ART Administration Manual

3.0-beta7

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ART Administration Manual

1. Introduction

ART is a Java EE web application that enables quick deployment of SQL query results.

- **ART Administrators** define datasources, reports, users, etc.
- **ART Users** run reports and view the results in a browser or in a variety of file formats.

ART is open source software distributed under the GPLv3 license. You can install and use it without any charge.

1.1. Administration Overview

The Administrators define a number of items including

- **ART Database** used to store ART objects e.g. report definitions
- **Settings** used to configure how ART works
- **Datasources** against which reports are run
- **Report Groups** used to group reports
- **Reports** that can be run
- **User Groups** used to group users
- **Users** who can access the application
- **User Group Membership** to add or remove users from user groups
- **Access Rights** to determine which users or user groups can access which reports, report groups or jobs
- **Admin Rights** to determine which report groups and datasources administrators can manage
- **Parameters** to be used by reports
- **Rules** to be applied to reports
- **Rule Values** to be used with specific users or user groups
- **Jobs** to run reports at scheduled times
- **Schedules** to manage schedules that can be used when creating jobs
- **Caches** to enable clearing of ART object caches
- **Connections** to view datasource connection pools
- **Loggers** to manage which application debug information is logged by ART

The typical flow when defining a new report is

- Obtain the plain SQL statement
- Define the report
- Update access rights to allow users to run the report

2. ART Database

The ART database is the database used by ART to hold details like users, report definitions etc. Use the **Configure | ART Database** menu to define connection details for the ART database.

Attribute	Description
Database Type	The database software that the database runs on
JNDI	Defines whether the ART database is a JNDI datasource
JDBC Driver	JDBC driver name
JDBC URL	JDBC URL. If you are using a JNDI datasource, set this to the JNDI name of your datasource e.g. `jdbc/MyDatasource`. You can also use the full JNDI url e.g. `java:comp/env/jdbc/MyDatasource`
Username	Database username. The user needs SELECT, INSERT, UPDATE and DELETE rights on the ART tables.
Password	Database password
Test SQL	Short SQL query used to determine if a connection is alive e.g. "Select 1"
Connection Pool Timeout	How long an idle connection should be maintained in the connection pool before being closed. This setting applies to the ART database as well as all report data-sources.
Max Pool Connections	The maximum number of connections a connection pool can open to the same datasource. Further requests are queued. This setting applies to the ART database as well as all report datasources.
Connection Pool Library	The connection pool library to use. This setting applies to the ART database as well as all report datasources.

3. Settings

Certain settings are used to configure how ART works. Use the **Configure | Settings** menu to manage ART settings.

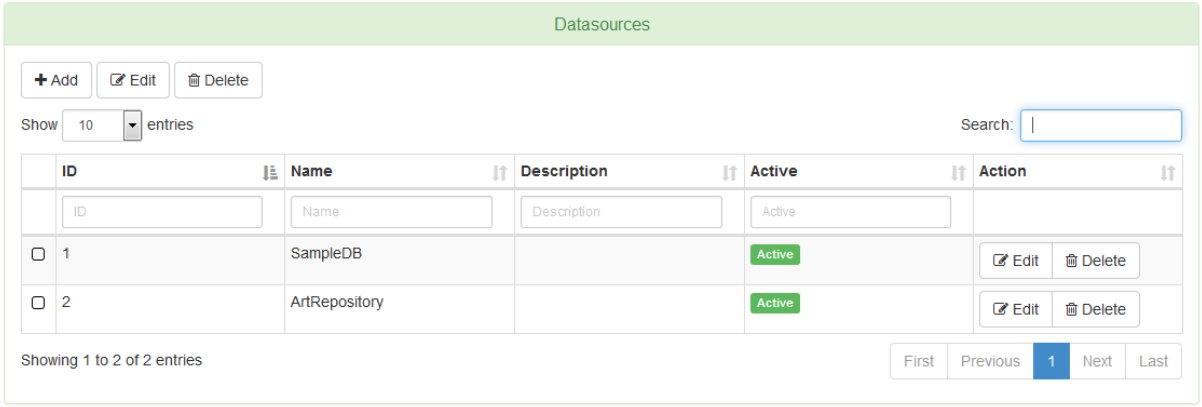
Setting	Description
SMTP Server	Host name for the email server used to send emails
SMTP Port	Port on which SMTP server is listening
Use StartTLS	Defines whether to use the StartTLS protocol when sending emails
Use SMTP Authentication	Defines whether the SMTP server requires a username and password in order to send emails
SMTP Username	Username to be used when sending emails if the email server is configured to require SMTP authentication
SMTP Password	Password to be used when sending emails if the email server is configured to require SMTP authentication
Default Authentication Method	The authentication method that will be used by ART
Windows Domain Controller	Used with windows domain authentication. The IP address of the windows domain controller.
Allowed Windows Domains	Used with windows domain authentication. The domain name of the windows domain used for authentication. Multiple domains can be specified, each separated by a comma.
Database Authentication JDBC Driver	Used with database authentication. The JDBC driver for the database used for authentication.
Database Authentication JDBC URL	Used with database authentication. The JDBC URL for the database used for authentication.
LDAP Server	Used with LDAP authentication. IP address of the LDAP server.
LDAP Port	Used with LDAP authentication. LDAP server port.
LDAP Connection Encryption Method	Used with LDAP authentication. Defines which protocol to use for the LDAP connection.
LDAP URL	Used with LDAP authentication. LDAP server URL. If the LDAP server and port fields have been used, leave this setting blank. This setting only provides an alternative way of specifying the location of the LDAP server.

Setting	Description
Use Anonymous Bind	Used with LDAP authentication. Defines whether to use anonymous bind when connecting to the LDAP server in order to search for and authenticate users.
LDAP Bind DN	Used with LDAP authentication. The DN to use when connecting to the LDAP server in order to search for and authenticate users.
LDAP Bind Password	Used with LDAP authentication. The password to use when connecting to the LDAP server in order to search for and authenticate users.
LDAP User ID Attribute	Used with LDAP authentication. The LDAP attribute which will be used to match ART usernames.
LDAP Authentication Method	Used with LDAP authentication. The authentication method to be used with the LDAP server
LDAP Realm	Used with LDAP authentication. The LDAP realm when using the Digest-MD5 authentication method. If blank, the default realm will be used.
Default Max Rows	The default maximum number of rows to output for a report
Specific Max Rows	The maximum number of rows to output for specific report formats, defined as a comma separated list of settings with each setting in the format `viewmode:value` e.g. `htmlGrid:5000,xls:10000`. Report formats are case sensitive.
PDF Page Size	Size and layout of documents generated by pdf output
PDF Font Name	Name of a custom font that should be used in generation of pdf output, and charts. For jasper reports, custom fonts need to be defined in the jrxml file. See the Tips documentation for details on how to use custom fonts with jasper reports.
PDF Font File	Path to a font file that contains the custom font
PDF Font Directory	Path to a directory that contains font files, one of which may be used in the pdf font name field
PDF Font Encoding	Encoding to use for the custom font
PDF Font Embedded	Whether the custom font should be embedded in the generated pdf output
Administrator Email	Email address which is displayed in link at the bottom of ART web pages
Date Format	Format to be used for date portions of dates. Format strings to be used is as per the java SimpleDateFormat class. See http://docs.oracle.com/javase/6/docs/api/java/text/SimpleDateFormat.html
Time Format	Format to be used for time portion of dates. Format strings to be used is as per the java SimpleDateFormat class. See http://docs.oracle.com/javase/6/docs/api/java/text/SimpleDateFormat.html

Setting	Description
Report Formats	The report formats that will be available to users when they run a report, defined as a comma separated list. Report format names are case sensitive and the order specified will be respected in the list shown to users.
Display Null	Defines whether the string "null" is displayed where a column in a report is null
Max Running Reports	The maximum number of reports that can be running at any one time
Show Header in Public User Session	Defines whether to show the menu bar and page footer for reports that are run with public access
Mondrian Cache Expiry Period	Number of hours after which the mondrian cache is automatically cleared. Set to 0 to disable automatic clearing.
Scheduling Enabled	Defines whether scheduled jobs will run.
RSS Link	RSS URL if ART will be used to generate RSS feeds
Max File Upload Size (MB)	Maximum file upload size for jasperreports, jXLS or mondrian files. Set to -1 for no limit.
ART Base URL	The base URL for ART e.g. http://art-server:8080/art. This is used to include a link to publish job output in publish job reminder emails.

4. Datasources

A datasource is a database against which you want to run reports. Use the **Configure | Datasources** menu to manage datasources.



- Use the **Add** button to create a new datasource
- Use the **Edit** and **Delete** buttons at the top to edit or delete multiple datasources and the buttons on the side to edit or delete individual datasources
- Use the **Search** field to search for a particular datasource. You can also search by individual columns using the appropriate search fields below the column headings.
- You can sort the datasources list by clicking on the column headings

4.1. Creating a new datasource

From the Datasources page, use the Add button and then specify the settings for the datasource. ART can run reports against any datasource for which a JDBC driver is available.

Attribute	Description
Name	A name to identify the datasource
Description	A description for the datasource
Active	Defines whether the datasource is available for use
Datasource Type	Defines whether this is a JDBC based datasource or an OLAP datasource
JNDI	Defines whether the datasource is a JNDI datasource
Database Type	The database software that the database runs on
JDBC Driver	JDBC driver name
JDBC URL	JDBC URL of the target database. If you are using a JNDI datasource, set this to the JNDI name of your datasource e.g. `jdbc/MyDatasource`, or the full JNDI url e.g. `java:comp/env/jdbc/MyDatasource`
Username	Database user on the target database. This user should have minimum rights on the database and tables you plan to use in your reports, mostly only SELECT rights to the relevant tables.
Password	Password for the database user
Test SQL	Short SQL query used to determine if a connection is valid e.g. "Select 1"
Connection Pool Timeout	How long a connection should be maintained in the connection pool before being closed

Note:

- The Database Type field is not saved. It is only there as a guide to help fill the JDBC Driver and URL fields.
- Connections do not always close gracefully - for example if a network outage occurs a broken connection might stay in the pool and would throw an error when used. The **Test SQL** query is used every **Timeout** minutes to validate the connection. If it does not execute successfully, the connection is closed and removed from the pool.

4.2. Some JDBC Drivers and URLs

Database: **CUBRID**

Driver Name: cubrid.jdbc.driver.CUBRIDDriver

JDBC URL: `jdbc:cubrid:<server_name>:<port>:<database_name>[:?<property1>=<value1>[&<property2>=<value2>][&...]` (default port is 33000)

Driver Available from: http://www.cubrid.org

Database: **Oracle**

Driver Name: oracle.jdbc.OracleDriver

JDBC URL: `jdbc:oracle:thin:@<server_name>:<port>:<sid>` (default port is 1521)

Driver Available from: http://www.oracle.com/technetwork/database/features/jdbc/index-091264.html

Database: **MySQL**

Driver Name: com.mysql.jdbc.Driver

JDBC URL: `jdbc:mysql://<server_name>[:port]/<database_name>[?<property>=<value>[&...]` (default port is 3306)

Driver Available from: http://dev.mysql.com/downloads/connector/j/

Database: **MariaDB**

Driver Name: org.mariadb.jdbc.Driver

JDBC URL: `jdbc:mariadb://<server_name>[:port]/<database_name>[?<property>=<value>[&...]` (default port is 3306)

Driver Available from: Driver Available from:
https://mariadb.com/kb/en/mariadb/about-mariadb-connector-j/

Database: **PostgreSQL**

Driver Name: org.postgresql.Driver

JDBC URL: `jdbc:postgresql://<server_name>[:port]/<database_name>[?<property>=<value>[&...]` (default port is 5432)

Driver Available from: http://jdbc.postgresql.org/

Database: **SQL Server (Microsoft driver)**

Driver Name: com.microsoft.sqlserver.jdbc.SQLServerDriver

JDBC URL: `jdbc:sqlserver://<server_name>[:port];databaseName=<database_name>[;instanceName=<instance_name>][;<property>=<value>[;...]` (default port is 1433)

Driver Available from: http://msdn.microsoft.com/en-us/data/aa937724.aspx

Database: **SQL Server (jTDS driver)**

Driver Name: net.sourceforge.jtds.jdbc.Driver

JDBC URL:
`jdbc:jtds:sqlserver://<server_name>[:port]/<database_name>[;instance=<instance_name>][;<property>=<value>[;...]`
(default port is 1433)

Driver Available from: http://jtds.sourceforge.net

Database: **HSQLDB (Standalone mode)**

Driver Name: org.hsqldb.jdbcDriver

JDBC URL: `jdbc:hsqldb:file:<file_path>[;shut-down=true;hsqldb.write_delay=false;create=false][;<property>=<value>[;...]`

Driver Available from: http://hsqldb.org/

Database: **HSQLDB (Server mode)**

Driver Name: org.hsqldb.jdbcDriver

JDBC URL: `jdbc:hsqldb:hsql://<server_name>[:port]/<database_alias>[;<property>=<value>[;...]` (default port is 9001)

Driver Available from: http://hsqldb.org/

Database: **DB2 (IBM Data Server Driver for JDBC and SQLJ)**

Driver Name: com.ibm.db2.jcc.DB2Driver

JDBC URL: `jdbc:db2://<server_name>[:port]/<database_name>[:<property>=<value>[;...]` (default port for IBM DB2 is many times one of the following: 446, 6789, or 50000)

Driver Available from: http://www-01.ibm.com/support/docview.wss?rs=4020&uid=swg21385217 (registration required).
This driver can connect to a DB2 database on any platform i.e. iSeries, zSeries, or Intel-based machines with Linux or Windows.

Database: **DB2 for iSeries (Toolbox driver)**

Driver Name: com.ibm.as400.access.AS400JDBCDriver

JDBC URL: `jdbc:as400://<server_name>;prompt=false;translate binary=true[;<property>=<value>[;...]`

Driver Available from: http://jt400.sourceforge.net/

Database: **Generic ODBC Datasource**

Driver Name: sun.jdbc.odbc.JdbcOdbcDriver

JDBC URL: `jdbc:odbc:<dsn_name>`

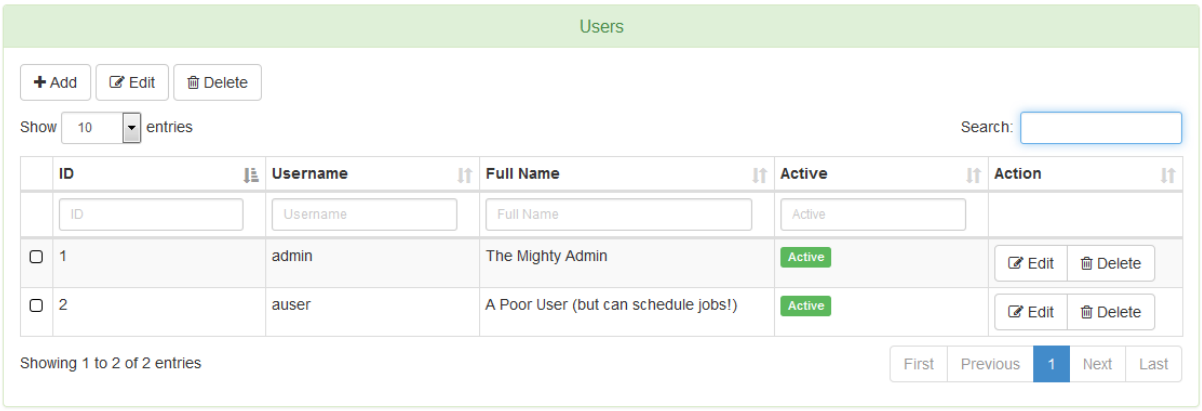
Note:

- The sun JDBC-ODBC bridge driver is available by default. You need to set up the DSN on the server. For optimal performance you should use the specific DBMS JDBC driver.
- ART comes with drivers for CUBRID, PostgreSQL, MySQL, MariaDB, HSQLDB, jTDS so you

dont need to download these drivers

5. Users

Use the **Configure | Users** menu to manage users.



- Use the **Add** button to create a new user
- Use the **Edit** and **Delete** buttons at the top to edit or delete multiple users and the buttons on the side to edit or delete individual users
- Use the **Search** field to search for a particular user. You can also search by individual columns using the appropriate search fields below the column headings.
- You can sort the users list by clicking on the column headings

Note:

- It is always possible to log into ART by specifying the ART database username and password

5.1. Setting up the Public User

If you want a report to be run by anyone, without authentication, you can define a user with the special username **public_user** and grant this user access to the report. This is useful for availing reports without requiring users to log in to ART

5.2. Access Levels

Users are assigned access levels depending on the permissions they require within the application. Each higher access level has the permissions of all access levels below it.

Level	Permissions
Normal User	Run reports, view jobs, view archives
Schedule User	Schedule jobs
Junior Admin	Create reports, view application documentation
Mid Admin	Manage access rights
Standard Admin	Create users, create user groups, define user group membership, manage admin user rights, manage jobs
Senior Admin	Create datasources, create report groups, create rules and rule values, create schedules, manage caches, connections and loggers, view application logs
Super Admin	Manage ART database and application settings

6. Authentication

Use the **Configure | Settings** menu to define the authentication method to be used by ART.

6.1. Internal Authentication

Internal authentication authenticates users with a username and password combination defined and stored within ART. Users can change their passwords using the **Password** menu.

6.2. Windows Domain Authentication

If the users are in a windows domain environment, you can have them log in to ART using the user-names and passwords they use to log in to windows.

Do the following to configure ART to use windows domain authentication.

- In the Settings page, set the **Default Authentication Method** to **Windows Domain**
- Set the **Windows Domain Controller** field to the domain controller machine name (IP address should also work). You can do the following to get the domain controller machine name.

```
ping <domain name> (This will get the ip address of the domain controller)
ping -a <ip address of domain controller> (This will get the hostname of the domain controller)
```

- Set the **Allowed Windows Domains** field to the windows domain name. Use all uppercase letters for the domain name

For each user who requires access to ART, you will also need to create a user within ART with the same username as their windows login username. Grant them appropriate access to reports. The users can now log in to ART using their windows username and password.

6.3. LDAP Authentication

Do the following to configure ART to use LDAP authentication.

- In the Settings page, set the **Default Authentication Method** to **LDAP**
- Provide values for the LDAP fields. If you fill the ldap server and port fields, leave the url field blank. If you use the url field, leave the server and port fields blank.

For each user who requires access to ART, you will also need to create a user within ART with the same username as their uid (or samAccountName for Active Directory). Grant them appropriate access to reports. The users can now log in to ART using their ldap uid and password.

6.4. Database Authentication

Database logins can also be used to access ART. Do the following to use the database authentication that comes with ART.

- Have or create database users on any database. The users need to be able to connect to the database but don’t need to have any other rights on the database
- In the Settings page, set the **Default Authentication Method** to **Database**

- Fill the Database Authentication JDBC fields. The JDBC driver for the database will need to be available in the **ART_HOME\WEB-INF\lib** directory or **TOMCAT_HOME\lib** directory if using Apache Tomcat.

For each user who requires access to ART, you will also need to create a user within ART with the same username as their database login username. Grant them appropriate access to reports. The users can now log in to ART using their database username and password.

6.5. CAS Authentication

ART can use an existing CAS server to do the authentication of users. To use CAS authentication, take the following steps

- Ensure the CAS server is running
- Start ART with Internal authentication configured
- Ensure the CAS users are also created within ART. The password within ART is not important as CAS will be doing the authentication.
- In the Settings page, change the **Default Authentication Method** to **CAS**
- Enter the **CAS Logout URL** e.g. `https://cas-server:8443/cas/logout` to enable users to log out of CAS, and thereby log out of all applications that use CAS.
- Log out of ART
- Stop ART
- Edit ART's **web.xml** file and uncomment the items in the CAS configuration section, providing appropriate urls for the CAS and ART applications.
- Start ART again
- You should be redirected to the CAS login page where you will provide appropriate credentials, after which you will be redirected back to ART

For each user who requires access to ART, you will also need to create a user within ART with the same username as their CAS login username. Grant them appropriate access to reports.

6.6. Custom Authentication Sources

Additional, custom authentication sources can be used by creating a jsp page to check the user credentials - for example by executing a query on a remote database - and then redirecting to the reports page.

This is the code fragment to redirect an authenticated user to ART.

```
if ( <CONDITION> ) {
// Authentication Successful!
session.setAttribute("username", username);
response.sendRedirect("/art/reports");
}
```

The user needs to be defined in ART. ART will check if the username exists, and if this is the case, will let the user proceed.

7. User Groups

Use the **Configure | User Groups** menu to manage user groups.

User groups are used to logically treat a set of users as one entity. If a group is granted access to a report, members of that group get access to the report. This allows for easier management of access rights. A user can belong to zero, one or many user groups.

8. User Group Membership

Use the **Configure | User Group Membership** menu to manage user group membership.

9. Report Groups

Use the **Configure | Report Groups** menu to manage report groups.

Report groups are used to logically associate reports.

Note:

- In a standard organization, you may want to define several groups to match the different business areas of the company e.g. INVENTORY, PURCHASING, FINANCE etc.
- In order to create Development, QA and Production environments, you can create several groups e.g. INVENTORY_PROD, INVENTORY_QA, and INVENTORY_DEV, and have a newly developed report created in the INVENTORY_DEV group, moved to the INVENTORY_QA group for user tests and finally to INVENTORY_PROD once testing is complete.
- It is possible to limit the report groups that an administrator can deal with. You can therefore have administrators who deal only with a development environment and others who deal with the production environment.

10. Reports

Use the **Configure | Reports** menu to manage reports.

10.1. Creating a new report

Use the Add button from the Reports Configuration page to create a new report.

Attribute	Description
ID	Auto-generated ID used to uniquely identify the report
Name	Name of the report
Report Group	Report Group to which the report will be belong
Active	Whether the report can be run or not
Hidden	Whether the report is listed to users or not
Short Description	Short description for the report. For charts, this will appear as the title of the chart.
Description	Longer description for the report
Contact Person	Can be used to store the name of the contact or reference person for the report
Type	The type of report
Datasource	The datasource against which the report will be executed
Uses Rules	This specifies if the report will use rules
Parameters In Output	This determines if the selected parameter values should be displayed in the report output
Display Resultset	The resultset to display if the sql source contains multiple sql statements. Leave as 0 if the sql source doesn't have multiple statements. Set to 1 to use the first statement, 2 to use the second, etc. Set to -1 to use the **select** statement, regardless of how many statements exist. Set to -2 to use the **last** statement, regardless of how many statements exist. Your RDBMS may not support multiple statements in a query or may require some configuration for it to work. See the **Multiple Statements** section for more details.
Default Report Format	The default report format that should be selected for this report. Please note that not all report formats are available for all report types.
Hidden Columns	For tabular reports, a comma separated list of column indices or column names for columns that should not be included in the generated output

Attribute	Description
Total Columns	For tabular reports, a comma separated list of column indices or column names for columns that should be totalled in the generated output
Date Format	For tabular reports, the format that should be used for date columns. Leave blank to use the default.
Number Format	For tabular reports, the format that should be used for numeric columns. Leave blank to use the default.
Column Formats	For tabular reports, the formats that should be used for specific date or numeric columns. Each column specification comes in a new line. The specification is in the format `{column index or column name}:{format}`. Examples `1:dd/MM/yyyy` or `due_date:dd MMM yyyy` or `amount:#,##0.00`. For xls and xlsx report formats, one cannot use individual column formats so the formats specified in the Date Format and Number Format fields would be used for all respective columns.
Locale	For tabular reports, the locale to be used when formatting dates and numbers e.g. `de` or `en_US`. Leave blank to use the default. For xls and xlsx report formats, this setting has no effect.
Null Number Display	For tabular reports, a string that should be used for numeric columns where the value is null. Leave blank to use the default. For xls and xlsx report formats, this setting has no effect.
Null String Display	For tabular reports, a string that should be used for string columns where the value is null. Leave blank to use the default.
Fetch Size	The number of rows retrieved by the database driver per trip to the database. Leave as 0 to use the driver's default. This value reprents a trade-off between memory and query execution time and may be useful to set for reports that return large amounts of data in order to avoid out-of-memory errors. Not all databases honour this setting.
x-axis Label	For charts, the x axis label
y-axis Label	For charts, the y axis label
Width	For charts, the chart width
Height	For charts, the chart height
Background Colour	For charts, the background colour
y-axis Min	For charts, the minimum value for the y-axis. Leave as 0 to use the full data range.
y-axis Max	For charts, the maximum value for the y-axis. Leave as 0 to use the full data range.
Rotate x-axis labels at	For charts, the number of categories at which the labels will be displayed vertically instead of horizontally. Set to 1 to always display labels vertically.
Remove x-axis labels at	For charts, the number of categories at which labels are omitted from the chart. Set to 1 to always omit labels.

Attribute	Description
Secondary Charts	For charts, a comma separated list of report IDs of other charts which are to be displayed with this one. These charts will use separate y-axes. Some chart types cannot have secondary charts, including pie charts, speedometer, bubble and heat map charts.
Template	For jasper reports, select the .jrxml file to use. For pivot table (mondrian) reports, select the mondrian cube .xml file to use. For jXLS reports, select the .xls or .xlsx template file to use. For FreeMarker reports, select the .ftl template file to use. For XDocReport reports, select the .docx, .odt or .pptx template file to use. For React-Pivot reports, specify the .js file that contains the react pivot configuration for the report.
XMLA Data-source	For mondrian via xmla, the xmla datasource name as it appears in the **data-sources.xml** file on the xmla server
XMLA Catalog	For mondrian or mondrian via xmla, the catalog name as it appears in the mondrian cube xml file. For SSAS, the database name.
Options	Provides additional options depending on the report type. The options are specified in JSON format with different report types expecting different JSON specifications.
Source	The SQL query used to retrieve the required data. It can contain parameter place-holders, specified using labels (`#parameter_name#`). XML-style elements can be used to create Dynamic SQL statements. Some special tags can be used in the query (`:USERNAME:`, `:DATE:`, `:TIME:`)

Note:

- Three special tags can be used within the SQL statement and are substituted at runtime with their respective values:

```
:USERNAME: - replaced by the username of the user who is executing the query
:DATE: - replaced by the current date (format YYYY-MM-DD)
:TIME: - replaced by the current time (format YYYY-MM-DD HH:MI:SS)
```

- You can use a stored procedure to return query results. When defining the query, in the SQL source section, use the syntax for calling a stored procedure in the RDBMS you are using e.g. For MySQL you can use something like "call my_sp". Another RDBMS may use syntax like "exec my_sp".

10.2. Report Types

- **Tabular**
  A tabular result exportable to spreadsheet, pdf etc.

- **Tabular (html only)**
  A tabular result that can only be displayed in HTML format. This may be used to embed HTML code in the SQL query in order to modify display colours of certain columns etc. To do this, concatenate the SQL with the required HTML tags. e.g. For MySQL, to display positive values in green and negative values in red, you can use something like

```
SELECT col1,
CASE WHEN int_col2>0 THEN
concat('<div style="background-color: green">',cast(int_col2 as char),'</div>')
ELSE
concat('<div style="background-color: red">',cast(int_col2 as char),'</div>')
END as "My Formatted Column",
col3
from my_table
```

- **Crosstab**
  Rearranges the query output into crosstab format, exportable to spreadsheet, pdf etc. If you want values to be summed, include the summing in the SQL query e.g. select year,quarter,sum(amount) from orders group by year,quarter

The SQL result set is expected to have either 3 or 5 columns:

```
SELECT xAxisCol "xAxisLabel", yAxisCol "yAxisLabel", Value FROM ...
(data type: string, string, any)
```

OR

```
SELECT xAxisCol, xAxisAltSort, yAxisCol, yAxisAltSort, Value FROM ...
(data type: string, string, string, string, any)
```

The AltSort columns are used to sort the x-axis (rows) and y-axis (columns). The following helps to illustrate this.

```
/* input */                  /* input */
// A Jan 14                   A 1 Jan 1 14
// A Feb 24                   A 1 Feb 2 24
// A Mar 34                   A 1 Mar 3 34
// B Jan 14                   B 2 Jan 1 14
// B Feb 24                   B 2 Feb 2 24
// C Jan 04                   C 3 Jan 1 04
// C Mar 44                   C 3 Mar 3 44
//                           ^-----^------Used to sort the x/y axis

/* output */                 /* output */
//         y-axis                    y-axis
//           |                     |
//  x-axis - _   Feb Jan Mar          x-axis - _  Jan Feb Mar
//           A    24  14  34               A   14  24  34
//           B    24  14  -                B   14  24   -
//           C    -   04  44               C   04   -  44
//                   ^--- Jan comes after Feb!
```

Without the AltSort columns, as in the first output, Feb appears before Jan. This is because the string "Feb" is alphabetically before "Jan". However, Jan should appear before Feb because that is how they appear in the order of months. You can therefore use the month number in the sort column to ensure that Jan is displayed before Feb. Another example would be if you are displaying dates in a format like "Apr-2011" (MMM-YYYY). Apr-2011 is alphabetically before Jan-2011, so the alternative sort column could be set to YYYY-MM format (e.g. 2011-04) to order the period names in the right way.

- **Crosstab (html only)**
  Same as crosstab but limited to HTML output only
- **Charts**
  Display the results as a chart, exportable to pdf or png.

The layout of the SQL must follow a specific syntax for each different type of chart

- **XY**

```
SELECT Value1, Value2 "SeriesName" FROM ...
(data type: number, number )
```

Dynamic Series

```
SELECT Value1, Value2, SeriesName FROM ...
(data type: number, number, string)
```

- **Pie**

```
SELECT Category, Value FROM ...
(data type: string, number )
```

- **Bars/Stacked Bars/Line**

Static Series

```
SELECT Item, Value1 "SeriesName1" [, Value2, ...] FROM ...
(data type: string, number [, number, ...] )
```

Dynamic Series

```
SELECT Item, SeriesName, Value FROM ...
(data type: string, string, number)

Example:
SELECT Product, Region, SUM(VOLUME) FROM sales group by product,region
```

- **Time/Date Series**

Static Series

```
SELECT Timestamp|Date, Value1 "SeriesName1" [, Value2, ...] FROM ...
(data type: timestamp|date, number, [, number, ...] ). Timestamp/Dates must be unique.
```

Dynamic Series

```
SELECT Timestamp|Date, SeriesName, Value FROM ...
(data type: timestamp|date, string, number). Timestamp/Dates must be unique.

Example:
SELECT ORDER_DATE, PRODUCT, SUM(VOLUME) FROM orders group by order_date,product
```

- **Speedometer**

```
SELECT DataValue, MinValue, MaxValue, UnitsDescription [, Range1, Range2, ...] FROM ...
(data type: number, number, number, string)
Ranges represent optional columns and each range has 3 values separated by :  i.e.
RangeUpperValue:RangeColour:RangeDescription (data type: number, string, string).
RangeUpperValue can be a percentage.

Example:
SELECT reading, 0, 100, "degrees",
"50:#00FF00:Normal",
"80%:#FFFF00:Warning",
"100:#FF0000:Critical"
FROM temperature_reading
```

- **Bubble**

```
SELECT Value1, Value2 "SeriesName", Value3 [, normalisedValue3] FROM ...
(data type: number, number, number [, number] )
```

- **Heat Map**

```
SELECT Value1, Value2, Value3 [, Option1, Option2, ...] FROM ...
(data type: number, number, number [, string, string, ...] )

Example:
SELECT x, y, z, "upperBound=100"
FROM myvalues
```

Note:

- ART uses the cewolf and jfreechart libraries to generate charts. These libraries in turn use standard java AWT to plot charts. In order to work correctly, AWT needs a graphic display. If you are using a "headless" workstation (i.e. a Unix box without X) you need to start the JVM with the option **-Djava.awt.headless=true**

- You can specify specific colours to be used for the series displayed in a chart by adding columns to the query resultset in the format `seriesColor:<series index>:<hex color code>` e.g. for a pie chart,

```
SELECT description, volume, "seriesColor:0:#ff8000"
FROM orders
```

- For **bubble charts**, the size of the bubbles is determined by `Value3`. The actual size of the bubbles as they appear in the chart is also relative to the values on the y axis (`Value2`). If your values for `Value3` are much larger than those for `Value2` for example, you may find the whole chart filled in one colour, with no bubbles. In this case, you can increase the range of the y axis by setting the **y-axis Min** and **y-axis Max** fields for the query. Alternatively, you can include an extra column in the result set that contains a normalised value that will be used to scale the size of the bubbles e.g.

```
SELECT Value1, Value2 "MySeries", Value3,
Value3 * (SELECT max(Value2) FROM mytable)/(SELECT max(Value3) FROM mytable)
FROM mytable
```

- For **heat map** charts, the following options are available. Option names and values are case sensitive. Options are defined in the result set with a column value whose syntax is `<option>=<value>` i.e. the option name and value separated by `=`

Option	Possible Values	Default	Description
upperBound	Any number, positive or negative	1	Highest value displayed. If you don't specify this option, the chart may appear blank if all your values are above 1.
lowerBound	Any number, positive or negative	0	Lowest value displayed

Option	Possible Values	Default	Description
scalePos	top left bottom right	bottom	Default position of the colour scale relative to the chart
scaleLabel	Any string	None	Title the colour scale
scaleTextPos	topleft topright bottomleft bottomright	topleft	Position of the scale title relative to the colour scale
scaleBorder	Hex colour code e.g. `#00E000`	None	Colour of border displayed around the colour scale box
stripWidth	Any positive integer	10	Width/thickness of the colour scale
subdivisions	Any positive integer	10	For grey scale or a 2 colour scheme, i.e. if no `color#n` options are configured, the number of shades of grey or shades of the 2 colour scheme to use
`color#<n>` e.g. `color#1`, `color#2`	`<number>:<hex colour code>` e.g. `0.0:#FF0000`	None	The colour to use for a given range of values. The colour is determined by `Value3` of the result set. The number is the lower bound of the range. The option value has the lower bound and colour separated by `:` e.g. to display 0-10 in red and 11-50 in green, you'll define two columns in the result set, `"color#1=0:#FF0000"`, `"color#2=11:#00FF00"`
lowerColor	Hex colour code	None	The colour of the lowest value if you want a 2 colour scheme with a linear gradient from the lower colour to the upper colour e.g. set `lowerColor` to white (`#FFFFFF`) and `upperColor` to red (`#FF0000`) if you want values to be represented as shades of red
upperColor	Hex colour code	None	The colour of the highest value if you want a 2 colour scheme with a linear gradient from the lower colour to the upper colour e.g. set `lowerColor` to white (`#FFFFFF`) and `upperColor` to red (`#FF0000`) if you want values to be represented as shades of red

- **Group**
  Groups the report data.

For example, if a query's tabular output looks like:

```
AA | AA | B | C | D
AA | AA | E | F | G
AA | BB | H | J | K
AA | BB | X | Y | Z
```

using "Group on 2 columns", the data would be grouped by the first 2 columns, and the output would look like:

```
AA | AA
B | C | D
E | F | G
AA | BB
H | J | K
X | Y | Z
```

For a "Group on n columns" report, the query must be ordered by the the first n-1 columns.

- **Update Statement**
  Used to execute statements that do not return any rows e.g. INSERT/UPDATE/DELETE statements
- **Text**
  Used to define a piece of text that can be displayed
- **Dashboard**
  Used to display reports in a single portal-like page.
- **Dashboard: Gridstack**
  Used to display reports in a single portal-like page, allowing for specifying exact positioning of report items within the dashboard, specifying the height and width that the report items should occupy, allowing for resizing the items dynamically using the mouse, and moving the items around using drag-and-drop.
- **JasperReports: Template Query**
  To generate formatted reports e.g. statements given to customers, you can use Jasper Reports. To create a jasper report, use the iReport or JasperSoft Studio report designer.

Displays a jasper report based on the selected jrxml template. The query within the jasper report template will be used to generate the results. The query will be run against the selected datasource. You can define parameters that will be passed to the jasper report. Jasper report parameters are defined with a specific type. The following mapping of ART and jasperreport parameter types should be used.

ART parameter type	JasperReports parameter type
Varchar, Text	java.lang.String
Date, DateTime	java.util.Date
Integer	java.lang.Integer
Number	java.lang.Double
Multi-Value parameters	java.util.List

If the report needs a barcode element, use one of the **Barbecue** barcode elements. The Barcode4J elements will cause an error when the report is run within ART.

If the report contains a subreport, set the **Subreport Expression** property of the subreport object to the file name of the subreport with a .jasper extension e.g. **"subreport1.jasper"** (include the quotes). When creating the report in ART, upload the main report's .jrxml file using the main template field and upload the subreport's .jrxml file using the resources field. If there are multiple subreports, you can select multiple files and upload all of them at once using the **Start upload** button. You can also select files by dragging from the file explorer and dropping to the browser page.

- **JasperReports: ART Query**
  Displays a jasper report based on the selected jrxml template. The query as defined in the SQL source will be used to generate the results. The query will be run against the selected datasource.
- **Pivot Table: Mondrian**
  Used to provide OLAP (slice and dice) analysis using the mondrian engine. The MDX for the query should be put in the source section and the xml file that defines the mondrian cube should be selected in the template field.
- **Pivot Table: Mondrian XMLA**
  Used to provide OLAP analysis by accessing a mondrian server via the xmla protocol.
- **Pivot Table: Microsoft XMLA**
  Used to provide OLAP analysis by accessing an SQL Server Analysis Services server via the xmla protocol.
- **jXLS Spreadsheet: Template Query**
  Displays a report in MS Excel format(xls or xlsx) based on a pre-formatted jXLS template. The query within the jXLS template will be used to generate the results. The query will be run against the selected datasource.
- **jXLS Spreadsheet: ART Query**
  Displays a report in MS Excel format(xls or xlsx) based on a pre-formatted jXLS template. The query as defined in the SQL source will be used to generate the results. The query will be run against the selected datasource.
- **FreeMarker**
  Displays a report in the browser based on a freemarker template - http://freemarker.org/. The query as defined in the SQL source will be used to generate the results. The data can be accessed in the template by iterating over the **results** variable. Report parameters are also available using the parameter name e.g. **${param1.value}**. An example report is included in the demo database.
- **Thymeleaf**
  Displays a report in the browser based on a thymeleaf template - http://www.thymeleaf.org/. The query as defined in the SQL source will be used to generate the results. The data can be accessed in the template by iterating over the **results** variable. Report parameters are also available using the parameter name e.g. **${param1.value}**. An example report is included in the demo database.
- **ReactPivot**
  Generates a pivot-table-like report based on tabular data using the ReactPivot library - https://davidguttman.github.io/react-pivot/. You will need to create a javascript file that contains the react pivot configuration for the report. You need to define **dimensions**, **reduce** and **calculations** options. Other options can also be defined to override the defaults. The demo database also comes with some samples of this report type. This report type is useful when you want summary and analysis of numeric data by category.
- **PivotTable.js**
  Generates a pivot table based on data from a database - making use of the PivotTable.js library - https://github.com/nicolaskruchten/pivottable. A javascript file containing custom configuration can be uploaded using the **Template** field. The demo database contains a sample report of this type. Performace should be acceptable up to 100,000 rows, depending on the user's computer.
- **PivotTable.js: CSV Local**

Enables generation of a pivot table using data from a user supplied csv file. Additionally, a javascript file can be specified in the **Template** field with custom configuration options. Any delimited file can be used, not only csv.

- **PivotTable.js: CSV Server**
  Generates a pivot table based on data from a specific csv file uploaded to the server. This file can be uploaded using the **Add files** button. The file name will also need to be specified in the **Options** field with a format similar to the following. A **dataFile** attribute is expected, whose value is a string - the name of the csv file.

```
{
     "dataFile": "file_name.csv"
}
```

Additionally, a javascript template file can be specified in the **Template** field with custom configuration options. Any delimited file can be used, not only csv.

- **XDocReport: FreeMarker engine - Docx**
  You can use MS Word (docx), LibreOffice Writer (odt) or MS PowerPoint (pptx) docments as a template for reports. You simply create the document as you would like it to appear and then insert fields that will be replaced with data at runtime. This uses the XDocReport library. You can have a look at the XDocReport wiki, https://github.com/opensagres/xdocreport/wiki, for examples on how to create templates for different needs. The query results will be contained in a variable named **results** which can be used in the FreeMarker or Velocity expressions.

Displays a report based on the selected docx template, which uses freemarker syntax - http://freemarker.org/docs/index.html for expressions within the document. The query as defined in the SQL source will be used to generate the results.

- **XDocReport: Velocity engine - Docx**
  Displays a report based on the selected docx template, which uses velocity syntax - https://velocity.apache.org/engine/devel/user-guide.html for expressions within the document. The query as defined in the SQL source will be used to generate the results.
- **XDocReport: FreeMarker engine - ODT**
  Displays a report based on the selected odt template, which uses freemarker syntax. The query as defined in the SQL source will be used to generate the results.
- **XDocReport: Velocity engine - ODT**
  Displays a report based on the selected odt template, which uses velocity syntax. The query as defined in the SQL source will be used to generate the results.
- **XDocReport: FreeMarker engine - PPTX**
  Displays a report based on the selected pptx template, which uses freemarker syntax. The query as defined in the SQL source will be used to generate the results.
- **XDocReport: Velocity engine - PPTX**
  Displays a report based on the selected pptx template, which uses velocity syntax. The query as defined in the SQL source will be used to generate the results.

- **LOV: Dynamic**
  Creates an LOV query whose values are based on an sql query. The query can have either one column, or two columns if the parameter value and the text displayed to the user needs to be different

```
SELECT city_id, city_name
FROM cities
```

OR

```
SELECT city_id
FROM cities
```

- **LOV: Static**
  Creates an LOV query whose values are set in the sql source section. Values are separated by new lines. If the value and display text need to be different, separate the two with a |

  ```
  Toaster
  pr-01|Laptops
  pr-02|Desktops
  ```

- **Dynamic Job Recipients**
  Defines a query that can be used to specify dynamic recipients when scheduling a job. It can have either one column, or multiple columns. In either case, the first column must contain email addresses for the recipients.

- **Dygraphs**
  Generates a time series chart using data from a database - making use of the dygraphs library - http://dygraphs.com/. A javascript file containing custom configuration can be uploaded using the **Template** field. The demo database contains some sample reports of this type. The query must have a minimum of two columns. The first can be a date or number field, and will be the data on the x-axis. The second column must be a number and will represent the first series data. Additional columns of number type can be included, which will be data for additional series. There should be no record with a null date in the query result. If you zoom into the data by clicking and dragging, you double-click on the chart to zoom out.
- **Dygraphs: CSV Local**
  Enables generation of a dygraphs chart using data from a user supplied csv file. Additionally, a javascript file can be specified in the **Template** field with custom configuration options. Any delimited file can be used, not only csv. The first column of the data, if a date, should have dates formatted as `yyyy/MM/dd` e.g. 2017/02/17, and datetime data formatted as `yyyy/MM/dd HH:mm` e.g. 2017/02/17 16:02 or `yyyy/MM/dd HH:mm:ss` e.g. 2017/02/17 16:02:59. The csv data should not contain any quotes.

- **Dygraphs: CSV Server**
  Generates a dygraphs chart based on data from a specific csv file uploaded to the server. This file can be uploaded using the **Add files** button. The file name will also need to be specified in the **Options** field with a format similar to the following. A **dataFile** attribute is expected, whose value is a string - the name of the csv file.

  ```
  {
       "dataFile": "file_name.csv"
  }
  ```

Additionally, a javascript template file can be specified in the **Template** field with custom configuration options. Any delimited file can be used, not only csv.

- **DataTables**
  Enables display of data from a database in a table using the DataTables library - https://datatables.net/. A javascript file containing custom configuration can be uploaded using the **Template** field. The demo database contains some sample reports of this type. By default, column filters are added to all columns. If you would like to turn off column filters, provide a json object in the **Options** field, setting the **showColumnFilters** property to **false** e.g.

```
{
    "showColumnFilters": false
}
```

- **DataTables: CSV Local**
  Enables display of data from a user supplied csv file in a DataTables table. Additionally, a javascript file can be specified in the **Template** field with custom configuration options. Any delimited file can be used, not only csv.

- **DataTables: CSV Server**
  Enables display of data from a specific csv file uploaded to the server. This file can be uploaded using the **Add files** button. The file name will also need to be specified in the **Options** field with a format similar to the following. A **dataFile** attribute is expected, whose value is a string - the name of the csv file.

```
{
    "dataFile": "file_name.csv"
}
```

Additionally, a javascript template file can be specified in the **Template** field with custom configuration options. Any delimited file can be used, not only csv.

- **Fixed Width**
  Generates fixed width output, primarily for jobs that require output in fixed width format. The sql query determines which data will be in the output. The **Options** field determines the formatting of this output and has the following possible properties.

Property	Data Type	Description
fieldLengths	array of integers	Used to define the field lengths of the output e.g. `[5,6]` means that the first field will have a length of 5 and the second field will have a length of 6
fieldLengthsByName	array of objects	Each object specifies the field name and the field length e.g. `[{"order_id": 8}, {"order_date": 14}]` means the `order_id` field will have a length of 8 and the `order_date` field will have a length of 14. You must specify either the **fieldLengths** or the **fieldLengthsByName** property.
includeHeaders	optional - boolean (default = true)	Determines whether the column names will be included in the output as the first row

Property	Data Type	Description
defaultAlignmentForHeaders	optional - string	Either **left**, **right** or **center**. If present, overrides any field alignment set and uses the given alignment for the header columns
padding	optional - string (default = space)	A single character defining the default padding to use for fields. Must not be the empty string.
useDefaultPaddingForHeaders	optional - boolean (default = true)	Determines if the headers should use the global **padding** setting or use the padding set for individual fields
dateFormat	optional - string	Determines the format that should be used for DATE columns
dateTimeFormat	optional - string	Determines the format that should be used for DATETIME columns
numberFormat	optional - string	Determines the format that should be used for numeric columns
fieldDateFormats	optional - array of objects	Each object specifies the date format and an array of fields that should use that format e.g. `[{"dd/MM/yyyy": ["order_date", "due_date"]}, {"dd-MMM-yyyy": ["payment_date"]}]`
fieldNumberFormats	optional - array of objects	Each object specifies the number format and an array of fields that should use that format e.g. `[{"0.00": ["amount"]}, {"#,##0.#": ["volume"]}]`
fieldAlignmentByName	optional - array of objects	Each object specifies the alignment to be used and an array of field names that should use that alignment e.g. `[{"right": ["amount", "volume"]}]`. The alignment is either **left**, **right** or **center**.
fieldAlignmentByPosition	optional - array of objects	Each object specifies the alignment to be used and an array of field positions that should use that alignment e.g. `[{"right": [2, 5]}]`. The alignment is either **left**, **right** or **center**. The first field in the output is marked as position 0.
fieldPaddingByName	optional - array of objects	Each object specifies the padding to be used and an array of field names that should use that padding e.g. `[{"_": ["amount", "volume"]}]`. The padding should be a single character.

Property	Data Type	Description
fieldPaddingByPosition	optional - array of objects	Each object specifies the padding to be used and an array of field positions that should use that padding e.g. `[{"_": [2, 5]}]`. The padding should be a single character. The first field in the output is marked as position 0.

The demo database has a few sample fixed width reports and jobs.

- **C3.js**
  Generates charts using the c3.js library - http://c3js.org/. A javascript file containing chart configuration needs to be uploaded using the **Template** field. The demo database contains some sample reports of this type. If you would like to use custom css, provide a json object in the **Options** field, setting the **cssFile** property to the file name of the css file to use. This file can be uploaded using the **Add files** option.

  ```
  {
       "cssFile": "file_name.css"
  }
  ```

- **Chart.js**
  Generates charts using the chart.js library - http://www.chartjs.org/. A javascript file containing chart configuration needs to be uploaded using the **Template** field. The demo database contains some sample reports of this type. In the **Options** field, you can specify the **width** (integer - default = 300) or **height** (integer - default = 100) properties to define a custom width or height for the chart.

- **Datamaps**
  Enables display of data on a map, using the Datamaps library - https://datamaps.github.io/, using data from a database. A javascript file containing datamaps configuration needs to be uploaded using the **Template** field. In the **Options** field, there are a number of attributes that can be specified.

Property	Data Type	Description
datamapsJsFile	string	The file name of the datamaps javascript file. Appropriate files can be downloaded from https://github.com/mark-markoh/datamaps/tree/master/dist.
width	optional - string (default = 500px)	CSS width for the div that contains the map
height	optional - string (default = 300px)	CSS height for the div that contains the map
dataFile	optional - string	The file name of the json or csv file that contains data elements for the map. This file can be uploaded using the **Add files** option.
dataType	optional - string (default = json)	Either **csv** if the dataFile specified is in csv format or **json** if it's in json format.
mapFile	optional - string	The file name of a file that contains custom map data in topoJSON format. When using this option, use the **none** datamaps file. This file can be uploaded using the **Add files** option.

If using a custom map and you have a shapefile, you can **Import** the zip file with shapefile specification files to http://mapshaper.org/ and then use the **Export** option to convert the shapefile to **topoJSON**. You will then use the topoJSON file for the report.

- **Datamaps: File**
  Enables display of data on a map, using the Datamaps library, using data from a csv or json file. You can also use this report type if the data is hardcoded within the template file. The demo database contains some sample reports of this type.

Note:

- If the output for a report creates a file e.g. pdf, this file is stored in the **ART_HOME\work\export** directory

10.3. Parameters

Parameters enable different output to be generated depending on values selected or input by a user.

- **Single-Value Parameters**
  Single-value parameters are used to pass single values to the SQL query. The parameter's name surrounded by the # character is used to identify the parameter within the SQL source. For example, the following query has two parameters.

```
SELECT *
FROM orders
WHERE order_date > #date#
AND vendor_name like #vendor# -- you do not need to put the ’ character around the name
```

Take the following steps to use a single-value parameter

- Create the report, putting the parameter placeholder in the appropriate place within the SQL
- Use the **Configure | Parameters** menu to open the Parameters page
- Click on the **Add** button to create a new parameter
- Fill in the appropriate fields for the parameter
- In the **Parameter Name** field, specify the parameter name as used in the SQL source e.g. "date" for the example above
- **Save** the parameter
- Use the **Configure | Reports** menu to open the Reports Configuration page
- From the Reports Configuration page, identify the report and use the **More | Parameters** button of the report to open the Report Parameters page
- Click on the **Add** button to add the new report parameter

Note:

- The same parameter (`#parameter_name#`) can be used several times in the same query. All occurrences will be substituted with the same value.
- Avoid using the special labels **#rules#** or **#recipient#**. These labels are used for the rules and dynamic job recipients functionality respectively, and using them for your parameters may result in your query not working as expected.
- There is a slight difference between `Varchar` and `Text` parameters. `Varchar` parameters provide a text box for input of a few characters while `Text` parameters provide a text area for input of much longer strings.
- For `Date` and `DateTime` parameters, the following values can be used

Value	Meaning
now	The date and time when the report is run
today	The date when the report is run, with the time being 00:00
add `days,weeks,months,years` increment	The date when the report is run plus the given increment e.g. `add days 1` for the run date plus one day, `add months -1` for the run date minus one month.

- **Workaround for boolean parameters**

There is no boolean data type for single-value parameters because different RDBMSs implement the boolean data type differently. As a workaround, you can create a static LOV query to return the boolean states true and false, as used in your database, and use that LOV query to provide the boolean parameter values.

Example main query

```
SELECT * FROM mytable WHERE my_boolean_column=#boolean_param#
```

Example static LOV query for boolean values

```
true|True
false|False
```

Lastly, create a single-value parameter named "boolean_param", with data type as `Varchar`, set **Use LOV** to **Yes** and set the LOV Report to the report created for this purpose above.

If the boolean states are "1" and "0" instead of "true" and "false", you can create a static LOV query like the one below and set the parameter data type to `Integer` instead of varchar.

```
1|True
0|False
```

- **Multi-Value Parameters**
  Multi-value parameters are used to pass multiple values to the SQL query. To define a multi-value parameter, put the WHERE...IN clause in the desired location in your query and include the parameter placeholder to indicate where the values will go e.g.

  ```
  SELECT *
  FROM orders
  WHERE product_name IN(#product_list#)
  ```

Take the following steps to use a multi-value parameter

- Create the report, putting the WHERE...IN clause and parameter placeholder in the appropriate place within the SQL
- Create the parameter definition using the same process as with single-value parameters
- Now when a user runs the query, they will be presented with a parameters section where they can select one or more values for the parameter. Multiple values are selected using **control+click** or **shift+click**. An "All" option will be displayed to select all possible values.

Note:

- If the values for a multi-value parameter are not derived from an LOV, the end user will enter the multiple values required in the text box provided, with each value put on a new line.

10.4. Running a report via URL

It is possible to run a report directly via URL. The report format and parameters are included in the URL. The basic URL for running a report is something like
`http://server_name:port/art/runReport?reportId=x&other_parameters`

If direct URL access is needed without requiring the user to log in to ART beforehand, the special user **public_user** must be granted access to the query and **&public=true** must be included in the URL.

10.4.1. Report Options

Some report options can be specified in the URL to determine how the run should be handled.

Option	Data Type	Comments
p-{parameter_name}	String	Specifies report parameters e.g. `p-duedate=2010-05-06`
reportFormat	String	Specifies the report format that should be used for the output generated by the report e.g. `reportFormat=pdf`. Not all report formats are available for all report types.
splitColumn	Integer	For group reports, the group column i.e. the column index by which grouping should be done e.g. `splitColumn=2`
public	Boolean	If present, determines that the user doesn't need to be logged in to ART to view the report results e.g. `public=true`. If authentication is required, don't include this parameter, even with a value of false.
showSelectedParameters	Boolean	If present, indicates that the used or selected report parameters should be included in the report output e.g. `showSelectedParameters=true`. Omit the parameter entirely if this is not required.
showSql	Boolean	If present, indicates that the final SQL used to generate the report results is shown in the browser e.g. `showSql=true`. Omit the parameter entirely if this is not required.
allowSelectParameters	Boolean	If present, indicates that the parameters box should be displayed in the browser to allow the user to re-run the report by changing the reports parameter values.
startSelectParametersHidden	Boolean	If present, indicates that the parameters box should start as hidden/collapsed. The parameters box can then be displayed by clicking on the **Parameters** button.
prettyPrint	Boolean	For **json** and **jsonBrowser** report formats, determines if the json output should be pretty printed.

10.4.2. Chart Options

For chart reports, additional options specific to charts can be specified in the URL.

Option	Data Type	Comments
showLegend	Boolean	If present, indicates that the legend should be shown e.g. `showLegend=true`. Omit the parameter entirely if this is not required.
showLabels	Boolean	If present, indicates that data labels should be shown e.g. `showLabels=true`. Omit the parameter entirely if this is not required.
showData	Boolean	If present, indicates that the data used to generate the chart should be shown e.g. `showData=true`. Omit the parameter entirely if this is not required.
showPoints	Boolean	If present, indicates that data points on the chart should be highlighted e.g. `showPoints=true`. Omit the parameter entirely if this is not required.
rotateAt	Integer	Indicates the number of categories after which the x-axis labels will be displayed vertically instead of horizontally e.g. `rotateAt=1`. This may aid in the readability of the labels for some charts.
removeAt	Integer	Indicates the number of categories after which the x-axis labels will be removed completely e.g. `removeAt=10`.
chartWidth	Integer	Indicates the width of the chart in pixels e.g. `chartWidth=1000`. The maximum is 2048.
chartHeight	Integer	Indicates the height of the chart in pixels e.g. `chartHeight=700`. The maximum is 1024.
yAxisMin	Double	Indicates the minimum value of the y-axis e.g. `yAxisMin=-10.5`.
yAxisMax	Double	Indicates the maximum value of the y-axis e.g. `yAxisMax=100`
backgroundColor	String	Indicates the hex colour code for the background color of the chart e.g. `backgroundColor=#FFFFFF`.
labelFormat	String	Indicates the format of data labels e.g. `labelFormat={0} = {1} ({2})` or `labelFormat=off`. If set to "off", this indicates that labels should not be shown. For pie charts, `{0}` will display the pie section key, `{1}` will display the absolute section value and `{2}` will display the percent amount of the pie section. Setting it to `{0} = {1} ({2})` would display a string like "Laptops = 17 (42%)" for a section of the pie chart showing laptops numbering 17 and having a percentage value of 42%. For bar charts, use `{2}` to display the data value.

10.4.3. Examples

Example 1: (single-value parameters)

```
http://server_name:port/art/runReport?
reportId=120&reportFormat=html&p-startdate=2006-04-04&p-description=Desktop

runs report 120 in html format.
The #startdate# parameter (p-startdate) is set to 2006-04-04
and the #description# parameter (p-description) is set to "Desktop"
```

Example 2: (chart)

```
http://server_name:port/art/runReport?
reportId=121&p-date=2006-04-04
```

Example 3: (group)

```
http://server_name:port/art/runReport?
reportId=122&splitColumn=2&p-param=abc

runs report 122 in group on 2 columns mode (splitColumn parameter).
The parameter named param is set to "abc".
```

Example 4: (pdf, public)

```
http://server_name:port/art/runReport?
reportId=123&reportFormat=pdf&public=true

generates report as a pdf file without requiring the user to log in to ART
```

Example 5: (dashboard)

```
http://server_name:port/art/runReport?
reportId=124&p-param1=value1&p-param2=value2

runs report 124, setting values for parameters param1 and param2
```

Example 6: (show selected parameters)

```
http://server_name:port/art/runReport?
reportId=125&reportFormat=xls&p-startdate=2006-04-04&showSelectedParameters=true

generates report and includes the parameter value used in the report output
```

Example 7: (multi-value parameters)

```
http://server_name:port/art/runReport?
reportId=126&reportFormat=xls&p-category=Laptops&p-category=Desktops&p-category=Tablets

the #category# multi-value parameter (p-category) has 3 values defined:
Laptops, Desktops, Tablets
```

Example 8: (default parameter values)

```
http://server_name:port/art/runReport?
reportId=127

generates report using default parameter values
```

Note:

- If the report url contains some non-ASCII characters in the parameter values and they don't seem to be interpreted correctly, you may need to configure your application server to explicitly handle urls using UTF-8 encoding e.g. for Tomcat, edit the TOMCAT_HOME\conf**server.xml** file and add the **URIEncoding** attribute to the appropriate **Connector** element e.g.

```
<Connector port="8080" protocol="HTTP/1.1" URIEncoding="UTF-8"
    ...
```

10.5. Report Formats

When running reports interactively, or scheduling them for later execution, you can specify the format in which the results should be output. When running a report via url, you can specify the report format to be used using the `reportFormat` url parameter. Report format names are case sensitive. Some report formats are not available for certain types of reports.

Report Format	Display Name	Description
html	Browser	Shows results in a web page
htmlGrid	Browser (Grid)	Shows results in a web page. The data can be sorted by clicking on the column headers. Not available for scheduled jobs.
htmlFancy	Browser (Fancy)	Shows results in a web page, with minimal styling. Not available for scheduled jobs.
htmlPlain	Browser (Plain)	Shows results in a web page, with no styling.
htmlDataTable	Browser (DataTable)	Shows results in a web page. Data is displayed in pages. The data can be sorted by clicking on the column headers and one can filter or display certain rows by specifying some text to search for. Not available for scheduled jobs.
xls	Spreadsheet (xls)	Creates a Microsoft Excel spreadsheet file to download (xls format). Excel/OpenOffice/LibreOffice compatible
xlsZip	Spreadsheet (zip xls)	Creates a Microsoft Excel spreadsheet file to download (xls format), compressed using Zip.
xlsx	Spreadsheet (xlsx)	Creates a Microsoft Excel spreadsheet file to download (xlsx format). Excel/OpenOffice/LibreOffice compatible
slk	Spreadsheet (slk)	Creates a Microsoft Excel spreadsheet file to download (slk format). Excel/OpenOffice/LibreOffice compatible
slkZip	Spreadsheet (zip slk)	Creates a Microsoft Excel spreadsheet file to download (slk format), compressed using Zip.
tsv	File (text tsv)	Creates a tab-separated-values text file to download
tsvZip	File (zip tsv)	Creates a tab-separated-values text file to download, compressed using Zip

Report Format	Display Name	Description
tsvGz	File (gzip tsv)	Creates a tab-separated-values text file to download, compressed using GZip
pdf	Document (pdf)	Creates a pdf file to download
png	Image (png)	Creates a png file to download. Only available for charts.
xml		Creates xml output displayed on the browser
rss20		Output data as a rss2.0 compliant feed
docx	Document (docx)	Creates a Microsoft Word document file to download (docx format)
odt	Document (odt)	Creates an Open Document Format text document file to download (odt format)
ods	Spreadsheet (ods)	Creates an Open Document Format spreadsheet file to download (ods format)
pptx	Document (pptx)	Creates a Microsoft PowerPoint document file to download (pptx format). Only available for XDocReport - PPTX reports.
json	JSON	Outputs data in json format
jsonBrowser	JSON (Browser)	Outputs data in json format, for display in a browser. Data is output in a `<pre>` tag.
csv	CSV	Outputs data in csv format. Can also use another delimiter as defined in the report **Options** field - using the **delimiter** property. This format is primarily intended for jobs.

You can restrict which report formats are shown to users when running reports by modifying the Report Formats field in the Settings page.

Note:

- There is a limit set for the maximum number of rows that can be output with certain report formats. These limits are set, and can be modified from the Settings page.
- Use xlsx, slk or tsv report formats for large data sets. In particular, if you use the xls format for large data sets, you are likely to get out of memory errors. This is mainly due to the nature of the xls file format.

11. Multiple Statements

You may want to run some statements before or after the select statement for your report, e.g. to create a temporary table, create an index etc. Enter all your statements in the sql source section of the report, with each statement ending in a `;` and specify which statement should be used as the report's results by setting the **Display Resultset** field of the report.

Display ResultSet	Description
0	The sql source doesn't contain multiple statements
1, 2, ... n	Use the specified statement, with the first statement being 1
-1	Use the select statement, regardless of how many statements exist
-2	Use the last statement, regardless of how many statements exist

If you set the Display Resultset to -2 to use the last statement, ensure that your database driver is at least JDBC 3.0 compliant.

Some RDBMSs may require extra configuration to allow for execution of multiple statements in a query, and some may not support it at all.

RDBMS	Comment
SQL Server	No extra configuration needed
PostgreSQL	No extra configuration needed
MySQL	Add the property **allowMultiQueries=true** to the jdbc url of the query's datasource e.g. `jdbc:mysql://localhost/mydb?allowMultiQueries=true`
CUBRID	Driver is JDBC 2.0 compliant so don't use the -2 option
Oracle	Not supported
HSQLDB	Not supported

12. LOV Reports

LOV reports are used to generate parameter values for other reports. Dynamic LOV reports get their values from an sql query while static LOV reports use fixed values defined in the sql source section. An LOV report must have either one or two columns. The value of the first column is passed to the parameter. The value of the second column (if available) is displayed to the user. For example, for the following dynamic LOV query

```
SELECT location_id, location_name FROM LOCATIONS
```

Users see values from the `location_name` column while the actual parameter match is performed using values from the `location_id` column.
If the parameter options don't come from a database, you can use a static lov with something like the following in the sql source. If the parameter value and the display value are different, separate them with a |

```
local|Local
international|Worldwide
```

12.1. Example

This section shows how to define a simple report to retrieve information about the reports stored in the ART database. The report has one parameter (the report name), obtained from a dynamic lov.

In order to proceed with this example you need to:

- Set up a datasource that points to the ART database
- Define a user and a report group

- **LOV Report**
  This report is the one used to retrieve the list of values (i.e. the list of available reports that will be shown as a parameter). Use the **Configure | Reports** menu and then the **Add** button to create a new report. Set the name to "ART Report Names", the type to **LOV: Dynamic** and the following as the SQL source:

  ```
  SELECT NAME FROM ART_QUERIES ORDER BY NAME
  ```

Select the ART database as the Datasource and **Save**.

- **Main Report**
  This report retrieves the details of the reports that are defined in ART. It has one parameter whose values are retrieved from the "ART Report Names" report created above. Following the same process used for the previous report, name the report "ART Reports" and for the SQL source use:

  ```
  SELECT NAME
  , SHORT_DESCRIPTION
  , DESCRIPTION
  , UPDATE_DATE
  FROM ART_QUERIES WHERE NAME = #report_name#
  ```

Select the ART database as the Datasource and Save.

Use the **Configure | Parameters** menu and then the **Add** button to create a new single-value paramter named `report_name`. Select the **Use LOV** option and select "ART Report Names" in the **LOV Report** field. Click on the **Save** button to save the parameter details.

Use the **Configure | Reports** menu to go back to the Reports Configuration page. Find the main report, ART Reports, click on the **More | Parameters** button and **Add** a new parameter, setting the parameter to the `report_name` parameter that has just been created.

Use the **Configure | Access Rights** menu to define users who can run the main report. Now you can log in as the user and run the report.

Note:

- You don’t have to assign access to the LOV report itself
- You can’t use rules with static lovs. If you have a PostgreSQL database, you can create a dynamic lov that will return the static values, with syntax like the following

```
select id from
(select unnest(ARRAY[1, 5, 10]) as id) as id_list
where #rules#
```

13. Dynamic Queries

It is possible to create Dynamic SQL queries using xml-like tags in the SQL source section. This feature allows you to modify the structure of the query based on user parameters, possibly running completely different queries depending on the user input.

The syntax is as follows. Tag names are case sensitive.

```
<IF>
<EXP1>value1</EXP1> <OP>operator</OP> <EXP2>value2</EXP2>
<TEXT> ... </TEXT>
<ELSETEXT> ... </ELSETEXT>
</IF>
```

ART parses the query and leaves only the text in the <TEXT> tag if the condition (value1 operator value2) is true or the text in the <ELSETEXT> tag if the condition is false. The EXP1 or EXP2 contents can be static values, single-value parameters or :tags, while the OP content is an operator (see supported list below).

For example in the following query:

```
SELECT *
FROM <IF><EXP1>#level#</EXP1><OP>equals</OP><EXP2>summary</EXP2>
<TEXT> orders_summary </TEXT>
<ELSETEXT> orders_details </ELSETEXT>
</IF>
WHERE VENDOR like #vendor#
<IF><EXP1>#date#</EXP1><OP>is not null</OP>
<TEXT> AND order_date > #date# </TEXT>
</IF>
```

if the #level# parameter is set to "summary" and the #date# parameter is not null, ART rewrites the query as:

```
SELECT *
FROM orders_summary
WHERE VENDOR like #vendor#
AND order_date > #date#
```

if the #level# parameter is not set to "summary" and the #date# is null, ART rewrites the query as:

```
SELECT *
FROM orders_details
WHERE VENDOR like #vendor#
```

13.1. Operators

Operator	Description
eq or **equals**	equals (case insensitive)
neq or **not equals**	not equals (case insensitive)
ln	less than (numbers)
gn	great than (numbers)
la	less than (alphabets) (case insensitive)
ga	great than (alphabets) (case insensitive)
is blank or **is null**	returns true if EXP1 is blank (EXP1 can never be the null object)
is not blank or **is not null**	returns true if EXP1 is not blank (EXP1 can never be the null object)
starts with	returns true if EXP1 string begins with EXP2 (case insensitive)
ends with	returns true if EXP1 string ends with EXP2 (case insensitive)
contains	returns true if EXP1 string contains EXP2 string within it (case insensitive)
eq cs or **equals cs**	equals (case sensitive)
neq cs or **not equals cs**	not equals (case sensitive)
la cs	less than (alphabets) (case sensitive)
ga cs	great than (alphabets) (case sensitive)
starts with cs	returns true if EXP1 string begins with EXP2 (case sensitive)
ends with cs	returns true if EXP1 string ends with EXP2 (case sensitive)
contains cs	returns true if EXP1 string contains EXP2 string within it (case sensitive)

13.2. Dynamic Query Examples

Dynamic OR/AND selection:

```
SELECT *
FROM orders_summary
WHERE VENDOR like #vendor#
<IF><EXP1>#logic#</EXP1><OP>equals</OP><EXP2>OR</EXP2>
<TEXT> OR country = #country# </TEXT>
<ELSETEXT> AND country = #country# </ELSETEXT>
</IF>
```

Dynamic ORDER BY: The order by part is driven by the user input

```
SELECT *
FROM orders_summary
WHERE VENDOR like #vendor#
<IF><EXP1>#sortby#</EXP1><OP>equals</OP><EXP2>Vendor</EXP2>
<TEXT> ORDER BY 1 </TEXT>
<ELSETEXT> ORDER BY 2 </ELSETEXT>
</IF>
```

Dynamic query selection: A different query is executed depending on user input

```
<IF><EXP1>#showaddr#</EXP1><OP>equals</OP><EXP2>Y</EXP2>
<TEXT>
SELECT name, code, address, phone FROM VENDOR
WHERE VENDOR like #vendor#
</TEXT>
<ELSETEXT>
SELECT name, code, vat, pay_term FROM VENDOR
WHERE VENDOR like #vendor#
</ELSETEXT>
</IF>
```

Dynamic SQL with tags: The condition is verified only if the date supplied by the user (`#date#`) is earlier than the system date at report execution time (`:DATE` tag)

```
SELECT *
FROM orders_summary
WHERE VENDOR like #vendor#
<IF><EXP1>#date#</EXP1><OP>la</OP><EXP2>:DATE</EXP2>
<TEXT> AND order_date > #date# </TEXT>
</IF>
```

Check user input: Show a warning instead of executing the query

```
<IF><EXP1>#value#</EXP1><OP>ln</OP><EXP2>10000</EXP2>
<TEXT> SELECT ... </TEXT>
<ELSETEXT> SELECT 'Value too High' "Warning" </ELSETEXT>
</IF>

the select statement to use to show the warning depends on the DBMS (for example in
Oracle you should use SELECT 'Value too High' "Warning" FROM DUAL)
```

Dynamic WHERE condition: E.g. to drill down on null values

```
SELECT * FROM customers
WHERE
<IF><EXP1>#email#</EXP1><OP>equals</OP><EXP2>null</EXP2>
<TEXT>customer_email is null</TEXT>
<ELSETEXT>customer_email=#email#</ELSETEXT>
</IF>
```

14. Drill Down Reports

This functionality provides a main report with links from which a user can click to get to a different (drill down) report. For example, the main report can display summary information and a user can click on the drill down report link to display detailed information about a particular item.

The main report can be a normal tabular query - displayed in one of the html view modes - or a chart. The drill down report can be of any type.

14.1. Defining the main report

The main report is created like any other report. Once the report is saved, use the **More | Drilldowns** button to add or modify the drill down reports that will be available for that report.

14.2. Defining the drill down report

The drill down report is created like any other report. The only requirement is that it needs to have at least one single-value parameter defined, with this parameter having the **Drilldown Column Index** field with a value greater than or equal to 1. The Drill Down Column refers to the column in the main report that will provide the value for the parameter. If the value will come from the first field, the drill down column will have a value of 1 and so on.

14.3. Example

- **Sales Summary** (Main report)

```
select REGION "Region", SUM(VOLUME) "Volume"
from ORDERS
where ...
```

- **Sales Details** (Drill Down report)

```
select REGION, CITY, ITEM, VOLUME
from ORDER_DETAILS
WHERE REGION = #region#
```

On the Drill Down report, when defining the `#region#` parameter, set the option **Drilldown Column Index** to 1. This means this parameter will match with the first column value on the Main Report i.e. "Region"

From now on this report will appear as an available Drill Down report.

On the Main report, select the **More | Drilldowns** option

Select **Add** and:

- Pick the Drill Down report from the list
- Specify the link column title (header) and link text
- Select which report format will be used to display the Drill Down Report results. Using the **All** option will enable the user to select the report format.
- Set if the result of the drill down report should be opened in a new window

When running the Main Report, a new column will appear on the right:

Click on it and the drill down report will be executed - the `#region#` parameter will match with the first column value

14.4. Using the main report's parameters

In addition to using the main report's column values, a drill down report can also use the main report's parameter values. If in our example above the Main Report allowed the user to select a city, e.g.

```
select REGION "Region", SUM(VOLUME) "Volume"
from ORDERS
WHERE CITY=#city# AND ...
```

The Drill Down Report can make use of this `#city#` parameter even if it is not among the columns displayed by the Main Report's select statement. To use the value of the `#city#` parameter in the Drill Down Report,

- Define the parameter with the same name as in the Main Report
- Set the Drilldown Column Index for this parameter to 0, since the value of this parameter will not be coming from the columns displayed in the Main Report

So the Drill Down Report would look something like

```
select REGION, CITY, ITEM, VOLUME
from ORDER_DETAILS
WHERE REGION = #region# and CITY=#city#
```

Here the `#region#` parameter will still be set as Drilldown Column 1, since it's getting its value from the Main Report's column 1, while the `#city#` parameter will be set as Drilldown Column 0, since it's not getting its value from any of the Main Report's columns (the Main Report's select doesn't include the city column).

The parameter values from one report are passed down to all drill down reports down the line. So if this drill down report had another drill down report, that report can also use the value of the `#city#` parameter set in the Main Report.

Note:

- Multiple Drill Down Reports can be linked to one Main Report. Extra columns will appear with links allowing the user to select which drill down report to run.
- A Drill Down Report can have several parameters to match any number of column values from the Main Report. It can also have parameters that use values from the Main Report's parameters.
- If the Main Report is a chart, the drill down parameter will get the following values
  - Drilldown column 1 = data value
  - Drilldown column 2 = category name
  - Drilldown column 3 = series name

15. Dynamic Datasources

When you define a report, you specify the datasource from which data will be retrieved. Sometimes, you may have several databases that have the same schema but contain different data e.g. a live production database, a test database, a database that has data as at end of month etc. You may want to have the possibility of running the same query over these different databases. Rather than creating several reports with identical sql but different datasources, you can create one report and have the datasource as a parameter that can be selected at runtime. This eliminates the work of creating multiple reports and makes management of the relevant sql much easier - if you need to change the sql, you only have to do it in one place. The process of using dynamic datasources is as follows.

- Create a datasource for each of your target databases
- Create the report that will retrieve the data you want. What you select in the Datasource field is not important as the report will use a dynamically specified datasource. It is advisable though to set this to a valid, default datasource for your sql.
- Define a single-value parameter for your report, setting the Data Type to Datasource. If you would like the available datasources to be selected from a list, create and specify the LOV report that will display the desired datasources.

When you run the report, it will use the value of the datasource parameter to determine which datasource to run the report on. The value of this parameter should be an existing datasource id.

16. RSS Feeds

Since ART 1.11 it is possible to create RSS 2.0 compliant feeds out of any datasource.

This is achieved in three steps:

- Create a report where column names follow RSS item element naming convention - see below. The resultset column names are used as the names of the `<item>` sub-elements in the produced xml file.
- Grant access to **public_user**
- Run the report via direct URL, setting the **reportFormat** parameter to **rss20**. This URL, when executed via a browser or RSS reader/aggregator will return an RSS feed.

As a minimum, the report should contain a column named **title** or **description**.

Element Name	Description
title	The item title
description	The item description
pubDate	The date where the specific item is published
link	The URL pointing to the items
guid	The unique id of the item. If present, a feed aggregator may choose to use this string to determine if an item is new. It may/should be a URL pointing to the full item.

Please refer to the RSS specification for more details.

For example the following query:

```
select col1 "title", col2 "description" , col3 "pubDate", col4 "guid"
from myTable
```

Will produce the following RSS 2.0 XML content:

```
<?xml version="1.0" encoding="UTF-8"?>
<rss version="2.0">
<channel>
 <title>[Report Name]</title>
 <link>[As configured in ART settings]</link>
 <description>[Report Name]</description>
 <pubDate>[Current date]</pubDate>
 <generator>http://art.sourceforge.net</generator>
 <item>
  <title>[resultset "title" column]</title>
  <description>[resultset "description" column]</description>
  <guid>[resultset "guid" column]</guid>
  <pubDate>[resultset "pubDate" column]</pubDate>
 </item>
 <item>
  ...
```

```
 </item>
 ...
</channel>
</rss>
```

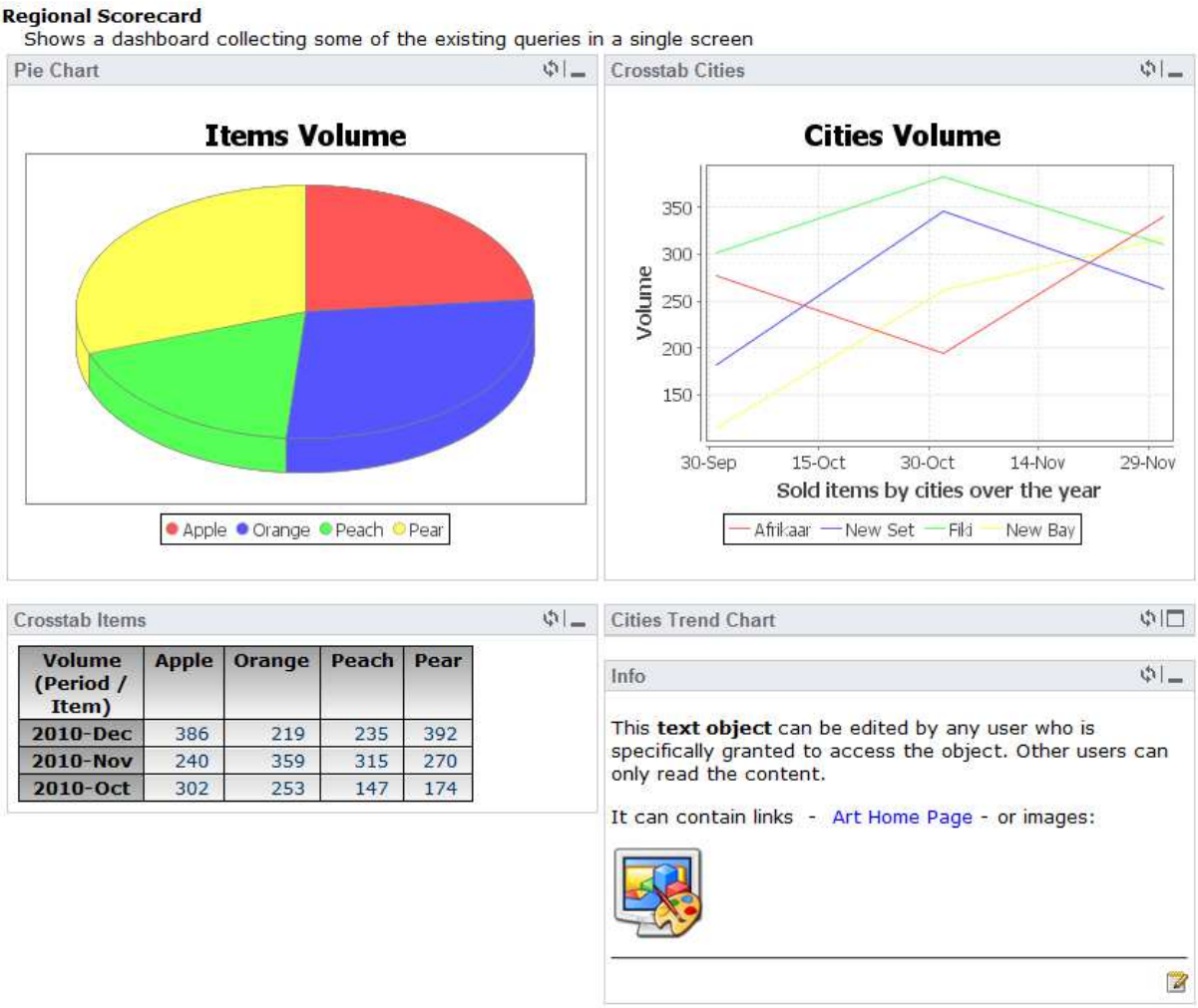
Note:

- Date/Timestamp columns are converted to RfC 822 formatted strings. Characters <, > and & are converted to html escape entities. If needed, for any other special characters, you should take care of proper conversion.
- Only the `<item>` elements are customizable by using the proper column names. Channel elements are as in the example: the default channel link tag can be set by an administrator from the Settings page.

17. Dashboards

Dashboards are used to display reports on a single portal-like page.

Any ART report can be considered a portlet i.e. a small embeddable frame within a web page. Each portlet uses AJAX components to dynamically load itself within the page. Users can refresh or minimize each portlet independently by clicking on the buttons at the top of the portlet frame. When a user runs a dashboard, he can choose to modify the default parameters used by the reports in the dashboard. All the embedded reports are parsed and their parameters, if any, are displayed. If several reports use the same parameter, it is displayed only once.



17.1. Regular Dashboards

17.1.1. Features

- You can define as many columns as you need (tag: `<COLUMN>`)
- For each column you can specify a size (tag: `<SIZE>`)
- Within each column you can specify one or more portlets (tag: `<PORTLET>`)
- Each portlet has a title (tag: `<TITLE>`)
- A portlet can display any ART report using the report's ID (tag: `<REPORTID>`)
- An external URL (tag: `<URL>`) can also be displayed within a portlet
- A portlet can be refreshed by the end user by clicking on the refresh button. You can set a refresh time (in seconds) to have the portlet auto-refresh itself. (tag: `<REFRESH>`)
- Each portlet is rendered on page load. You can override this and let the user decide when he wants to see the content (by clicking on the refresh button). (tag: `<ONLOAD>`)

17.1.2. Example Syntax

XML-like syntax is used to define the dashboard structure

```
<DASHBOARD>

    <COLUMN>
        <!-- column size: auto|small|medium|large. default is auto-->
        <SIZE>medium</SIZE>

        <!-- create a new portlet within this column
        to embed an ART report (tabular, chart, text, etc) -->
        <PORTLET>
            <TITLE>Portlet title</TITLE>

            <!-- (optional, default is true) load content when page is displayed -->
            <ONLOAD>false</ONLOAD>

            <!-- (optional, default is -1 meaning never) refresh content every 30 seconds-->
            <REFRESH>30</REFRESH>

            <!-- embed ART report -->
            <REPORTID>2</REPORTID>
        </PORTLET>

        <!-- create a new portlet within this column
        to embed an external html page -->
        <PORTLET>
            <TITLE>Portlet title</TITLE>
            <URL>http://my.site.com/page.html</URL>
        </PORTLET>

        <!-- .. you can add as many portlets as you want -->
    </COLUMN>

    <COLUMN>
        <!-- you can add as many columns as you want -->
    </COLUMN>

</DASHBOARD>
```

Note:

- Using the `<REPORTID>` tag, tabular reports are displayed using the htmlFancy format. To override this, use the `<URL>` tag and type the direct access URL for the report
- Tag names are case sensitive (use uppercase)
- Minimum refresh period allowed is 5 seconds. Be careful with this so as not to overload the server and databases.
- If you need to use xml special characters within tag content, ensure to replace them with the relevant xml character entities e.g. if the `<URL>` tag should contain a url like `http://localhost:8080/art/runReport?reportId=1&p-param1=test`, you'll need to replace the `&` character with `&`, to have the url as `http://localhost:8080/art/runReport?reportId=1&p-param1=test`. For a list of the 5 special xml characters and their respective replacement strings or character entities, see http://support.esri.com/technical-article/000005870

17.2. Gridstack Dashboards

Gridstack dashboards allow for specifying exact positioning of report items within the dashboard, specifying the height and width that the report items should occupy, allowing for resizing the items dynamically using the mouse, and moving the items around using drag-and-drop.

17.2.1. Dashboard Properties

Gridstack dashboards also use xml syntax, similar to regular dashboards. A number of tags are used to define properties of the dashboard.

Tag	Description
<DASHBOARDWIDTH>	(optional - integer) default = 12. The number of columns to be taken up by the grid, forming the basis of the horizontal or x axis of the grid co-ordinates.
<FLOAT>	(optional - boolean) default = false. Allows for moving of report items to arbitrary locations on the dashboard. If false, grid items can only snap to given locations.
<ANIMATE>	(optional - boolean) default = false. Allows for using some animation when grid items are moved around.
<DISABLEDRAG>	(optional - boolean) default = false. Disallows dragging of items.
<DISABLERESIZE>	(optional - boolean) default = false. Disallows resizing of items.
<CELLHEIGHT>	(optional - string) default = 60px. Defines the dimensions of one unit of the grid co-ordinates on the vertical or y axis. Can also be defined in terms of **em** and **rem** units instead of pixels e.g. 10em or 10rem. Can also be defined as "**auto**" in which case the height will be calculated from the cell width.
<VERTICALMARGIN>	(optional - string) default = 20px. Defines the size of the vertical gap between cells. Can also be defined in terms of **em** and **rem** units instead of pixels e.g. 2em or 2rem.
<ALWAYSSHOWRESIZEHANDLE>	(optional - boolean) default = false. Determines if the resizing handles on the bottom corners of a cell are shown even if the user is not hovering over the item.
<DASHBOARDHEIGHT>	(optional - integer) default = 0. The maximum number of rows or y units on the grid co-ordinate system. Items cannot be resized or moved beyond these limits. A value of 0 means that there is no maximum.

17.2.2. Item Properties

A gridstack dashboard has a number of items, enclosed within <ITEM> tags. These items have a number of properties as specified in the following tags.

Tag	Description
<XPOSITION>	(**required** - integer) The x axis position of the item.
<YPOSITION>	(**required** - integer) The y axis position of the item.
<WIDTH>	(**required** - integer) The width of the item. This defines the number of columns that the item will occupy, in relation to the number of columns of the whole grid as defined by the dashboard's <DASHBOARDWIDTH> property.
<HEIGHT>	(**required** - integer) The height of the item. This defines the number of rows that the item will occupy, one row being the size defined in the dashboard's <CELLHEIGHT> property.
<NORESIZE>	(optional - boolean) default = false. Disables element resizing.
<NOMOVE>	(optional - boolean) default = false. Disables element moving.
<AUTOPOSITION>	(optional - boolean) default = false. Specifies to ignore the <XPOSITION> and <YPOSITION> and instead place the element in the first available position.
<LOCKED>	(optional - boolean) default = false. Defines that the widget will be locked. It means another widget wouldn't be able to move it during dragging or resizing. The widget itself can still be dragged or resized. You need to specify the <NORESIZE> and <NOMOVE> options to completely lock the widget.
<MINWIDTH>	(optional - integer) default = 0. Specifies the minimum width beyond which the item cannot be resized.
<MINHEIGHT>	(optional - integer) default = 0. Specifies the minimum height beyond which the item cannot be resized.
<MAXWIDTH>	(optional - integer) default = 0. Specifies the maximum width beyond which the item cannot be resized. A value of 0 means no maximum.
<MAXHEIGHT>	(optional - integer) default = 0. Specifies the maximum height beyond which the item cannot be resized. A value of 0 means no maximum.

In addition to these properties that are unique to gridstack items, the following properties of regular dashboard portlets should also be used within gridstack items, with the same effect: <TITLE>, <REPORTID>, <URL>, <REFRESH>, <ONLOAD>.

17.2.3. Example Syntax

```
<DASHBOARD>

    <ITEM>
        <TITLE>Report 1</TITLE>
        <REPORTID>1</REPORTID>
```

```
        <XPOSITION>0</XPOSITION>
        <YPOSITION>0</YPOSITION>
        <WIDTH>4</WIDTH>
        <HEIGHT>4</HEIGHT>
    </ITEM>

    <ITEM>
        <TITLE>Report 2</TITLE>
        <REPORTID>2</REPORTID>
        <XPOSITION>8</XPOSITION>
        <YPOSITION>0</YPOSITION>
        <WIDTH>4</WIDTH>
        <HEIGHT>4</HEIGHT>
    </ITEM>

</DASHBOARD>
```

17.3. Tabbed Dashboards

Both regular and gridstack dashboards can be modified to have their components displayed within tabs. This would be done by adding the optional <TABLIST> tag to the dashboard xml. Tabs will then be defined according to the desired number of tabs, and which portlets/items should appear in which tabs.

17.3.1. Example Syntax

```
<DASHBOARD>

    <ITEM>
        <TITLE>Report 1</TITLE>
        <REPORTID>1</REPORTID>
        <XPOSITION>0</XPOSITION>
        <YPOSITION>0</YPOSITION>
        <WIDTH>4</WIDTH>
        <HEIGHT>4</HEIGHT>
    </ITEM>

    <ITEM>
        <TITLE>Report 2</TITLE>
        <REPORTID>2</REPORTID>
        <XPOSITION>8</XPOSITION>
        <YPOSITION>0</YPOSITION>
        <WIDTH>4</WIDTH>
        <HEIGHT>4</HEIGHT>
    </ITEM>

    <TABLIST>
        <DEFAULTTAB>1</DEFAULTTAB>
        <TAB>
            <TITLE>Tab 1</TITLE>
            <ITEM>2</ITEM>
        </TAB>
    </TABLIST>

</DASHBOARD>
```

17.3.2. Tag Descriptions

Tag	Description
<TABLIST>	Container tag for tab definitions. If present, only the items defined in the tabs will be displayed. If absent, all items as defined in the main dashboard xml will be displayed.
<DEFAULTTAB>	(optional - integer) default = 1. Defines the index of the tab that will be active when the dashboard is displayed. The first tab has an index of 1.
<TAB>	Container tag for a specific tab. The <TABLIST> can have any number of <TAB> tags.
<TITLE>	(optional - string) default = blank/empty string. Defines the title/heading/name of the tab. Even though this tag is optional, it is recommended to always set it so as to have a better visual indication for users of the different tabs.
<ITEM>	(optional - integer) no default. The index of the item to display, as it appears in the main dashboard xml definition. The dashboard portlets/items are assigned an index according to the order in which they appear in the xml, with the first item having an index of 1. So setting this to 1 indicates that the fist portlet/item in the main dashboard xml should be displayed. A tab can have any number of <ITEM> tags.

18. jXLS Spreadsheets

ART uses the jXLS library to provide support for reports based on pre-formatted MS Excel spreadsheets. For details on the syntax of these jXLS templates, see the documentation available on the jXLS website. Generally, you'll follow the following steps to create a jXLS spreadsheet report.

- Create an Excel file (either xls or xlsx) with any text and formatting that will be required in the final report
- Insert jXLS syntax as appropriate to define where the raw data should go
- Create a new report in ART and select the jXLS template to use

- If the report is of type **jXLS: ART Query**, the sql used to retrieve the data will be the one defined in the SQL source section. You can use parameters, rules and any other features of ART reports. In the template, use the identifier **results** to output report values. e.g.

  ```
  jx:each(items="results" var="row" lastCell="E10")

  ${row.description}
  ```

- If the report is of type **jXLS: Template Query**, the sql used to retrieve the data will be the one defined in the template.The database used for the report will be the one selected in the datasource field of the report.

19. Pivot Tables (OLAP)

ART uses the Mondrian OLAP server to provide OLAP functionality. There are 3 report types that can be created to provide OLAP analysis.

19.1. Mondrian

This report type uses ART's internal mondrian engine to run OLAP queries. To use it, do the following.

19.1.1. Create the schema xml file

- Create a mondrian cube schema file that defines your cube

19.1.2. Create a datasource

- Create a new datasource in ART using the **Configure | Datasources** menu and then clicking on the **Add** button
- In the **Datasource Type** section, select **JDBC**
- Provide the url, username and password to use to access the database that has the star schema tables referenced in the schema xml file
- Save the datasource

19.1.3. Create the report

- Create a new report in ART of the type **Pivot Table: Mondrian**
- In the **Datasource** field, select the datasource you have just created
- For the **Template** field, select the schema file for the cube
- In the MDX source field, enter the MDX for your report

19.2. Mondrian XMLA

This report type is used to access cubes defined in an external mondrian server. To use it, do the following.

19.2.1. Create the schema xml file

- Create a mondrian cube schema file that defines your cube

19.2.2. Create the datasources.xml file

- Create the datasources.xml file that has the cube details. ART can act as a Mondrian XMLA server by configuring a file named **datasources.xml** and putting it in the **ART_HOME\WEB-INF\work\templates** directory, and using a url like http://server-name:8080/art/xmla as the XMLA url.

19.2.3. Create a datasource

- Create a new datasource in ART using the **Configure | Datasources** menu and then clicking on the **Add** button
- In the **Datasource Type** section, select **OLAP**
- In the **URL** field, enter the url to use to access the xmla server e.g. http://localhost:8080/art/xmla
- If the AuthenticationMode section of the datasources.xml file is set to Unauthenticated, leave the **Username** and **Password** fields blank. Otherwise enter the username and password to be used to access to the cube.
- Save the datasource

19.2.4. Create the report

- Create a new report in ART of the type **Pivot Table: Mondrian XMLA**
- In the **Datasource** field, select the datasource you have just created
- Enter the required **XMLA Datasource** name. This should match exactly with the contents of the **DataSourceName** in the **datasources.xml** file defined on the external server. These names can be any string and don't have to match any name in the schema xml file.
- Enter the required **XMLA Catalog** name. This should match exactly with the contents of the **Catalog** name in the **datasources.xml** file defined on the external server. These names can be any string and don't have to match any name in the schema xml file.
- In the MDX source field, enter the MDX for your report

19.2.5. Potential errors

- If you encounter a **404** error, the URL specified in the ART datasource may be invalid.
- If you encounter a **No metadata for catalog** error, the catalog name in the **XMLA Catalog** field may be misspelt. Catalog names are case sensitive.
- If you get a **XMLA connection datasource not found** error, the datasource name in the **XMLA Datasource** field may be misspelt. Datasource names are case sensitive.
- If you get a **XMLA Discover unparse results error** error, the file specified in the **Definition** section of the **Catalog** section of the **datasources.xml** may not exist. Alternatively, the JDBC details provided in the **DataSourceInfo** tag may not be correct. Alternatively, the **Catalog** name may not be matching the **name** attribute of the **Schema** tag in the cube's schema xml file. Alternatively, the **DataSource** name may not be matching the **XMLA Datasource** field of the report.
- If you get a **No metadata schema dimensions for catalog** error, the catalog name entered in the **XMLA Catalog** field may be incorrect. Note that if a change is made to the datasources.xml, the application needs to be restarted for the changes to take effect.

19.2.6. Accessing the Mondrian XMLA instance from MS Excel

You can configure ART to serve as a mondrian XMLA server by defining a file named **datasources.xml** and placing it in the **ART_HOME\WEB-INF\work\templates** directory. A sample datasources.xml file can be found in the ART_HOME\WEB-INF\etc directory. The steps outlined here refer to MS Excel 2010 and may be different for different versions of Excel.

- Download the XMLA connect provider from https://sourceforge.net/projects/xmlaconnect/files/
- Run the .exe file
- Open Excel
- Select the **Data** tab
- Click on the **From Other Sources** menu and then select **From Data Connection Wizard**
- In the dialog that opens, select **Other/Advanced** and then click on **Next**
- Select the **XMLA Data Source** provider and click on **Next**
- In the **Location** box, type a url like http://localhost:8080/art/xmla as per the ART installation
- Click on the drop-down arrow in the **Catalog** box and select the required item
- Click on **OK**
- In the next screen, select which cube you want to deal with and click **Next**
- Click on **Finish** to complete the process
- Click on **OK** to have the pivot table details loaded in the current work sheet
- From the **Pivot Table Field List** on the right, drag a measure under the Values section to the Values section in the below panel
- You should now have a value in your worksheet displaying the total value for this measure
- You can drag items to the Row Labels, Column Labels and Report Filter sections in order to do further analysis
- You can also slice the data. Click on any cell in the pivot table. From the **Options** tab, click on the **Insert Slicer** menu, check an item and click on **OK**. You can now slice your data by clicking the different available values of the slicer you selected, with the data being updated to reflect your selection. To remove the slicer, right-click on its heading or any empty space within the slicer and click on the **Remove ...** menu.

If you want to view the MDX that is generated for the analysis you are doing, download and install the **OLAP Pivot Table Extensions** plugin for Excel from https://olappivottableextend.codeplex.com/. Once you download the correct version of the plugin for your version of Excel, and start Excel, you can view the MDX for any analysis by right-clicking on any cell in the pivot table data, selecting the **OLAP Pivot Tables Extensions** menu and selecting the **MDX** tab.

19.3. SQL Server XMLA

This report type is used to access cubes defined in a Microsoft SQL Server Analysis Services (SSAS) server. Before being able to run reports based on a SSAS cube, you need to configure SSAS for HTTP access.

19.3.1. Configure SSAS for HTTP access

Some resources on how to do this are as follows

- http://geekswithblogs.net/darrengosbell/archive/2007/11/04/SSAS-Connecting-via-HTTP-on-Windows-Vista.aspx
- http://ssas-wiki.com/Articles#HTTP_Access

After you have finished the configuration, start IIS.

To test that you can access SSAS via HTTP, open SQL Server Management Studio, select Analysis Services as the Server type, put the URL in the Server name box e.g. http://localhost/olap/msmdpump.dll and try to connect. If you are able to connect, access to the server is fine, and next you need

to provide access rights to the cube.

19.3.2. Provide access to the cube

These steps outline the process for providing access on SQL Server 2008R2 and may be different for other versions of SQL Server.

- Using SQL Server Management Studio, connect to the SSAS server using an administrator user
- Expand the **Databases** folder then expand the desired database
- Right-click on the **Roles** section for the database and select the **New Role** menu to create a new role
- Provide a **Role name** for the role and tick the **Read definition** box to give the role read access
- Select the **Membership** section on the left-hand pane to add the users who will have access. If HTTP access is configured for anonymous access, add the **IUSR** user. If not, add the user whose credentials will be used to access the cube. Enter a given user and click on the **Check Names** button to have the user retrieved.
- Select the **Data Sources** section on the left-hand pane and then select **Read** in the **Access** column of the desired cube
- Select the **Cubes** section on the left-hand pane and the select **Read** in the **Access** column for the desired cube
- Click on **OK** to save the role

To verify that you can access the cube and generate reports from it

- Open a new SQL Server Management Studio instance and connect to SSAS using the msmdpump URL e.g. http://localhost/olap/msmdpump.dll and using the user which you assigned to the role.
- Expand the **Databases** folder
- Expand the folder for your database
- Expand the **Cubes** folder
- Right click on your cube and select **Browse**
- You should be able to drag and drop dimension members to the analysis pane to display some data

19.3.3. Create a datasource

- Create a new datasource in ART using the **Configure | Datasources** menu and then clicking on the **Add** button
- In the **Datasource Type** section, select **OLAP**
- In the **URL** field, enter the url to use to access SSAS e.g. http://localhost/olap/msmdpump.dll
- If the SSAS server is configured to allow anonymous access, leave the **Username** and **Password** fields blank. If it's configured to require basic authentication, enter the username and password of a user in a role that has access to the required cube.
- Save the datasource

19.3.4. Create the report

- Create a new report in ART using the **Configure | Report** menu and then clicking on the **Add** button
- In the **Type** field, select **Pivot Table: SQL Server XMLA**
- In the **Datasource** field, select the datasource you have just created
- In the **XMLA Catalog** field, enter the database name for your database on the SSAS server
- In the MDX source field, enter the MDX for your report

You should now be able to run the report and perform analysis. If you encounter a **connection refused** error, IIS may not be started. If you encounter a **No metadata schema dimensions for catalog** error, you may not have permissions on the cube.

Note:

- You can use single-value parameters in the mdx using the direct parameter substitution syntax `#!<param name>#` e.g.

```
SELECT
{ [Measures].[Sales Amount], [Measures].[Tax Amount] } ON COLUMNS,
{ [Date].[Fiscal].[Fiscal Year].&[#!FromYear#], [Date].[Fiscal].[Fiscal Year].&[#!ToYear#] } ON ROWS
FROM [Adventure Works]
WHERE ( [Sales Territory].[#!Territory#] )
```

- You can also use multi-value parameters. In this case, construct the LOV query such that it returns strings as they would appear in the MDX. e.g.
  Example LOV

```
SELECT CONCAT("[Order.Order Sale Type].[",sale_type_code,"]") as typecodes, sale_type_code
FROM dim_orders
```

  Use multi-value parameter in MDX as desired...

```
SELECT ... FROM ...
WHERE {#!saleTypes#}
```

- Pivot Tables use cached data where possible. To manually clear the cache, use the **Configure | Caches** menu and Clear the **Mondrian** cache. If you'd like the cache to be automatically cleared periodically, use the **Mondrian Cache Expiry Period** setting on the **Settings** page.

- For the SQL Sever XMLA

20. Rules

Rules are used to filter report results. They allow the same report to be filtered depending on the user that is running it.

The following steps need to be performed in order to use rules:

- **Create the rule**
  Use the **Configure | Rules** menu and then the **Add** button to specify the rule name

- **Link the rule to a report**
  On the report definition page, select the **Uses Rules** option
  In the SQL source section, use the special, hard coded placeholder **#rules#** where you want the rule values to go e.g

```
SELECT * from transactions
where #rules#
```

On the reports configuration page, find the report and use the **More | Rules** menu to specify which column the rule values will apply to

- **Assign rule values to users or user groups**
  Use the **Configure | Rule Values** menu to assign rule values to users or user groups. Select the user or user group and rule name, and specify the rule values that will apply to that user or user group. If you want the user or user group to have multiple rule values, add each value separately. i.e enter the first value, then click on Add, then enter the next value etc.

Example:

- You have a table named "employees" with the a column named "region"
- Create a rule named "GeoArea"
- Set up a report that selects rows from the employees table and link it to the rule named "GeoArea" on the column "employees.region"
- Link the user to the rule "GeoArea" for values NORTH and EAST

When the user runs the report, he will extract only the rows where the "region" column has the values NORTH or EAST (i.e. the SQL query will be modified on the fly before execution by adding `AND employees.region IN ('NORTH','EAST')` to the WHERE clause).

Note:

- If a report is linked to a rule but the user who runs the report has not been set up for that rule, the report execution will not be performed and an error message will be displayed.
- If the report uses multiple rules, each user that needs to execute it must have values set for all the rules that the report uses.
- If the report uses parameters, the placeholder **#rules#** shouldn't be used for any parameter as it will conflict with the special placeholder for rules.
- If you don't want results filtered for a given user e.g. an administrator, manager etc, define a rule value for this user where the rule value is **ALL_ITEMS**.

21. Chained Parameters

A chained parameter is one whose values depend on the value selected in another parameter. The parameter that triggers the change is called the "parent". A chained parameter can be used as a parent for another parameter, which in turn can have another child parameter and so on.

21.1. Example

Suppose we want to view customers who reside in a particular city. We want the user to select a country and then have cities in that country displayed. He'll then pick one of these cities and run the report. We have a `CUSTOMERS` table, and one of the columns it has is `CITY_ID`. We also have a `COUNTRIES` table which has `COUNTRY_ID` and `COUNTRY_NAME` columns. Finally, we have a `CITIES` table with `CITY_ID`, `CITY_NAME` and `COUNTRY_ID` columns.

We could take the following steps to set up the report.

- Create a Dynamic LOV report named **countries** that will display country names. The country will be the parent parameter. Depending on what country is selected, the available cities will change. The report would have the following SQL.

  ```
  SELECT COUNTRY_ID, COUNTRY_NAME
  FROM COUNTRIES
  ORDER BY 2
  ```

- Create a Parameter named **countryId** with a Data Type of **Integer**, set it to **Use LOV** and select "countries" as the **LOV Report**.

- Create a Dynamic LOV report named **cities** that will display city names. The query needs to have a parameter label for the country parameter. This will be replaced at runtime with the country selected.

  ```
  SELECT CITY_ID, CITY_NAME
  FROM CITIES
  WHERE COUNTRY_ID = #countryId#
  ORDER BY 2
  ```

- Once you have saved the cities report, select the **More | Parameters** option for this report to allocate the countryId parameter.

- Add a Report Parameter and set the **Parameter** field to the **countryId** parameter created earlier.
- Create a Parameter named **cityId** with a Data Type of **Integer**.

- Create the main report. The SQL for the report will need to have a placeholder for the cityId parameter.

  ```
  SELECT FIRST_NAME, LAST_NAME, EMAIL
  FROM CUSTOMERS
  WHERE CITY_ID = #cityId#
  ```

- Once you have saved the main report, select the **More | Parameters** option for this report in order to allocate the report parameters.

- Add a Report Parameter and set the **Parameter** field to the **countryId** parameter created earlier.
- Add another Report Parameter, set the **Parameter** field to **cityId** and the **Chained Parents** field to "countryId" i.e. the name of the parent parameter for this chained parameter.

Now when you run the main report, you are presented with two drop down boxes. Depending on what country you select, a different set of cities is displayed, from which you can choose one and run the report to see the final results.

22. Scheduling

In order to schedule a report, a user needs an access level of at least **Schedule User**. Once logged in, a user's scheduled reports are available from the **Jobs** menu.

22.1. Scheduling a new job

Take the following steps to schedule a new job

- From the Reports page, select the report to schedule and click on the **Schedule** button
- Specify the job details and Save
- The job will now run as per the schedule defined

Note:

- Dashboards and pivot tables cannot be scheduled
- The **Runs To Archive** field indicates, for Publish and Conditional Publish jobs, how many runs should be kept for viewing from the Archives page e.g. setting it to 5 will retain output from the last 5 runs in the Archives page. This allows users to access past job output as per their requirements.
- The **Fixed File Name** field indicates that the output file generated should use the file name indicated in this field e.g. `test.html`

- The **Batch File** field indicates the name of a batch file or script that should be run after the job completes. The batch file must exist in the **ART_HOME\WEB-INF\work\batch** directory. You only set the file name in this field e.g. `test.bat` or `test.sh`. ART passes the file name of the generated output as the first parameter to the batch file so you can use this e.g. to copy the file to another location e.g. the `test.bat` file may have the following contents.

  ```
  copy ..\export\jobs\%1 C:\temp
  ```

22.2. Job Types

- **E-Mail Output (Attachment)**
  The output is emailed as an attachment to the specified recipients (in the "To" section). The attachment type can be selected in the Output Format field.
- **E-Mail Output (Inline)**
  The output is emailed to the specified recipients, in the email body.
- **Publish**
  The output is saved to a file. The file is reachable from the Jobs page. Once the file is generated, a notification email is sent to the specified recipients (in the "To" section). Leave the "To" area empty if you don't want a notification email to be sent.
- **Alert**
  Send an email to the specified recipients if the first column of the first row in the query result has a value greater than zero. You can construct a simple SQL query to return a non zero value in case of a certain business condition.

Example query to be used for an alert. Send an email if a big order is made

```
SELECT count(*)
FROM todays_order_details
WHERE quantity>100
```

- **Just Run It**
  Simply run the report. Uuseful to launch stored procedures or perform periodic data updates.
- **Conditional E-Mail Output (Attachment)**
  If the result set has records, an email with the output attached is sent to the specified recipients. If it has no records, no email is sent.
- **Conditional E-Mail Output (Inline)**
  If the result set has records, an email is sent to the specified recipients with the output contained in the email body. If it has no records, no email is sent.
- **Conditional Publish**
  If the result set has records, the output will available from the Jobs page. A notification email is sent to the specified recipients if this is configured. If the result set has no records, no output is generated and no email is sent.
- **Cache ResultSet (Append)**
  Cache the result set in a database table (Append)
- **Cache ResultSet (Delete&Insert)**
  Cache the result set in a database table (Delete&Insert)
- **Print**
  Prints the report output to the default printer
- **Burst**
  Generates report files for each distinct value in a resultset. This requires that the query for the report be ordered by the first column, which will be the burst-id column. When the value of this column changes, a new file is generated. Burst jobs are only possible with **Tabular** reports. The files generated will have the burst-id in their file names so different files can be identified and copied or ftped to different locations for example.

Note:

- If the output for a job creates a file e.g. publish to pdf, this file is stored in the **ART_HOME\WEB-INF\work\export\jobs** directory

22.3. Archives

For publish and conditional publish jobs, you can specify that a certain number of job runs should be archived i.e. files generated from past runs should be available for viewing. This is done by setting the **Number of Runs to Archive** field when defining the job, and archived files are available from the **Archives** menu.

22.4. Job Auditing

Use the **Enable Auditing** option to enable/disable logging of additional information for a job run. If unchecked, only the last start and end time is recorded (in the `ART_JOBS` table). If checked, an additional record will be created in the `ART_JOBS_AUDIT` table indicating the start time, end time and status of each job run.

22.5. Saved Schedules

If a schedule is used frequently, it can be saved such that you don't need to enter all the details each time you create a job. To reuse a schedule, select it from the **Schedules** option and click on the **Get** button. The schedule details will be retrieved and filled in the appropriate job schedule fields. Administrators can create, modify or delete schedules using the **Configure | Schedules** menu.

22.6. Job Duration

When defining the job schedule, you can specify the date when the job should start running and the date when it should stop in the **Start Date** and **End Date** fields respectively. If the start date is left blank, the job will start running on the current date, as per it's schedule. If the end date is left blank, the job will continue to run indefinitely.

22.7. Shared Jobs

By default, only the owner of a job has access to its output, particularly for published jobs. Shared jobs allow the output of a job to be shared with other users. To share a job's output, check the **Allow Sharing** field and select the users or user groups with whom the output will be shared using the **Configure | Access Rights** menu. These users will be able to access the job's output from the Jobs menu.

22.7.1. Split Jobs

If the report for a shared job uses rules, you can specify that the rule values for the shared users be applied so that each individual user may get different, individualized output. To do this, check the **Allow Splitting** field. If this field is unchecked and the report uses rules, the rule values of the job owner will be applied and all shared users will get the same output. If the report doesn't use rules, the value of this field will have no effect. A single, identical output will be availed to all users.

22.8. Random Start Times

You may not care when exactly a job runs, as long as it runs in a certain window of time. If you leave the Hour and Minute fields blank when creating the job, the job will be assigned a random hour between 3-6 and a random minute between 0-59 in which it will run. This may be useful for jobs that your require to run at night. Additionally, you can specify an explicit time range in which the job should run. To do this, in the **Hour** field, define the required start time and end time separated by | e.g. 4|7, 4:30|6, 12:45|13:15. The job will then be assigned a random execution time in this range.

23. Cached Results

ART can be used to reverse query results from a datasource to the same or a different datasource. This allows administrators to:

- Group data to summary tables, creating a data mart from which to develop other reports
- Create Data-Transformation-Load procedures (DTL) to feed other systems

One typical usage is when a large dataset would create performance issues if queried directly by end users. If the underlying data can be grouped - for instance on a monthly basis - a Cached Result job can summarize the information and then fast-performing queries can be created to analyse the summarized data.

23.1. Create a new Cached Result

In order to cache the results of an existing report:

- Schedule a job for the report
- In the Add Job screen among the **Job Type** items, the following items appear for administrators:
  - **Cache ResultSet (Append)**
  - **Cache ResultSet (Delete & Insert)**
- Select the datasource where to reverse the data (note: the datasource must be writeable i.e. the datasource user should have UPDATE/DELETE/INSERT/CREATE TABLE rights on the target database table)
- In the **Cached Table Name** field, enter the name of the table in the target datasource that will contain the data
- Schedule the timing when the action should take place, like any other job

23.2. Accessing a Cached Result

At the given time ART will:

- Run the query
- Connect to the datasource where to reverse the results
  - The Cached Table is created in the selected datasource (if the table doesn't exist). The column names will match with the query column names. Blanks or other special charaters in the names are replaced with "_".
  - The table content is deleted if the option **Cache ResultSet (Delete & Insert)** was selected
- Reverse all the query results in the new table

A cached table is just a normal table in the database. Details about the columns names are available in the Jobs page.

Note:

- The Cached Table is removed when the job is deleted. However if the job is edited and the table name changed, the previous table is maintained.
- No indexes are created on top of the Cached Table. For large datasets to be queried, it is suggested to manually create indexes once the table is created. Since the table is not dropped/recreated at each Job execution the indexes will persist.

- Basic columns types (integer, varchar, date, etc) can be properly reversed. BLOB, CLOB or other database specific non-standard data types have not been tested and will likely generate errors.

24. Dynamic Recipients

Dynamic recipients allows you to email report results to a dynamic list of people. This may be useful where the recipients may change from day to day or week to week e.g. sending an email to staff who are low on their targets. It may also be useful to send filtered report results e.g. send to managers only the sales for their branch.

Using the dynamic recipients feature will involve the following process

- Create the main report with the data to be sent to the desired recipients
- Create a report of type **Dynamic Job Recipients** that will contain details of the recipients, including their email addresses
- Schedule a job for the main report and select the dynamic recipients report you created in the **Dynamic Recipients** field

There are several ways to use dynamic recipients.

24.1. Dynamic Recipients only

If you want all the recipients to get the same data and the same email message, then define a dynamic recipients report with only one column. This column should contain the email addresses of the recipients. The name of the column doesn't matter. Example:

```
SELECT email
FROM employee
```

24.2. Dynamic Recipients + Personalization

If you want all the recipients to get the same data, but you would like some personalization of the email message e.g. having a greeting like `Dear John` instead of `Dear Employee`, then define a dynamic recipients report where the first column contains the recipient email addresses, and any additional columns that you would like to use in the email message e.g.

```
SELECT email, first_name, other_name last_name, order_count
FROM employee, orders
WHERE employee.id=orders.employee_id
```

When defining the job for your data query, in the email message section, you can then use column labels as placeholders where personalized details will be put. The labels consist of column names from the recipients report surrounded by # signs e.g. you can have a message like

```
Dear #first_name# #last_name#
You are now at #order_count# orders, which is below the target of 100.
```

Each person in the dynamic recipients report list will get a personalized email with the column labels substituted with his values.

24.3. Dynamic Recipients + Filtering

If you want the recipients to get different data, you will define a dynamic recipients report where the first column contains the recipient email addresses, any additional columns with personalization information if you want, and 2 other special, hard coded columns named **recipient_column** and **recipient_id**. These will be used to filter the data query. i.e. WHERE `<recipient_column>` = `<recipient_id>`. The main, data query will also need to have a special, hard coded label, **#recipient#**, in the where clause.

Example:
If we want to email users only transactions that they created, our data query can be something like

```
SELECT *
FROM transactions
WHERE transaction_date = CURDATE()
AND #recipient#
```

We can then define a dynamic recipients report like

```
SELECT email, "transaction_user" recipient_column, employee_id recipient_id
FROM employee
```

This will cause the `#recipient#` placeholder in the data query to be replaced with the condition `transaction_user = <employee_id>`, where `<employee_id>` will be different for each recipient, as per the dynamic recipients query. We can then schedule a job for the main report and set the dynamic recipients field, and all the recipients will get a separate email with their specific data only.

If we also want to include personalization fields in the email message body, we can add these to the dynamic recipients query e.g

```
SELECT email, "transaction_user" recipient_column, employee_id recipient_id, first_name
FROM employee
```

and we can then include the personalization placeholders in the email message field as desired.

Note:

- With the personalization and filtering options, you can include columns with the name **email_cc** or **email_bcc** to specify email addresses that should be included in the cc or bcc fields of the email sent.
- Email address columns can have multiple emails separated by `;`

25. FTP Servers

You can configure ftp servers to be used after a publish job is generated, to ftp the generated file to a given ftp server.

Use the **Configure | FTP Servers** menu to manage ftp server configurations. When Adding an ftp server, the following fields are available.

Field	Comment
ID	A unique ID for the ftp server configuration, generated by ART
Name	A name for the ftp server configuration. This will be used in the Add Job page in the list of available ftp servers.
Description	A description for the ftp server configuration
Active	Whether this configuration is active or not. If it is not active, no files will be ftped for jobs that use this ftp server configuration.
Server	The IP address or host name of the ftp server
Port	The ftp port of the server
User	The ftp user to use to connect to the server
Password	The ftp user’s password
Remote Directory	If the files are to be ftped to the user’s home directory, then this field should be left blank. If the files are to be ftped to another directory, then the path should be given here, always beginning with "/" e.g. /sub-folder-a or /sub-folder-a/sub-sub-folder-b.

26. Integrated Windows Authentication

ART uses the spnego library available at http://spnego.sourceforge.net/ to provide Integrated Windows Authentication functionality. These instructions are largely based on the documentation found on that project's website.

26.1. Prerequisites

You need to have at least 3 separate machines as follows

- Active Directory server (or other KDC server)
- Application server (a different machine where the application server e.g. Tomcat is installed)
- Client machine(s) (from where you'll access ART)

26.2. On the Active Directory server

- Create a user in AD to be used for authentication purposes. This user doesn't need to have access to log in to computers. e.g. a user named spnego. Set the password to never expire

- Create spns that point to the application server/spnego user combination using the setspn command. Use syntax like below

```
setspn -A HTTP/app-server spnego
setspn -A HTTP/app-server.domainname spnego
```

Replace **app-server** with the appropriate machine name of the application server, **my.domain.com** with the domain name and **spnego** with the username of the domain account to be used for spnego access. If you'll also be accessing the web application on the application server via ip address e.g. `http://192.168.56.101:8080/art`, also create spns for the ip address. Examples

```
setspn -A HTTP/app-server spnego
setspn -A HTTP/app-server.my.domain.com spnego
setspn -A HTTP/192.168.56.101 spnego
setspn -A HTTP/192.168.56.101.my.domain.com spnego
```

26.3. On the Application server

- Create a file in the ART_HOME\WEB-INF directory named **login.conf** with the following details

```
spnego-client {
    com.sun.security.auth.module.Krb5LoginModule required;
};

spnego-server {
    com.sun.security.auth.module.Krb5LoginModule required
    storeKey=true
    isInitiator=false;
};
```

- Create a file in the ART_HOME\WEB-INF directory named **krb5.conf** with the following details. Replace **MY.DOMAIN.COM** with your domain name. For the kdc parameter, use the fully qualified domain name of the AD server.

```
[libdefaults]
    default_realm = MY.DOMAIN.COM
    default_tkt_enctypes = aes128-cts rc4-hmac des3-cbc-sha1 des-cbc-md5 des-cbc-crc
    default_tgs_enctypes = aes128-cts rc4-hmac des3-cbc-sha1 des-cbc-md5 des-cbc-crc
    permitted_enctypes   = aes128-cts rc4-hmac des3-cbc-sha1 des-cbc-md5 des-cbc-crc

[realms]
    MY.DOMAIN.COM  = {
        kdc = ad-server.my.domain.com
        default_domain = MY.DOMAIN.COM
}

[domain_realm]
    .MY.DOMAIN.COM = MY.DOMAIN.COM
```

- Edit the ART_HOME\WEB-INF**web.xml** file and add a filter as below. Replace the **spnego.preauth.username** and **spnego.preauth.password** parameter values with the details of the domain account created to enable spnego access. Replace the **spnego.krb5.conf** and **spnego.login.conf** parameter values with the full path of the respective files. Leave all the other parameters as they are. The spnego filter mapping must come before other filter mapping elements.

```
<filter>
    <filter-name>SpnegoHttpFilter</filter-name>
    <filter-class>net.sourceforge.spnego.SpnegoHttpFilter</filter-class>

    <init-param>
        <param-name>spnego.allow.basic</param-name>
        <param-value>true</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.allow.localhost</param-name>
        <param-value>false</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.allow.unsecure.basic</param-name>
        <param-value>true</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.login.client.module</param-name>
        <param-value>spnego-client</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.krb5.conf</param-name>
        <param-value>C:\tomcat\webapps\art\WEB-INF\krb5.conf</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.login.conf</param-name>
        <param-value>C:\tomcat\webapps\art\WEB-INF\login.conf</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.preauth.username</param-name>
        <param-value>spnego</param-value>
    </init-param>
```

```
    <init-param>
        <param-name>spnego.preauth.password</param-name>
        <param-value>spnego</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.login.server.module</param-name>
        <param-value>spnego-server</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.prompt.ntlm</param-name>
        <param-value>true</param-value>
    </init-param>

    <init-param>
        <param-name>spnego.logger.level</param-name>
        <param-value>1</param-value>
    </init-param>
</filter>
<filter-mapping>
    <filter-name>SpnegoHttpFilter</filter-name>
    <url-pattern>*.jsp</url-pattern>
</filter-mapping>
```

26.4. On the client machine

- The **Default Authentication Method** for ART needs to have been set to **Auto** (done in the Settings page)
- Login to a client machine using a domain account
- Access the ART home page as usual

26.4.1. Omitting the credentials box

- **Firefox**
  By default, firefox will still display a credentials box requiring a user to enter their domain username and password. To avoid this, do the following

  - In the address bar, type **about:config**
  - In the filter box, type **network.negotiate**
  - Double click on the **network.negotiate-auth.trusted-uris** option and enter the url of the application server (excluding the http part and including port number if not port 80) e.g. app-server:8080

  If the credentials box is still displayed, set the following options in a similar way

  - **network.negotiate-auth.delegation-uris**
  - **network.automatic-ntlm-auth.trusted-uris**

- **IE**
  For IE, the credentials box may be displayed if you access the web application using an ip address. To avoid this, do the following

- Under internet options, security, local intranet, sites, click on advanced and add the url to the application server e.g. `http://192.168.56.101:8080`

26.5. Using a keytab file

Instead of having the spnego username and password in plain text in the web.xml file, you can use a keytab file to hold these credentials. Take the following steps on the application server

- Stop tomcat
- Copy the file ART_HOME\WEB-INF\krb5.conf to the windows directory e.g. C:\windows
- Rename the file to krb5.ini

- Open a command prompt window, cd to the ART_HOME\WEB-INF directory and type a command with syntax like the following

```
ktab -a <spnego user> <spnego password> -k <file name>
```

E.g.

```
ktab -a spnego spnego -k art.keytab
```

- Edit the ART_HOME\WEB-INF**login.conf** file to have contents like the following. Set the full path to the keytab file and the spnego username (principal) as per your configuration

```
spnego-client {
    com.sun.security.auth.module.Krb5LoginModule required;
};

spnego-server {
    com.sun.security.auth.module.Krb5LoginModule required
    storeKey=true
    useKeyTab=true
    keyTab="file:///c:/tomcat/webapps/art/WEB-INF/art.keytab"
    principal=spnego;
};
```

- Edit the ART_HOME\WEB-INF**web.xml** file. Make the **spnego.preauth.username** and **spnego.preauth.password** parameters blank. i.e.

```
<init-param>
    <param-name>spnego.preauth.username</param-name>
    <param-value></param-value>
</init-param>

<init-param>
    <param-name>spnego.preauth.password</param-name>
    <param-value></param-value>
</init-param>
```

- Restart tomcat

You should have integrated authentication as before

26.6. Changing the spnego user

If you need to change the AD user used to enable spnego access, first delete the spns associated with the application server and then create new ones for the desired user. An spn for a given server can only refer to a single user. To delete the spns, you can use syntax similar to the following

```
setspn -D HTTP/app-server spnego
setspn -D HTTP/app-server.my.domain.com spnego
```

27. CAS Authentication

To use CAS authentication, edit the **web.xml** file and uncomment the items in the CAS configuration section, providing appropriate urls for the CAS server and for ART.

Also, from the Settings page, set the **Default Authentication Method** for ART to **CAS** and set the **CAS Logout URL** to enable users to log out of CAS after logging out of ART.

28. Application Logs

ART uses the Logback library for application logging. By default, application logging is done to standard output and includes logging on errors, warnings and information messages. The location of the logs or the amount of logging generated can be modified by making appropriate configuration changes to the ART_HOME\WEB-INF\classes**logback.xml** file. Changes made to the logging configuration e.g. changing certain logging levels from "info" to "debug" automatically take effect after the configured **scanPeriod** (values can be specified as milliseconds, seconds, minutes or hours. See http://logback.qos.ch/manual/configuration.html for more details).

In addition to being available on the application server's standard output log files, e.g stdout.log or catalina.log on Tomcat, application logs can also be viewed from within ART. This means that you don't need to have access to the application server machine in order to view application logs.

Application logs can be viewed from the **Logs** menu. New logs are added to the bottom and you'll need to refresh the page to view them. Also note that this page doesn't display all the logs ever generated by the application, only the most recent ones.

28.1. SQL Logging

You can set up logging for the sql that is generated when queries are run, e.g. to see the final sql generated, or to see how long queries take to execute. ART comes with the log4jdbc library that enables such logging. Take the following steps to configure sql logging.

- Select the **Configure | Datasources** menu and **Edit** the datasource you're interested in
- Set the **JDBC Driver** to `net.sf.log4jdbc.DriverSpy`
- Modify the **JDBC URL** by prepending **jdbc:log4** to the existing url, e.g. resulting in a url like `jdbc:log4jdbc:mysql://localhost/mydb`
- **Save** the datasource details

- Modify the ART_HOME\WEB-INF\classes**logback.xml** file and add loggers for the items you are interested in e.g.

```
<logger name="jdbc.sqltiming">
    <level value="info" />
</logger>
```

- The available loggers and what events they log can be found on the log4jdbc project home page, http://code.google.com/p/log4jdbc/

- That's all. The logging information will now be included in the application logs when reports are run against that datasource.

29. Tomcat Configuration

29.1. Memory options

If you are using Tomcat as the application server, there are some configuration items you can set to improve performance. This is mainly setting Tomcat to run in server mode and increasing the amount of memory available to Tomcat e.g. so that jobs don't run out of memory.

29.1.1. Windows

If Tomcat was installed as a service

- Run the TOMCAT_HOME\bin\tomcat8w.exe (or similar file for your Tomcat version). This may need to be run as administrator.
- In the Java tab, in the **Java Virtual Machine** section, set Tomcat to run in server mode by changing the jvm.dll to the one in the JDK e.g. C:\Program Files\Java\jre1.8.0_25\bin\server\jvm.dll
- Increase the amount of memory available to Tomcat by setting a value in the **Maximum memory pool** textbox e.g. 1024 (this value shouldn't be very large compared to the total amount of memory available on the machine, otherwise the operating system and other applications may be starved of RAM)

Note:

- The "service user account" configured to start and stop the Tomcat service needs to have appropriate permissions, otherwise you may get errors when accessing ART. In particular, ART requires write access to the `ART_HOME\WEB-INF\work` and `ART_HOME\js-templates` directories.

If Tomcat is run from a batch file

- Create a file named **setenv.bat** in the TOMCAT_HOME\bin directory (or edit it if it exists) and set the configuration options in the JAVA_OPTS environment variable e.g.

```
set JAVA_OPTS=-server -Xmx1024m
```

29.1.2. Linux

Create a file named **setenv.sh** in the TOMCAT_HOME/bin directory (or edit it if it exists) and set the configuration options in the JAVA_OPTS environment variable e.g.

```
export JAVA_OPTS="-server -Xmx512m"
```

29.2. Accessing Tomcat via Apache

You can use the Apache HTTP Server as a front end to your application that resides on Tomcat. This can be done for a number of reasons, including clustering or enabling access to the application from a more familiar url.

There are a number of ways to run Tomcat behind Apache.

29.2.1. Using mod_proxy

- Ensure the following lines in your Apache **httpd.conf** file are uncommented

```
LoadModule proxy_module modules/mod_proxy.so
LoadModule proxy_http_module modules/mod_proxy_http.so
```

- Add an item at the end of the **httpd.conf** file to indicate how ART will be accessed by users and how Apache will communicate with Tomcat e.g

```
ProxyPass /art http://localhost:8080/art
ProxyPassReverse /art http://localhost:8080/art
```

That's it. Start Apache and Tomcat (the order of starting and stopping doesn't matter), and now you can access ART from the url localhost/art (i.e `<apache-server>/art`).

29.2.2. Using mod_proxy_ajp

If you have Apache 2.2 and above, you can use mod_proxy_ajp

- Ensure the following lines in your Apache **httpd.conf** file are uncommented

```
LoadModule proxy_ajp_module modules/mod_proxy_ajp.so
LoadModule proxy_module modules/mod_proxy.so
LoadModule proxy_http_module modules/mod_proxy_http.so
```

- Ensure you have an AJP connector defined in the **TOMCAT_HOME\conf\server.xml** file e.g.

```
<Connector port="8009" protocol="AJP/1.3" redirectPort="8443" />
```

- Add an item at the end of the **httpd.conf** file to indicate how ART will be accessed by users and how Apache will communicate with Tomcat e.g

```
ProxyPass /art ajp://localhost:8009/art
ProxyPassReverse /art ajp://localhost:8009/art
```

- Note that this definition uses the ajp protocol and port 8009, which is the port defined for the AJP connector in Tomcat's server.xml

That's it. Start Apache and Tomcat (the order of starting and stopping doesn't matter), and now you can access ART from the url localhost/art (i.e `<apache-server>/art`).

29.2.3. Using mod_jk

If you need more powerful proxying features, you can download, configure and use the mod_jk connector. This is slightly more involving than the other two methods already mentioned and you can use the instructions available at http://www3.ntu.edu.sg/home/ehchua/programming/howto/ApachePlusTomcat_HowTo.html to get it working.

Note:

- For Ubuntu/Debian, instead of using LoadModule to enable the modules, use a2enmod from the command line, e.g.

```
a2enmod proxy_ajp
a2enmod proxy
a2enmod proxy_http
```

- Also for Ubuntu/Debian, add the ProxyPass and ProxyPassReverse items to the **apache2.conf** file instead of httpd.conf.

30. Customizing ART

You can customize ART to fit your needs.

30.1. Using live files

You can customize or update ART files directly on the application server where ART is deployed. This may be especially useful for minor changes.

30.1.1. Setting up Apache Ant

If you are going to customize the application source code, you may want to setup Apache Ant to make compiling your changes easier. To do this, take the following steps

- Download the Apache Ant zip package from http://ant.apache.org/
- Extract the zip file to C:\, or other directory of your choice. A new directory will be created e.g. C:\apache-ant-1.8.1
- Add the Ant bin directory to the PATH environment variable e.g. `C:\apache-ant-1.8.1\bin`

30.1.2. Customizing java files

Java source files are contained in sub directories under the **ART_HOME\WEB-INF\classes\art** directory. To make customizations to these files, take the following steps.

- Configure Apache Ant as described above
- Make changes to the desired .java files
- Open a command prompt window and navigate to the **TOMCAT_HOME\webapps\art** directory
- Type the command `ant compile`
- The modified .java files will be recompiled
- Reload the ART application using the Tomcat Application Manager, or restart tomcat
- The application will now use the modified source code

30.1.3. Customizing jsp files

JSP files can be modified and results immediately viewable when the relevant page is refreshed. If you don't see the expected changes when you refresh the page, the page displayed may be a cached copy. You may need to clear the application server cache and the browser cache to ensure the page is refreshed. If using Tomcat, you can clear the tomcat cache by deleting the **TOMCAT_HOME\work\Catalina\localhost\art** directory. If using Firefox, you can clear the browser cache from the History | Clear Recent History menu.

30.1.4. Customizing other files

Other files that affect how ART works can also be modified. Examples include

- ART_HOME\WEB-INF\classes**quartz.properties** - Change quartz configuration items e.g. number of threads
- ART_HOME\WEB-INF\classes**logback.xml** - Change logging level for quartz or ART classes

30.1.5. Updating jasperreports

If you are using a version of iReport that is different from the jasperreports version contained in ART, you may want to update the jasperreports version contained in ART to match your iReport version. This may not be necessary, but would be useful if you encounter problems while running reports. Take the following steps to update the jasperreports library and template files.

- Download the required jasperreports .jar from the jasperreports sourceforge page, http://sourceforge.net/projects/jasperreports/files/jasperreports/ e.g download the file jasperreports-5.0.1.jar from the JasperReports 5.0.1 folder.
- Ensure Apache Ant is set up as described above
- Stop Tomcat
- Backup the contents of the **ART_HOME\WEB-INF\work\templates** directory, where the jasperreport template files reside
- Delete the jasperreports .jar file contained in the **ART_HOME\WEB-INF\lib** directory
- Copy the just downloaded jasperreports .jar file to the **ART_HOME\WEB-INF\lib** directory
- Open a command prompt window and navigate to the ART_HOME directory
- Type the command `ant clean-jasperreports`
- Type the command `ant compile-jasperreports`
- Restart Tomcat

Your reports should now work properly.

30.2. Using Ant

If you don't wish to modify the live files, e.g. you want to test the changes on a test server first, you can modify the files in another location and create an application .war file to deploy on your test environment.

30.2.1. Using Ant without an IDE

- Ensure Apache Ant is set up as described above
- Unzip the `PACKAGE_PATH\art.war` e.g. unzip to a new directory `PACKAGE_PATH\art`
- Using a text editor, make modifications to the required files
- Open a command prompt window and navigate to the `PACKAGE_PATH\art` directory
- Type the command `ant war`
- A new file named art.war will be created in the `PACKAGE_PATH\art` directory. Deploy this file to your desired application server.

30.2.2. Using Ant with NetBeans

Instead of using a text editor to make changes and Ant to compile and package the changes, you can use an IDE to do this. The following are sample steps using NetBeans 7.2.1.

- Unzip the `PACKAGE_PATH\art.war` file e.g. unzip to a new directory `PACKAGE_PATH\art`. You can unzip the war file the same way as any zip file e.g. using 7zip.
- Create a directory to hold NetBeans project files e.g. `C:\MyNetBeansProjects\art`
- Open NetBeans
- Select the **File | New Project** menu
- Select the **Java Web** category and **Web Application with Existing Sources** project and click on the **Next** button
- For the **Location** field, select the `PACKAGE_PATH\art` directory. For the Project Folder field, select the directory you created for this e.g. `C:\MyNetBeansProjects\art`. Click on the **Next** button.
- Select the Server to use e.g. Apache Tomcat and Java EE version e.g. Java EE 7 Web. Click on the **Next** button.
- The Existing Sources and Libaries dialog should be pre-populated correctly with the appropriate paths. Click on the **Finish** button. If prompted, choose to delete existing .class files.
- Make changes to the files as appropriate
- To test the changes, use the Run Project icon on the menu bar, or right click on the project in the Projects explorer and select Run.
- To debug the code, set breakpoints as appropriate by clicking on the edge of the editor at the desired line of code and use the Debug Project icon on the menu bar or right click on the project and select Debug. If the debug process doesn't start with NetBeans indicating that it is waiting for tomcat to stop, open Task Manager and kill the java.exe process.
- To generate a war file to deploy, right click on the project and select Clean and Build. The generated art.war file will be located in the `C:\MyNetBeansProjects\art\dist` directory. Deploy this file to your desired application server

30.3. Using Maven

You can take the following steps to modify ART source code, using Apache Maven as the build tool. ART source files with a maven structure will be found in the `PACKAGE_PATH\src` directory.

- Install Maven
- (Optional) Install a maven repository manager e.g. Sonatype Nexus. A repository manager is optional but greatly increases productivity.

30.3.1. Using Maven without an IDE

- Using a text editor, make modifications to the required files
- Open a command prompt window and navigate to the `PACKAGE_PATH\src\art-parent` directory
- Type the command `mvn clean package`
- A new file named art.war will be created in the `PACKAGE_PATH\src\art-parent\art\target` directory. Deploy this file to your desired application server.

30.3.2. Using Maven with NetBeans

The following are sample steps using NetBeans 7.2.1.

- Open NetBeans
- Select the **File | Open Project** menu
- Select the `PACKAGE_PATH\src\art-parent` directory in the left hand panel, and click on the **Open Required Projects** box on the right hand panel. Click on the **Open Project** button.
- Make changes to the files as appropriate
- To test the changes, right click on the art project in the Projects explorer and select Run. Select the server on which to deploy the application and click on OK.
- To generate a war file to deploy, right click on the Parent project and select Clean and Build. The generated art.war file will be located in the `PACKAGE_PATH\src\art-parent\art\target` directory. Deploy this file to your desired application server

30.3.3. Using Maven with Eclipse

The following are sample steps using Eclipse Juno (4.2) SR2.

- Download the Eclipse IDE for Java EE developers package
- Unzip the package to your desired location e.g. C:\, to generate a C:\eclipse directory. Run the C:\eclipse\eclipse.exe file.
- Ensure you have an internet connection
- Select the **Help | Eclipse Marketplace** menu
- On the Search tab, in the Find field, type maven and hit enter
- Find the "Maven Integration for Eclipse" plugin (m2e by eclipse.org) and click on the Install button
- Once the plugin installs, go back to the Eclipse Marketplace and again type maven in the Find field and hit enter
- Find the "Maven Integration for Eclipse WTP" plugin (m2e-wtp by eclipse.org) and click on the Install button.
- Create a directory to hold eclipse workspace files e.g. `C:\MyEclipseWorkspaces\art`
- In Eclipse, select the **File | Switch Workspace | Other** menu
- Select the workspace folder you created e.g. `C:\MyEclipseWorkspaces\art` and click on OK. Wait for Eclipse to restart
- Select the **File | Import** menu
- Open the Maven group, select the **Existing Maven Projects** option and click on Next.
- Set the **Root Directory** field to the `PACKAGE_PATH\src\art-parent` directory. This should list the art-parent project, with the artdbcp, artmail and art projects beneath it. If the projects aren't retrieved, try to hit the enter key after typing the path in the root directory field. Ensure all the projects are selected and click on Next.
- Click on Finish in the final screen.
- Click on the Restore icon in the left most panel to have the project windows displayed on the screen and close the welcome page.
- Make changes to the files as appropriate
- Ensure you have a JDK installed
- Select the **Window | Preferences** menu. Expand the **Java** group and select the **Installed JREs**

option. In the right hand panel, select the default JRE and click on the Edit button. Set the **JRE home** field to a JDK folder e.g. `C:\Program Files\Java\jdk1.8.0_20`. Instead of editing the default JRE you can also use the Add button to add a new one and then check it as the default workspace JRE.

- Right click on the art-parent project and select the **Run As | Run Configurations** menu. Select the **Maven Build** option, and then click on the **New launch configuration** icon at the top of the list. Give a **Name** to the configuration e.g. package and set the **Base directory** to the `PACKAGE_PATH\src\art-parent` directory. In the **Goals** field, type `clean package`. In the JRE tab, ensure the JRE selected is the one defined earlier. Click on the Apply button. To generate a war file immediately, click on the Run button.
- To test changes, set up a server. See https://github.com/OneBusAway/onebus-away/wiki/Setting-Up-a-Tomcat-Server-in-Eclipse . Convert the art webapp project to a Dymanic Web Module and run the application. See https://wiki.base22.com/display/btg/How+to+create+a+Maven+web+app+and+deploy+to+Tomcat+-+fast
- To generate a war file to deploy, click on the drop down on the **Run As** icon in the menu bar, and select the configuration you created e.g. package. The generated art.war file will be located in the `PACKAGE_PATH\src\art-parent\art\target` directory. Deploy this file to your desired application server

30.4. Custom Export Path

By default, if the output for a report creates a file e.g. pdf, this file is stored in the **ART_HOME\WEB-INF\work\export** directory. You can designate a different directory to be used as the export path e.g. to a location on the application server that contains more disk space. To do this, modify the **ART_HOME\WEB-INF\art-custom-settings.json** file and set the path in the **exportDirectory** field.

30.5. Translating ART

You can translate ART so that the user interface is displayed in your own language. Follow the following steps to translate ART.

- Download the latest ART package, unzip it and unzip the **art.war** file using any zip/unzip software. Get the **ArtMessages.properties** file from the **WEB-INF\i18n** directory and and make a copy of it, naming your new file in the format **ArtMessages_xx.properties**, where xx is the ISO 639-1 language code for your language. A List of these language codes can be found here - http://www.mathguide.de/info/tools/languagecode.html. An example would be ArtMessages_pt.properties for Portuguese. If your language is written differently in different countries you can add the 2 letter country specifier to the file name so that your have a file name like ArtMessages_pt_BR.properties for Brazilian Portuguese. You can find a list of country codes here - http://www.immigration-usa.com/country_digraphs.html.
- Change all the text in your new properties file after the = signs to your language

- If your language uses a non ISO-8859 character set (e.g. chinese, arabic, russian etc) name the file ArtMessages_xx-UTF8.properties and then decode it to an ISO-8859 character set with UTF-8 escapes using the **native2ascii** tool that is available with your Java installation. An example command is as below.

```
native2ascii ArtMessages_xx-UTF8.properties ArtMessages_xx.properties
```

- Once you have your translated properties file in the i18n folder, you can restart the application server to make the new translation available to the application, or wait for 1 hour after which the messages are refreshed.

- Now you can log in to the application and include the **lang=xx** parameter in browser url to activate the new language e.g. `http://localhost:8080/art/reports?lang=xx`
- If you would like the new language to be listed for selection within the application e.g. on the login page, add the language code and the language name to the **ART_HOME\WEB-INF\languages.properties** file, save the file and restart the application server.
- If in addition you would like this new translation to be included in future ART versions, email the properties file to **tanyona** (at) **users.sf.net** or create a new post on the Discussion forum and attach the file there.

31. Support

- If you have any questions or comments, post these on the ART Help Discussion forum, http://sourceforge.net/p/art/discussion/352129/