

Intelligent Query Tools for Querying and Reporting

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ABSTRACT

The SAS® System is continually expanding to offer additional functionality for users. Recent product development has focused on our customers who need to easily access and query data. The SAS System provides a variety of methods that allow you to access and query your data, ranging from SQL (Structured Query Language) editors to GUI-based query tools to natural language tools—you choose the tool that's right for your users.

In this paper, we'll focus on two query tools—the SQL Query Window and Query and Reporting from DB2 (Q&R). We'll also briefly describe a third query tool, SAS/ENGLISH® software, that can be used to query data through the use of SAS views. The intent of this paper is to introduce these query tools—the information is not comprehensive of all features.

The advantages you will gain from using the Institute's query tools are four-fold:

- direct, transparent access to local or remote data
- support of DBMS specific SQL
- fully integrated and robust report-writing features
- complete client/server support.

In addition, because we offer a variety of ways to access and query your data, your data will be readily available to a wide variety of users and they can use the query tool best suited for their skill and comfort level.

Why the Need For Query Tools?

There is a fundamental move to provide users with tools that allow them to interact directly with the organization's data. If users can access the organization's data, they can make better business decisions quicker and reduce the support burden on MIS. This assertion is backed by recent market research and trade journal articles stating that SQL-based query tools will be to the 90's what spreadsheets were to the 80's.

What Solutions Does the SAS System Provide?

The SAS System provides a query tool that can query any data the SAS System can access. This tool is specific to each DBMS data using the DBMS's intelligence and specific SQL. It also provides a query tool that is specific to DB2 data using DB2 intelligence and DB2 specific SQL. These tools are the SQL Query Window and Query and Reporting from DB2. Both tools are accessible through SAS/ASSIST® software. There is some overlap in the functionality of these two tools, but they are targeted for different platforms and types of users. A third tool, SAS/ENGLISH software, is also available to query data.

Let's take a look at these tools. For each tool, we'll define it, specify the target audience, and discuss the features and benefits.

THE SQL QUERY WINDOW

The SQL Query Window is a feature of SAS/ASSIST software available beginning with Release 6.08 of the SAS System. The SQL Query Window provides a GUI for easy data access and

querying. It allows you to point and click to select tables and columns you want to query. As you make selections through this GUI, SQL code is generated, thereby building efficient queries automatically.

You can use the Query Window to query any data that the SAS System can access. The data you query can be in tables from any of the database management systems (DBMSs) that are supported by SAS/ACCESS® software, or the data can be in SAS data files, or SAS views (SAS views include SQL views, DATA step views, and SAS/ACCESS View Descriptor views).

Based on the access mode specified (for example, SAS mode, DB2 mode, ODBC mode, and so on), the main difference is the SQL generated. If you select DB2 as the access mode, SQL will be generated that can be passed directly to DB2 for processing with the results coming back to your local SAS session. This eliminates the need to copy or move data for querying.

Who is the Target Audience?

The SQL Query Window can be utilized by a wide range of users, from non-technical, occasional end users to experienced database administrators (we'll call them data providers because they don't need to be database administrators). From the end user perspective, querying is made easier through the use of a graphical user, point-and-click interface. Users are shielded from having to know any data retrieval language or worry about where their data reside. They concentrate on what they need to extract and in what form it will be represented (text report, graph, etc.).

Data providers can also use the SQL Query Window for universal data access and querying, using the same GUI. In addition, the data providers have a new tool that also makes their job easier. They can use the Query Window as a powerful tool to set up query session profiles that establish a set of preferences that govern a preferred way of accomplishing a task (i.e., you customize your query session). Each different set of preferences is known as a profile. The profile preferences include specifications such as how to access data if it is remote, the access method of Pass-Through SQL (the Pass-Through facility in SAS software allows you to submit the native DBMS SQL dialect for maximum efficiency), what columns to automatically join tables on when they are selected in the same query, how many rows to query, and more. The data provider can specify these settings in a particular profile once and allow multiple users to use that profile. There is no limit to the number of profiles that can be created.

Using the SQL Interface

Generating Queries - The Query Window graphical user interface generates SQL queries based on selections from the selection lists provided by the interface. Queries can be executed against local data or data that resides on a remote platform. In the case of DB2, access to local DB2 data or to DB2 data residing on a remote host is accomplished through utilizing features found in other products within the SAS System: SAS/ACCESS and SAS/CONNECT® software. SAS/ACCESS to DB2 provides access to DB2 and SAS/CONNECT enables you to implement client/server applications across platforms. However, when using the Query Window, end users do not need to know anything about these products, because the data provider can set up profiles that

make the SAS/ACCESS and SAS/CONNECT strategies transparent.

The Query Window supports inner joins of multiple tables. Data can be joined manually through the Query Window GUI or data can be joined automatically through predefined join paths established in the profile preference settings.

The Query Window also supports subsetting, computed column expressions, and summary functions. Additionally, group processing and ordering are supported. Queries can also contain prompts so that users can be prompted for column values at run time. Automatic lookups can be provided for easy subsetting.

After you construct your query, you can easily create and save the results of your query to a new SAS table or create a SAS view to that data to use later. If you are linked to a remote session and request to save a SAS data set, you have the option of specifying whether the data will be saved locally or remotely. The generated SQL code can be viewed and queries can be saved for use later in the Query Window or within the SAS System.

Generating Reports - The Query Window produces default SQL output that can be used as a report. To customize the output, the Query Window is fully integrated with the REPORT procedure. The REPORT procedure allows you to design custom reports and save the report template that can be applied against the same (or similar) table or view later. When you save a query, you can save the report definition as well, and it will be associated with the query when you include it later.

In addition to integration with the REPORT procedure, the Query Window is also integrated with the entire SAS System through SAS/ASSIST software. Once your query is generated, you have direct access to the report writing, analytical, decision support, and applications development tools available in SAS/ASSIST.

Customizing through the Profile

The data provider can create and store customized profiles through the Query Window's point-and-click GUI. The customizing of a profile is referred to as setting the preferences. Preference settings can provide both data integrity and security and add to the ease and transparency of an end user's Query Window session.

Some of the Preference settings options include:

- ☐ configuring a remote session to provide transparent access to remote data
- ☐ setting an access mode for the session that defines the data source and any specific options for the access mode's DBMS
- ☐ creating and setting automatic column links for transparent joins
- ☐ creating and setting automatic lookup strategies that ease subsetting
- ☐ restricting access to certain data
- ☐ setting SQL options
- ☐ restricting input rows to query
- ☐ restricting output rows of query
- ☐ password protecting the profile.

Details on Preference settings can be found in SAS Technical Report P-254, *Using the SQL Query Window, Release 6.08*.

QUERY AND REPORTING FROM DB2

Query and Reporting from DB2 is a recent addition to SAS/ASSIST software, beginning with Release 6.08 (fourth maintenance version) for the MVS operating system only. This menu-driven interface is designed specifically for querying and reporting on DB2 data. Like the Query Window, it provides facilities for accessing the data, subsetting, joining multiple tables, creating expressions, and creating new tables or views based on the query results. Q&R contains a higher level of DB2 intelligence, such as indexes and referential integrity. Relations between DB2 tables are used for automatic joins of tables.

Q&R offers its features through a character-based interface that does not require a color monitor or the use of a mouse. This tool is specifically aimed for use on 3270 type terminals.

Who Is the Target Audience?

Query and Reporting from DB2 can be utilized by a wide range of users, from non-technical, occasional end users to experienced data providers. To address the varied skill levels of different users, Q&R can be used in two ways—there are two environments. The first, for end users who do not know SQL, can utilize Q&R through an intelligent interface. This interface is called the Query Window, not to be confused with the tool discussed earlier in this paper. The Query Window in Q&R provides a menu-driven environment for users to compose their query. The second, the SQL Editor, provides users who know SQL an environment to enter and edit SQL statements.

How Does Q&R Incorporate DB2 Intelligence?

An underlying component of Q&R is the Query Manager. The Query Manager stores information about DB2 tables. The information stored in the Query Manager is used to generate intelligent selection lists, provide information on table/column descriptions, indexes, key columns, and relations (referential constraints) between tables. Relations are used for automatic joins of tables. This information is gathered from DB2 system tables and/or additional sources (third-party data dictionaries) and stored in SAS files for fast access. This also serves to insulate the system tables from being queried repeatedly by multiple users.

The Query Manager can be customized for a single user, or several users can access a common Query Manager.

Using the Interface—the Query Window in Q&R

The Query Window in Q&R is a menu-driven interface that generates DB2 SQL queries based on selections from the intelligent selection lists provided by the Query Manager. Queries support automatic and manual joins of tables. In addition to inner joins (the default join method in DB2 SQL, only retrieving matching rows from the contributing tables), the Query Window in Q&R also supports outer joins (left, right, and full) that output matching rows as well as non-matching rows.

The Query Window in Q&R also supports subsetting, expressions, and column functions. Additionally, group processing and ordering are supported. Queries can also contain prompts so that users can be prompted for column values at run time.

The output from queries can be saved as DB2 tables or SAS data sets. The SQL code generated can be viewed and queries can be saved for use later in Q&R.

Using the SQL Editor

The SQL Editor is an interface for the DB2 SQL programmer. You can enter, edit, and submit SQL SELECT statements (also called queries) to DB2. Or, you can submit non-query SQL statements, such as CREATE or GRANT, or DROP, to DB2. The SQL Editor uses the Query Manager to get information on DB2 tables and views. Templates of DB2 SQL code can then be generated by providing a DB2 table or view name.

You can use the SQL Editor to include queries that are generated from the Query Window or queries that are stored in external files. Query results can be saved as DB2 tables or SAS data sets (SAS data files or data views).

Using the Report Window

The Report Window creates various reports based on queries that are generated from the Query Window or the SQL Editor. You can also use SAS data sets as input for the Report Window.

You can switch between different report types including:

- ☐ listings
- ☐ tables
- ☐ bar and pie charts
- ☐ plots
- ☐ dynamic drilldown reports.

Depending on the report type, data are automatically summarized. Further, you can edit reports and graphs interactively by using the REPORT procedure and the SAS/GRAPH® Graphics Editor. Specifications for reports can be saved and re-used in other parts of the SAS System.

In addition, the integration with the REPORT procedure and SAS/GRAPH software, Q&R is also integrated into the entire SAS System through SAS/ASSIST software.

Using the Results Window

The Results Window provides an overview of saved entries (queries, reports, and output). You can search and subset catalog entries based on entry types and names. Search patterns include the use of wildcards.

You have the option of editing or browsing your entries in this environment. Management of entries includes the capability to copy, rename, delete, print, or export to an external file. You can also execute an entry either in foreground or in batch. Entries can be put into a script, which is a "job stream" or sequence of entries to be submitted for processing.

Customizing through the Setup Window

The Setup Window is for the data provider to create user profiles for Q&R. The data provider fills in values in a window to set a profile for one or more users.

Some of the Setup options include:

- ☐ creating the Query Manager
- ☐ batch processing
- ☐ using multiple DB2 subsystem IDs
- ☐ where to store saved queries
- ☐ when to prompt users after number of query output lines.

Note that the Query Manager setup must be done before users can take advantage of most of the Query and Reporting from DB2 capabilities.

COMPARISONS AND CONTRASTS BETWEEN THE SQL QUERY WINDOW AND Q&R FOR QUERYING DB2 DATA

Both the SQL Query Window and Query and Reporting from DB2 query DB2 data. These tools are similar in that they provide interfaces for users of varied skill levels. Both tools provide you the option of either going directly against the system tables or of supplying DB2 table information to SAS data sets. This latter method has been specifically designed for DB2 users under MVS.

Both query facilities provide subsetting, ordering, grouping, summarizing, prompting, and reporting features. Both tools provide the capability to join multiple tables. In the SQL Query Window, automatic joins are defined through the preference settings. Q&R goes a step further by recognizing indexes and automatically joining tables based on information supplied by the Query Manager.

Q&R provides the additional facility for entering and editing SQL statements instead of using a menu-driven interface. This provides the capability to execute any SQL statement, including CREATE, DROP, GRANT, REVOKE, INSERT, UPDATE, DELETE, and EXPLAIN.

A major difference is the interfaces GUI versus character-based. Additional differences include the DB2 intelligence in Q&R, the integrated reporting options, and the client/server options in the SQL Query Window. Also, Q&R is more than a query tool in that it can be used to manage DB2 data since non-select statements can be written and executed in the SQL editor.

Ultimately, the plans are for the SQL Query Window to incorporate all of the DB2 intelligence found in Q&R. Q&R will remain a character-based, MVS mainframe tool.

SAS/ENGLISH SOFTWARE

A third query tool to consider when you need to query DB2 data is SAS/ENGLISH software. SAS/ENGLISH is a natural language query tool. Using this interface, you ask questions of your data using natural language.

How does SAS/ENGLISH work? SAS/ENGLISH software automatically translates your question into SQL commands. Users can find, order, and summarize data by asking simple **who**, **what**, **when**, **where**, **how many**, and **yes/no** questions. To query DB2 data, you would create SAS views to the data. This is different from the SQL Query Window and Q&R in that those two tools go directly against the DB2 data using pass-through SQL.

To understand a question or query, SAS/ENGLISH software uses an information storage facility called the Knowledge Base. The Knowledge Base describes the data in terms of real-world concepts, relationships, and vocabulary.

SUMMARY

If you need to query your DB2 data, you'll want to consider

- ☐ the SQL Query Window for a GUI interface and
- ☐ Query and Reporting from DB2 for 3270-based MVS users.

Both of these tools provide an interface to query your data using SQL. For users who want to write and edit SQL, Q&R also

provides an SQL editor for entering and editing SELECT and non-SELECT statements.

Querying can be made easier for end users by setting up profiles in the SQL Query Window or by using the Query Manager in Q&R. By using these query tools, the result is productivity. End users are able to do their own data extraction and reporting.

In addition to the functionality of these two tools, you also have the power of the SAS System available. If you need to query additional data sources, other than DB2, take advantage of the SQL Query Window. If you need to do additional reporting or analysis, you'll want to explore the myriad of options available.

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