connection to Teiid is *not* bundled with the Teiid distribution. The appropriate driver needs be *downloaded* [http://www.postgresql.org/ftp/odbc/versions/] directly from the PostgreSQL web site. We have tested with *8.04.200* version of the ODBC driver.

7.1.1. Microsoft Windows

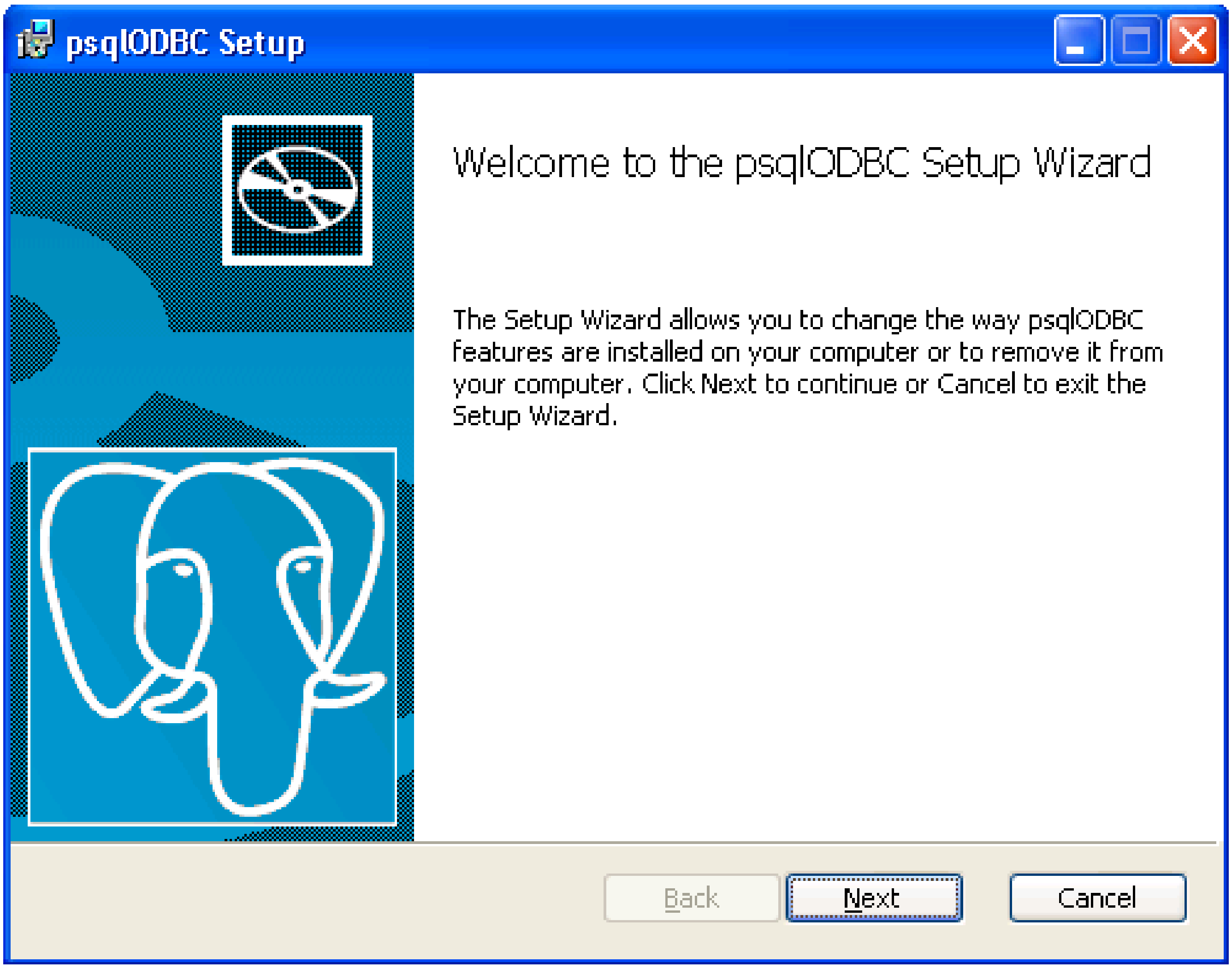
1. Download the ODBC driver from *PostgreSQL download site* [http://wwwmaster.postgresql.org/download/mirrors-ftp/odbc/versions/msi/psqlodbc_08_04_0200.zip]. If you are looking for 64-

bit Windows driver download the driver from *here* [http://code.google.com/p/visionmap/wiki/psqlODBC].

2. Extract the contents of the ZIP file into a temporary location on your system. For example: "c:\temp\pgodbc"

3. Double click on "psqlodbc.msi" file or (.exe file in the case of 64 bit) to start installation of the driver.

4. The Wizard appears as



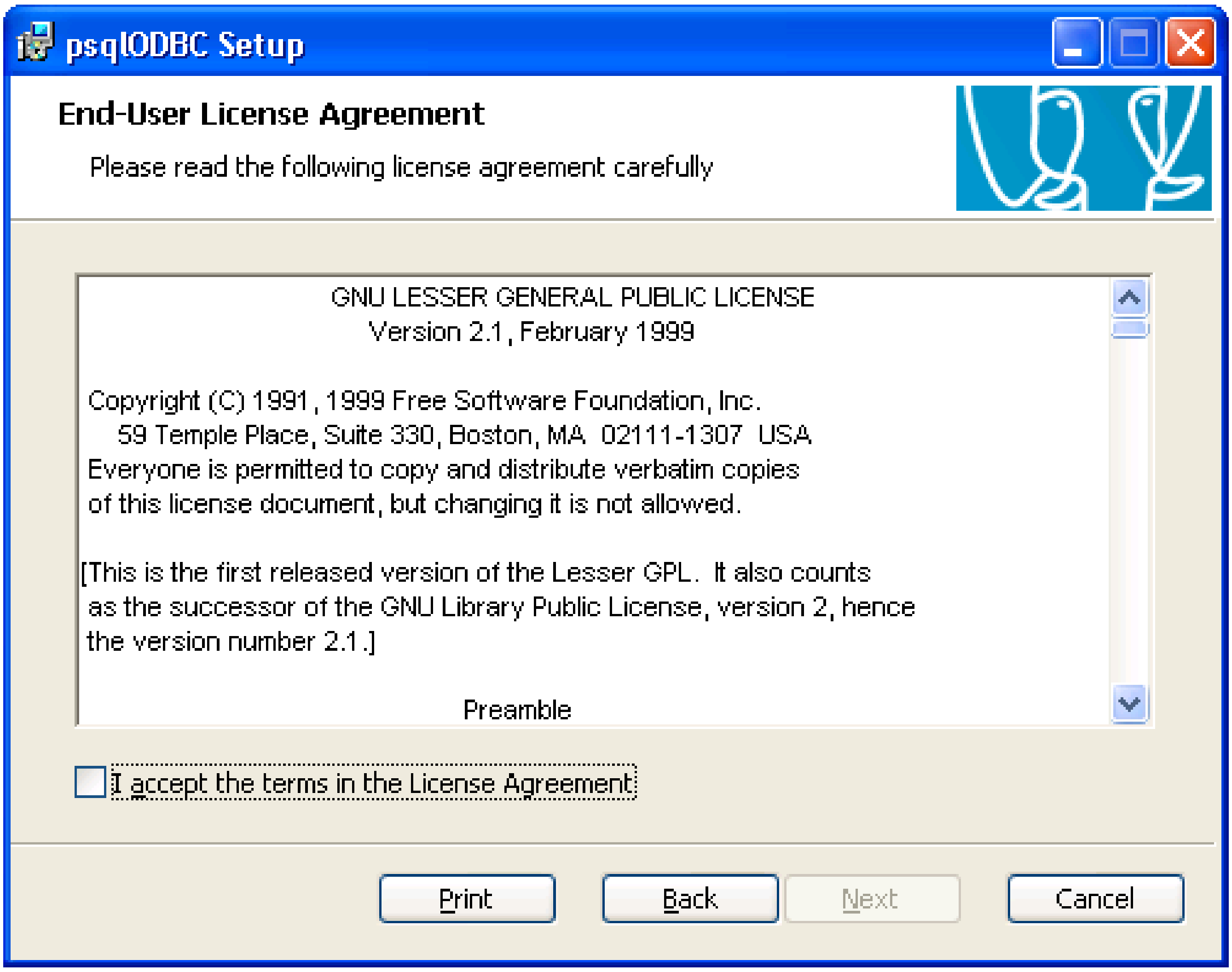
Welcome to the psqlODBC Setup Wizard

The Setup Wizard allows you to change the way psqlODBC features are installed on your computer or to remove it from your computer. Click Next to continue or Cancel to exit the Setup Wizard.

Figure 7.1. Welcome Screen

Click "Next".

5. The next step of the wizard displays.


psqlODBC Setup
End-User License Agreement
Please read the following license agreement carefully

GNU LESSER GENERAL PUBLIC LICENSE
Version 2.1, February 1999

Copyright (C) 1991, 1999 Free Software Foundation, Inc.
59 Temple Place, Suite 330, Boston, MA 02111-1307 USA
Everyone is permitted to copy and distribute verbatim copies
of this license document, but changing it is not allowed.

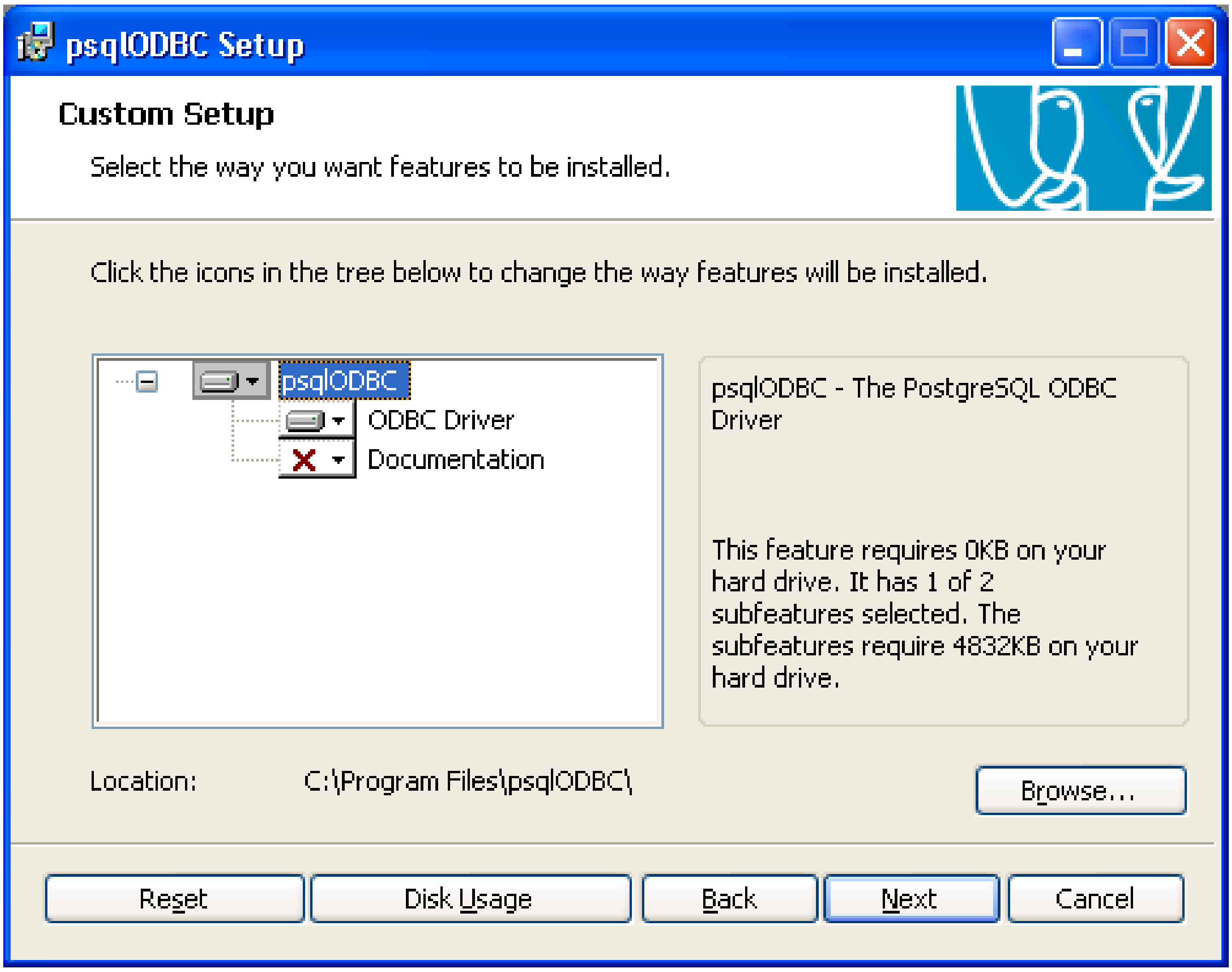
[This is the first released version of the Lesser GPL. It also counts
as the successor of the GNU Library Public License, version 2, hence
the version number 2.1.]

Preamble

Figure 7.2. End-User License Agreement

Carefully read it, and check the "I accept the terms in the License Agreement", if you are agreeing to the licensing terms. Then click "Next".

6. The next step of the wizard displays.


psqlODBC Setup

Custom Setup

Select the way you want features to be installed.

Click the icons in the tree below to change the way features will be installed.

psqlODBC - The PostgreSQL ODBC Driver

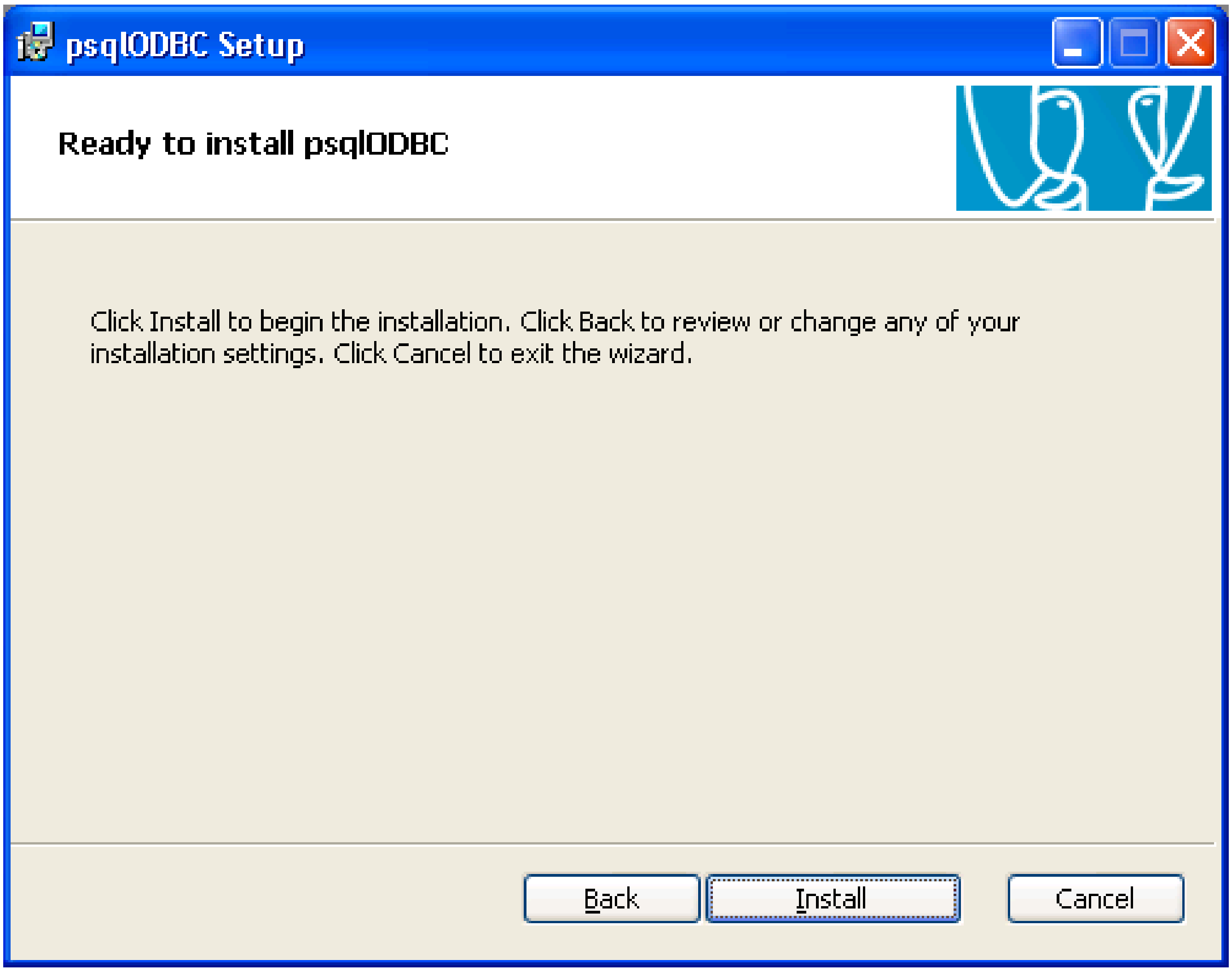
This feature requires 0KB on your hard drive. It has 1 of 2 subfeatures selected. The subfeatures require 4832KB on your hard drive.

Location: C:\Program Files\psqlODBC\

Figure 7.3. Setup

If you want to install in a different directory than the default that is already selected, click the "Browse" button and select a directory. Click "Next" to start installing in the selected directory.

7. The next step of the wizard displays.


psqlODBC Setup

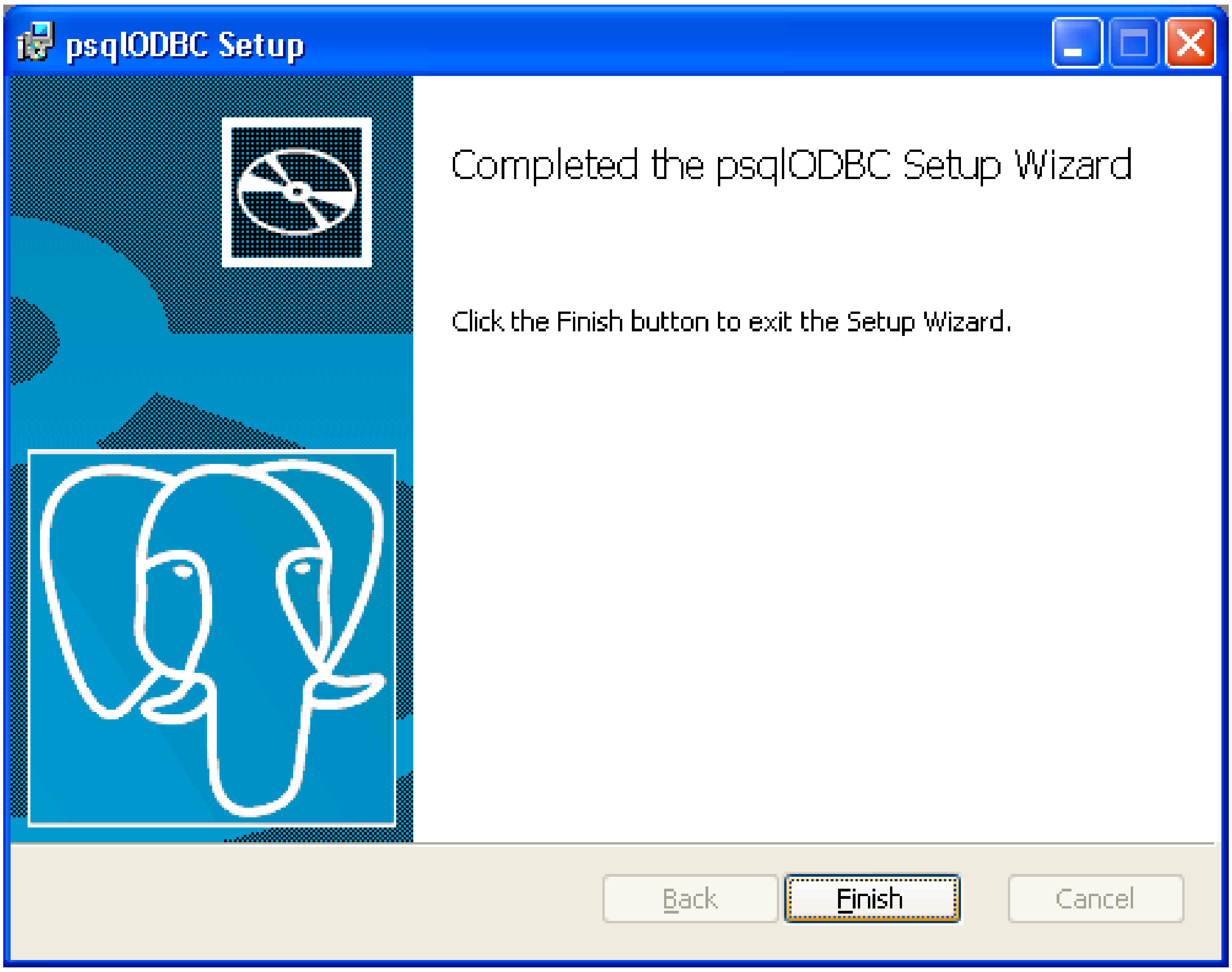
Ready to install psqlODBC

Click Install to begin the installation. Click Back to review or change any of your installation settings. Click Cancel to exit the wizard.

Figure 7.4. Confirm the Install

This step summarizes the choices you have made in the wizard. Review this information. If you need to change anything, you can use the Back button to return to previous steps. Click "Install" to proceed.

8. 1.The installation wizard copies the necessary files to the location you specified. When it finishes, the following screen displays.



Completed the psqlODBC Setup Wizard

Click the Finish button to exit the Setup Wizard.

Figure 7.5. Finish

Click "Finish" to complete.

7.1.2. Other *nix Platform Installations

For all other platforms other than Microsoft Windows, the ODBC driver needs built from the source files provided. Download the ODBC driver source files from *the PostgreSQL download site* [http://wwwmaster.postgresql.org/download/mirrors-ftp/odbc/versions/src/psqlodbc-08.04.0200.tar.gz]. Untar the files to a temporary location. For example: "~/tmp/pgodbc". Build and install the driver by running the commands below.

Note

You should use super user account or use "sudo" command for running the "make install" command.

```
% tar -zxvf psqlodbc-xx.xx.xxxx.tar.gz
% cd psqlodbc-xx.xx.xxxx
% ./configure
% make
% make install
```

Some *nix distributions may already provide binary forms of the appropriate driver, which can be used as an alternative to building from source.

7.2. Configuring the Data Source Name (DSN)

7.2.1. Windows Installation

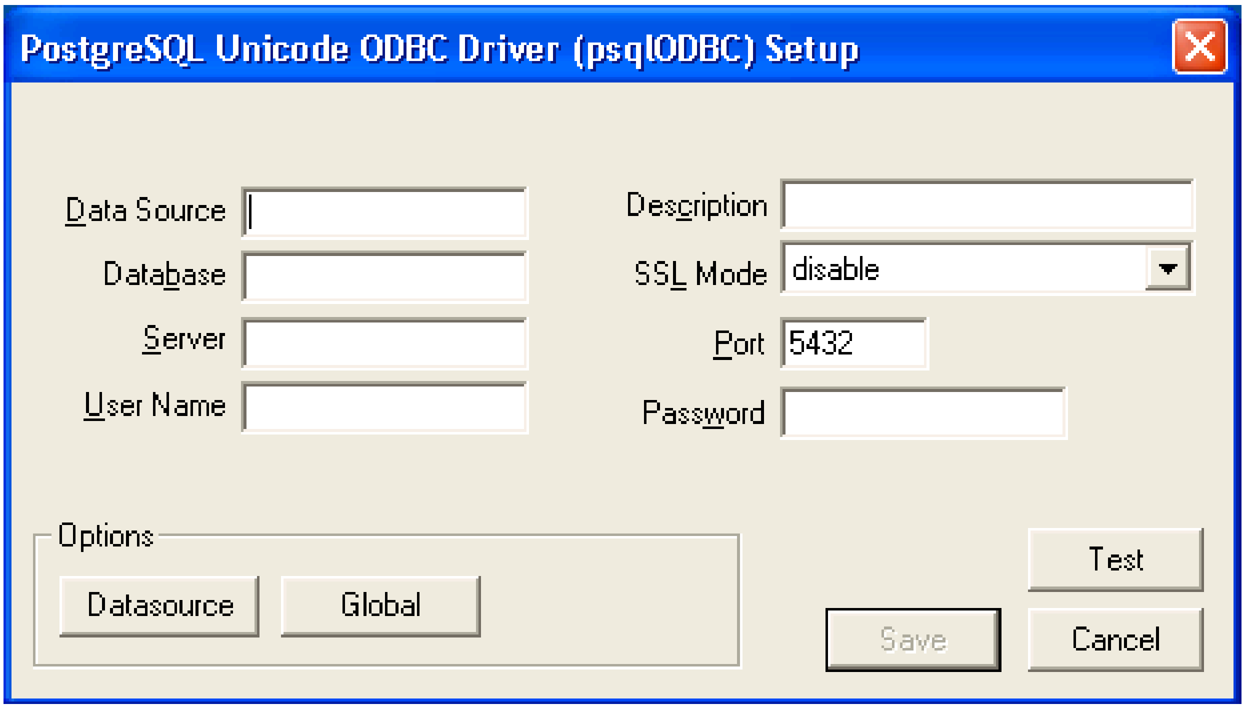
Once you have installed the ODBC Driver Client software on your workstation, you have to configure it to connect to a Teiid Runtime. Note that the following instructions are specific to the Microsoft Windows Platform.

To do this, you must have logged into the workstation with administrative rights, and you need to use the Control Panel's *Data Sources (ODBC)* applet to add a new data source name.

Each data source name you configure can only access one VDB within a Teiid System. To make more than one VDB available, you need to configure more than one data source name.

Follow the below steps in creating a data source name (DSN)

1. From the Start menu, select Settings > Control Panel.
2. The Control Panel displays. Double click *Administrative Tools*.
3. Then Double-click *Data Sources (ODBC)*.
4. The ODBC Data Source Administrator applet displays. Click the tab associated with the type of DSN you want to add.
5. The Create New Data Source dialog box displays. In the Select a driver for which you want to set up a data source table, select *PostgreSQL Unicode*.
6. Click Finish
7. The PostgreSQL ODBC DSN Setup dialog box displays.



Data Source
Database
Server
User Name
Description
SSL Mode: disable
Port: 5432
Password

Figure 7.6. Main Screen

In the *Data Source* Name edit box, type the name you want to assign to this data source.

In the *Database* edit box, type the name of the virtual database you want to access through this data source.

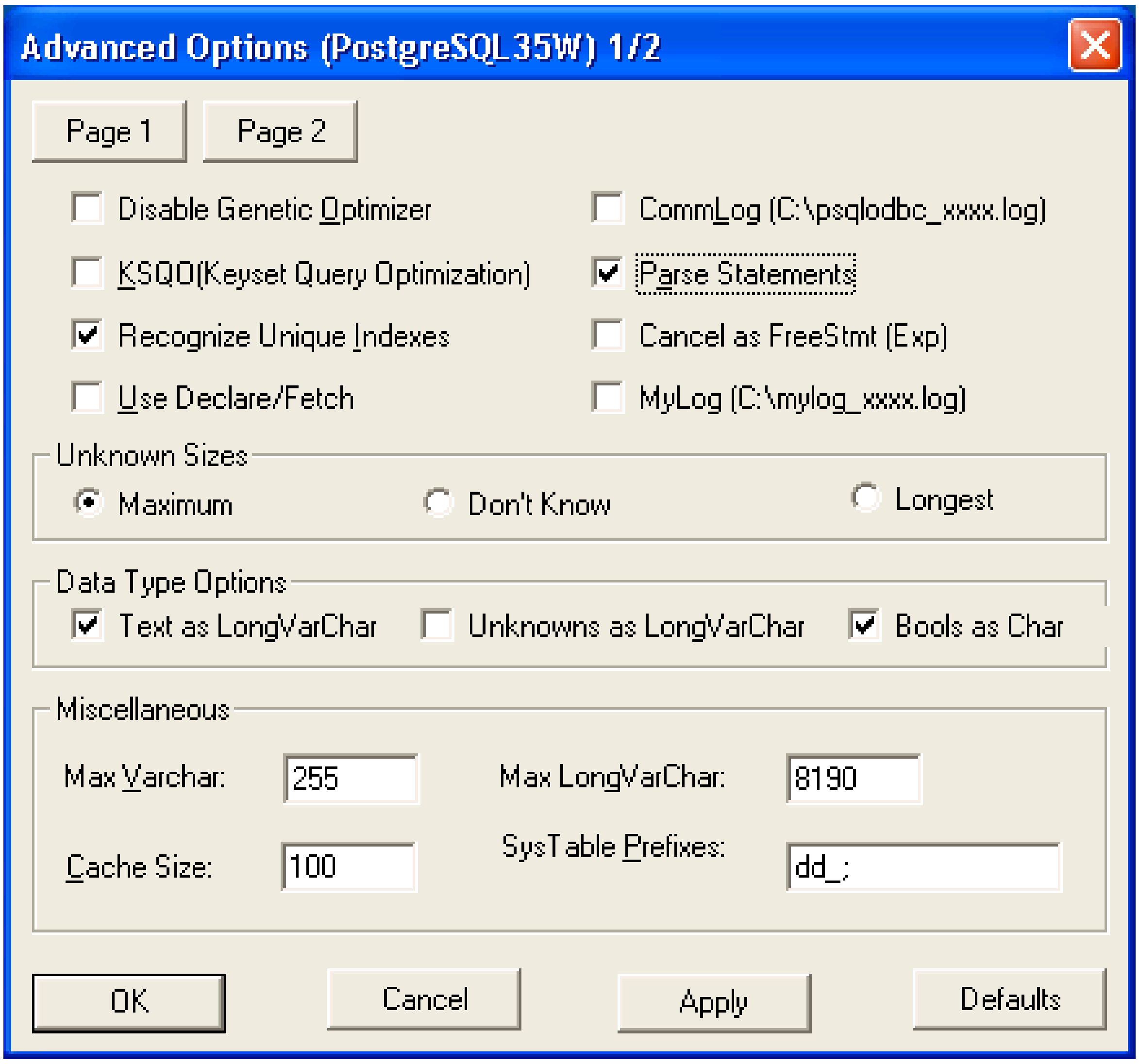
In the *Server* edit box, type the host name or IP address of your Teiid runtime. If connecting via a firewall or NAT address, the firewall address or NAT address should be entered.

In the Port edit box, type the port number to which the Teiid System listens for ODBC requests. By default, Teiid listenes for ODBC requests on port 35432

In the *User Name* and *Password* edit boxes, supply the user name and password for the Teiid runtime access.

Provide any description about the data source in the *Description* field.

9. Click on the *Datasource* button, you will see this below figure. Configure options as shown.


Advanced Options (PostgreSQL35W) 1/2

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- [ ] Disable Genetic Optimizer
- [ ] KSQO(Keyset Query Optimization)
- [x] Recognize Unique Indexes
- [ ] Use Declare/Fetch
- [ ] CommLog (C:\psqlodbc_xxxx.log)
- [x] Parse Statements
- [ ] Cancel as FreeStmt (Exp)
- [ ] MyLog (C:\mylog_xxxx.log)

Unknown Sizes

[✓ Maximum] Don't Know Longest

Data Type Options

- [x] Text as LongVarChar
- [ ] Unknowns as LongVarChar
- [x] Bools as Char

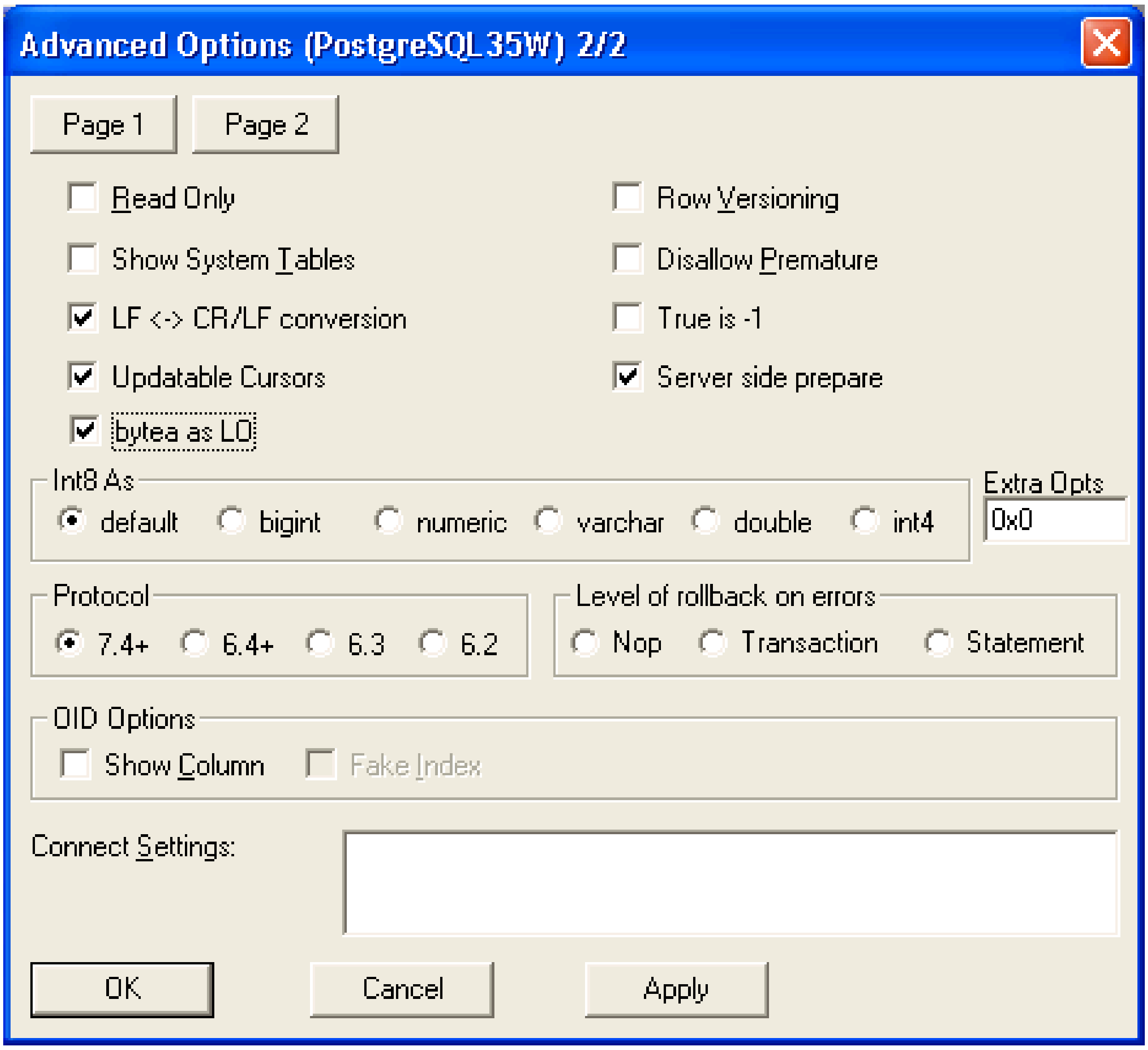
Miscellaneous

Max Varchar:	255	Max LongVarChar:	8190
Cache Size:	100	SysTable Prefixes:	dd_;

OK | Cancel | Apply | Defaults

Figure 7.7. DSN Options Page-1

Click on "page2" and make sure the options are selected as shown


Advanced Options (PostgreSQL35W) 2/2

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- [ ] Read Only
- [ ] Row Versioning
- [ ] Show System Tables
- [ ] Disallow Premature
- [✓] LF <-> CR/LF conversion
- [ ] True is -1
- [✓] Updatable Cursors
- [✓] Server side prepare
- [✓] bytea as LO

Int8 As: [✓ default] bigint numeric varchar double int4

Extra Opts: 0x0

Protocol: [✓ 7.4+] 6.4+ 6.3 6.2

Level of rollback on errors: Nop Transaction Statement

OID Options:
- [ ] Show Column
- [ ] Fake Index

Connect Settings:

Figure 7.8. DSN Options Page-2

10.Click "save" and you can optionally click "test" to validate your connection if the Teiid is running.

You have configured a Teiid's virtual database as a data source for your ODBC applications. Now you can use applications such as Excel, Access to query the data in the VDB

7.2.2. Other *nix Platform Installations

Before you can access Teiid using ODBC on any *nix platforms, you need to either install a ODBC driver manager or verify that one already exists. As the ODBC Driver manager Teiid recommends *unixODBC* [http://www.unixodbc.org/]. If you are working with RedHat Linux or Fedora you can check the graphical "yum" installer to search, find and install unixODBC. Otherwise you can *download* [http://www.unixodbc.org/unixODBC-2.3.0.tar.gz] the unixODBC manager here. To install, simply untar the contents of the file to a temporary location and execute the following commands as super user.

```
./configure
make
make install
```

Check *unixODBC* [http://www.unixodbc.org/] website site for more information, if you run into any issues during the installation.

Now, to o verify that PostgreSQL driver installed correctly from earlier step, execute the following command

```
odbcinst -q -d
```

That should show you all the ODBC drivers installed in your system. Now it is time to create a DSN. Edit "/etc/odbc.ini" file and add the following

```
[<DSN name>]
Driver = /usr/lib/psqlodbc.so
Description = PostgreSQL Data Source
Servername = <Teiid Host name or ip>
Port = 35432
Protocol = 7.4-1
UserName = <user-name>
Password = <password>
Database = <vdb-name>
ReadOnly = no
ServerType = Postgres
ConnSettings =
UseServerSidePrepare=1
ByteaAsLongVarBinary=1
Optimizer=0
Ksqo=0
Debug=0
Fetch = 10000
```

```
            # enable below when dealing large resultsets
            #UseDeclareFetch=1
```

Note that you need "sudo" permissions to edit the "/etc/odbc.ini" file. For all the available configurable options that you can use in defining a DSN can be found *here* [http://psqlodbc.projects.postgresql.org/config.html] on postgreSQL ODBC page.

Once you are done with defining the DSN, you can verify your DSN using the following command

```
               isql <DSN-name> [<user-name> <password>] < commands.sql
```

where "commands.sql" file contains the SQL commands you would like to execute.

7.3. DSN Less Connection

You can also connect to Teiid VDB using ODBC with out explicitly creating a DSN. However, in these scenarios your application needs, what is called as "DSN less connection string". The below is a sample connection string

For Windows:

```
              ODBC;DRIVER={PostgreSQL  Unicode};DATABASE=<vdb-name>;SERVER=<host-
name>;PORT=<port>;Uid=<username>;Pwd=<password>
```

>For *nix:

```
                         ODBC;DRIVER={PostgreSQL};DATABASE=<vdb-name>;SERVER=<host-
name>;PORT=<port>;Uid=<username>;Pwd=<password>
```

Appendix A. Unsupported JDBC Methods

Based upon the JDBC in JDK 1.6, this appendix details only those JDBC methods that Teiid does not support. Unless specified below, Teiid supports all other JDBC Methods.

Those methods listed without comments throw a SQLException stating that it is not supported.

Where specified, some listed methods do not throw an exception, but possibly exhibit unexpected behavior. If no arguments are specified, then all related (overridden) methods are not supported. If an argument is listed then only those forms of the method specified are not supported.

A.1. ResultSet Limitations

- TYPE_SCROLL_SENSITIVE is not supported.
- `UPDATABLE` ResultSets are not supported.
- Returning multiple ResultSets from Procedure execution is not supported.

A.2. Unsupported Classes and Methods in "java.sql"

Table A.1. Connection Properties

Class name	Methods
`Array`	`Not Supported`
`Blob`	getBinaryStream(long, long) - throws SQLFeatureNotSupportedException setBinaryStream(long) - - throws SQLFeatureNotSupportedException setBytes - - throws SQLFeatureNotSupportedException truncate(long) - throws SQLFeatureNotSupportedException
`CallableStatement`	getArray - throws SQLFeatureNotSupportedException getBigDecimal(String parameterName)- throws SQLFeatureNotSupportedException getBlob(String parameterName)- throws SQLFeatureNotSupportedException

Class name	Methods
	getBoolean(String parameterName)- throws SQLFeatureNotSupportedException getByte(String parameterName)- throws SQLFeatureNotSupportedException getBytes(String parameterName)- throws SQLFeatureNotSupportedException getCharacterStream(String parameterName)- throws SQLFeatureNotSupportedException getClob(String parameterName)- throws SQLFeatureNotSupportedException getDate(String parameterName, *)- throws SQLFeatureNotSupportedException getDouble(String parameterName)- throws SQLFeatureNotSupportedException getFloat(String parameterName)- throws SQLFeatureNotSupportedException getInt(String parameterName)- throws SQLFeatureNotSupportedException getLong(String parameterName)- throws SQLFeatureNotSupportedException getNCharacterStream - throws SQLFeatureNotSupportedException getNClob - throws SQLFeatureNotSupportedException getNString - throws SQLFeatureNotSupportedException getObject(int parameterIndex, Map&lt;String, Class&lt;?&gt;&gt; map) - throws SQLFeatureNotSupportedException getObject(String parameterName) - throws SQLFeatureNotSupportedException getRef - throws SQLFeatureNotSupportedException getRowId - throws SQLFeatureNotSupportedException getShort(String parameterName) - throws SQLFeatureNotSupportedException getSQLXML(String parameterName) - throws SQLFeatureNotSupportedException getString(String parameterName) - throws SQLFeatureNotSupportedException getTime(String parameterName, *) - throws SQLFeatureNotSupportedException getTimestamp(String parameterName, *) - throws SQLFeatureNotSupportedException getURL(String parameterName) - throws SQLFeatureNotSupportedException

Class name	Methods
	registerOutParameter - ignores registerOutParameter(String parameterName, *) - throws SQLFeatureNotSupportedException setAsciiStream - throws SQLFeatureNotSupportedException setBigDecimal(String parameterName, BigDecimal x)- throws SQLFeatureNotSupportedException setBinaryStream(String parameterName, *) - throws SQLFeatureNotSupportedException setBlob(String parameterName, *)- throws SQLFeatureNotSupportedException setBoolean(String parameterName, boolean x) - throws SQLFeatureNotSupportedException setByte(String parameterName, byte x) - throws SQLFeatureNotSupportedException setBytes(String parameterName, byte[] x) - throws SQLFeatureNotSupportedException setCharacterStream - throws SQLFeatureNotSupportedException setClob(String parameterName, *) - throws SQLFeatureNotSupportedException setDate(String parameterName, *) - throws SQLFeatureNotSupportedException setDouble(String parameterName, double x) - throws SQLFeatureNotSupportedException setFloat(String parameterName, float x) - throws SQLFeatureNotSupportedException setLong(String parameterName, long x) - throws SQLFeatureNotSupportedException setNCharacterStream - throws SQLFeatureNotSupportedException setNClob - throws SQLFeatureNotSupportedException setNString - throws SQLFeatureNotSupportedException setNull - throws SQLFeatureNotSupportedException setObject(String parameterName, *) - throws SQLFeatureNotSupportedException setRowId(String parameterName, RowId x) - throws SQLFeatureNotSupportedException setSQLXML(String parameterName, SQLXML xmlObject) - throws SQLFeatureNotSupportedException setShort(String parameterName, short x) - throws SQLFeatureNotSupportedException setString(String parameterName, String x) - throws SQLFeatureNotSupportedException

Class name	Methods
	setTime(String parameterName, *) - throws SQLFeatureNotSupportedException setTimestamp(String parameterName, *) - throws SQLFeatureNotSupportedException setURL(String parameterName, URL val) - throws SQLFeatureNotSupportedException
`Clob`	getCharacterStream(long arg0, long arg1) - throws SQLFeatureNotSupportedException setAsciiStream(long arg0) - throws SQLFeatureNotSupportedException setCharacterStream(long arg0) - throws SQLFeatureNotSupportedException setString - throws SQLFeatureNotSupportedException truncate - throws SQLFeatureNotSupportedException
`Connection`	createArrayOf - throws SQLFeatureNotSupportedException createBlob - throws SQLFeatureNotSupportedException createClob - throws SQLFeatureNotSupportedException createNClob - throws SQLFeatureNotSupportedException createSQLXML - throws SQLFeatureNotSupportedException createStatement(int resultSetType,int resultSetConcurrency, int resultSetHoldability) - throws SQLFeatureNotSupportedException createStruct(String typeName, Object[] attributes) - throws SQLFeatureNotSupportedException getClientInfo - throws SQLFeatureNotSupportedException prepareCall(String sql, int resultSetType,int resultSetConcurrency, int resultSetHoldability) - throws SQLFeatureNotSupportedException prepareStatement(String sql, int autoGeneratedKeys) - throws SQLFeatureNotSupportedException prepareStatement(String sql, int[] columnIndexes) - throws SQLFeatureNotSupportedException prepareStatement(String sql, String[] columnNames) - throws SQLFeatureNotSupportedException

Class name	Methods
	releaseSavepoint - throws SQLFeatureNotSupportedException rollback(Savepoint savepoint) - throws SQLFeatureNotSupportedException setHoldability - throws SQLFeatureNotSupportedException setSavepoint - throws SQLFeatureNotSupportedException setTypeMap - throws SQLFeatureNotSupportedException
`DatabaseMetaData`	getAttributes - throws SQLFeatureNotSupportedException getClientInfoProperties - throws SQLFeatureNotSupportedException getFunctionColumns - throws SQLFeatureNotSupportedException getFunctions - throws SQLFeatureNotSupportedException getRowIdLifetime - throws SQLFeatureNotSupportedException
`NClob`	`Not Supported`
`PreparedStatement`	execute(String sql) - throws SQLException executeQuery(String sql) - throws SQLException executeUpdate(String sql) - throws SQLException setArray - throws SQLFeatureNotSupportedException setNCharacterStream - throws SQLFeatureNotSupportedException setNClob - throws SQLFeatureNotSupportedException setRef - throws SQLFeatureNotSupportedException setRowId - throws SQLFeatureNotSupportedException setUnicodeStream - throws SQLFeatureNotSupportedException
`Ref`	`Not Implemented`
`ResultSet`	deleteRow - throws SQLFeatureNotSupportedException getArray - throws SQLFeatureNotSupportedException

Class name	Methods
	getAsciiStream - throws SQLFeatureNotSupportedException getHoldability - throws SQLFeatureNotSupportedException getNCharacterStream - throws SQLFeatureNotSupportedException getNClob - throws SQLFeatureNotSupportedException getNString - throws SQLFeatureNotSupportedException getObject(*, Map&lt;String, Class&lt;?&gt;&gt; map) - throws SQLFeatureNotSupportedException getRef - throws SQLFeatureNotSupportedException getRowId - throws SQLFeatureNotSupportedException getUnicodeStream - throws SQLFeatureNotSupportedException getURL - throws SQLFeatureNotSupportedException insertRow - throws SQLFeatureNotSupportedException moveToInsertRow - throws SQLFeatureNotSupportedException refreshRow - throws SQLFeatureNotSupportedException rowDeleted - throws SQLFeatureNotSupportedException rowInserted - throws SQLFeatureNotSupportedException rowUpdated - throws SQLFeatureNotSupportedException setFetchDirection - throws SQLFeatureNotSupportedException update* - throws SQLFeatureNotSupportedException
`RowId`	`Not Supported`
`Savepoint`	`not Supported`
`SQLData`	`Not Supported`
`SQLInput`	`not Supported`
`SQLOutput`	`Not Supported`

`Statement`	execute(String, int)
	execute(String, int[])
	execute(String, String[])
	executeUpdate(String, int)
	executeUpdate(String, int[])
	executeUpdate(String, String[])
	getGeneratedKeys()
	getResultSetHoldability()
	setCursorName(String)

Class name	Methods
`Struct`	`Not Supported`

A.3. Unsupported Classes and Methods in "javax.sql"

Table A.2. Connection Properties

Class name	Methods
`RowSet*`	`Not Supported`
`StatementEventListener`	`Not Supported`

Appendix B. Generating Self Signed Certificate with Keytool

To generate a self-signed certificate, you need a program called “keytool”, which is supplied with any version of the Java SDK. The instructions below walk through the creation of both the key store and the trust store files for a 1-way SSL configuration with the security keys.

B.1. Creating private/public key pair:

```
keytool -genkey -alias teiid -keyalg RSA -validity 365 –keystore
server.keystore –storetype JKS

 Enter keystore password:  <enter password>
 What is your first and last name?
 [Unknown]:  <user’s name>
 What is the name of your organizational unit?
 [Unknown]:  <department name>
 What is the name of your organization?
 [Unknown]:  <company name>
 What is the name of your City or Locality?
 [Unknown]:  <city name>
 What is the name of your State or Province?
 [Unknown]:  <state name>
 What is the two-letter country code for this unit?
 [Unknown]:  <country name>

 Is CN=<user’s name>, OU=<department name>, O="<company name>",
 L=<city name>, ST=<state name>, C=<country name>  correct?
 [no]:  yes
 Enter key password for <server>
 (Return if same as keystore password)
```

The "server.keystore" can be used as keystore based upon the newly created private key.

B.2. Extracting the public key

From the "server.keystore" created above we can extract a public key for creating a trust store

```
keytool -export -alias teiid –keystore server.keystore -rfc -file public.cert
 Enter keystore password: <enter passsword>
```

This creates the "public.cert" file that contains the public key based on the private key in the "server.keystore"

B.3. Creating the Truststore

```
keytool -import -alias teiid -file public.cert –storetype JKS -keystore server.truststore
Enter keystore password:  <enter password>
Owner: CN=<user's name>, OU=<dept name>, O=<company name>, L=<city>, ST=<state>,
 C=<country>
Issuer: CN=<user's name>, OU=<dept name>, O=<company name>, L=<city>, ST=<state>,
 C=<country>
Serial number: 416d8636
Valid from: Fri Jul 31 14:47:02 CDT 2009 until: Sat Jul 31 14:47:02 CDT 2010
Certificate fingerprints:
         MD5:  22:4C:A4:9D:2E:C8:CA:E8:81:5D:81:35:A1:84:78:2F
         SHA1: 05:FE:43:CC:EA:39:DC:1C:1E:40:26:45:B7:12:1C:B9:22:1E:64:63
Trust this certificate? [no]:  yes
```

Now this has created "server.truststore". There are many other ways to create self signed certificates, the above procedure is just one way. If you would like create them using "openssl", see *this tutorial* [http://www.akadia.com/services/ssh_test_certificate.html].