DB2 Query Management Facility
Version 10 Release 1

Introducing DB2 QMF

GC19-2885-04

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Note!
Before using this information and the product it supports, be sure to read the general information under Appendix C, "Notices," on page 63.

| This edition applies to Version 10 Release 1 of IBM DB2 Query Management Facility (QMF) Classic Edition and
| Enterprise Edition, which are features of both IBM DB2 10 for z/OS (5605-DB2) and IBM DB2 Version 9.1 for z/OS
| (5635-DB2). This information also applies to Version 10 Release 1 of IBM DB2 QMF Classic Edition Value Unit
| Edition (VUE) and IBM DB2 QMF Enterprise Edition Value Unit Edition (VUE). QMF Classic Edition VUE is a
| feature of DB2 10 for z/OS Value Unit Edition (5697-P31) and QMF Enterprise Edition VUE is a feature of both DB2
| 10 for z/OS Value Unit Edition (5697-P31) and DB2 Version 9.1 for z/OS Value Unit Edition (5697-P12).

This information applies to all subsequent releases and modifications until otherwise indicated in new editions.

| This edition replaces GC19-2885-03.

Contents

About this information

DB2 Query Management Facility™ is a family of tightly integrated, powerful, and reliable tools that help you access relational or multidimensional data in the IBM® DB2® product family and beyond.

These topics are designed to help both administrators and end users with:

- Understanding new features of products in the QMF™ family
- Understanding, at a high level, how each product in the QMF family works
- Understanding the features offered in each of the different QMF editions

Service updates and support information

To find service updates and support information, including software fix packs, PTFs, Frequently Asked Questions (FAQs), technical notes, troubleshooting information, and downloads, refer to the following Web page:

http://www.ibm.com/software/data/qmf/support.html

Highlighting conventions

This information uses the following highlighting conventions:

- **Boldface** type indicates commands or user interface controls such as names of fields, folders, icons, or menu choices.
- `Monospace` type indicates examples of text that you enter exactly as shown.
- *Italic* indicates the titles of other publications or emphasis on significant terms. It is also used to indicate variables that you should replace with a value.

How to look up message explanations

You can use any of the following methods to search for messages and codes.

Searching an information center

In the search box that is located in the top left toolbar of any Eclipse help system, such as the IBM Information Management Software for z/OS® Solutions Information Center, enter the number of the message that you want to locate. For example, you can enter `DFS1065A` in the search field.

Use the following tips to help you improve your message searches:

- You can search for information on codes by entering the code; for example, enter -327.
- Enter the complete or partial message number. You can use wild cards in the message number to broaden your search; use * to represent multiple characters and use ? to represent any single character. For example:
  - The search string `DFS20?I` returns any messages that begin with the string DFS20, followed by any single character, followed by I.
  - The search string `DFS20??I` returns any messages that begin with the string DFS20, followed by any two characters, followed by I.

– The search string `DFS20*I` returns any messages that begin with the string DFS20, followed by any number and type of characters, followed by I.

The information center contains the latest message information for all of the information management products that are included in the information center.

Using a Web search engine

You can use any of the popular search engines that are available on the Web to search for message explanations. When you type the specific message number or code into the search engine, you will be presented with links to the message information in IBM information centers.

Using LookAt

LookAt is an online facility that you can use to look up explanations for most of the IBM messages you encounter, as well as for some system abends and codes. Using LookAt to find information is faster than a conventional search because in most cases LookAt goes directly to the message explanation.

You can use LookAt from the following locations to find IBM message explanations for z/OS elements and features, z/VM®, VSE/ESA, and Clusters for AIX® and Linux:

- The Internet. You can access IBM message explanations directly from the LookAt Web site at http://www.ibm.com/eserver/zseries/zos/bkserv/lookat/.
- Your z/OS TSO/e host system. You can install code on your z/OS or z/OS.e systems to access IBM message explanations, using LookAt from a TSO/e command line (for example, a TSO/e prompt, ISPF, or z/OS UNIX System Services running OMVS).
- Your Microsoft Windows workstation. You can install code to access IBM message explanations on the z/OS Collection (SK3T-4271) using LookAt from a Microsoft Windows command prompt (also known as the DOS command line).
- Your wireless handheld device. You can use the LookAt Mobile Edition with a handheld device that has wireless access and an Internet browser (for example, Internet Explorer for Pocket PCs, Blazer, or Eudora for Palm OS, or Opera for Linux handheld devices). Link to the LookAt Mobile Edition from the LookAt Web site.

You can obtain code to install LookAt on your host system or Microsoft Windows workstation from a disk on your z/OS Collection (SK3T-4271) or from the LookAt Web site (click **Download** and select the platform, release, collection, and location that suit your needs). More information is available in the LOOKAT.ME files available during the download process.

How to send your comments

Your feedback is important in helping to provide the most accurate and high-quality information. If you have any comments about this book or any other QMF documentation, use either of the following options:

- Use the online reader comment form, which is located at:
  www.ibm.com/software/data/rcf/
- Send your comments by e-mail to comments@us.ibm.com. Be sure to include the name of the book, the part number of the book, the version of QMF, and, if applicable, the specific location of the text you are commenting on (for example, a page number or table number).

Chapter 1. QMF at a glance

One of your most important assets is the operational data that forms the backbone of your business. Although many people at different organizational levels need access to this data, they might have different security levels, varying requirements for using the data, and a wide range of data processing skill levels. The difference between hindsight and insight can often mean being able to quickly isolate and interpret the data that drives your business decisions.

DB2 Query Management Facility is a family of business intelligence tools that helps you transform business data on demand into a visual information platform that supports and encourages business growth by getting the right data to the right users at the right time in a format tailored to their precise operational needs.

The following topics provide an overview of QMF:

Overview of QMF features

The QMF solution offers a robust set of business intelligence functions, including:

Relational and multidimensional queries
Creation of both relational and OLAP queries is facilitated by a variety of different query interfaces that are tailored to different skill and knowledge levels. Multidimensional analysis capabilities allow you to drill down through an unlimited number of levels of detail, exposing underlying information with each click.

For more information, see Chapter 2, "Query functions," on page 15.

Reports, charts, graphs, and maps
QMF offers an extremely flexible design environment for reports, allowing you to group, aggregate, and summarize data, add calculation expressions, and conditionally format the report depending on the query results. Dozens of visual elements can be embedded in reports by simply dragging the elements onto the report canvas, allowing you to create reports that are rich with graphical content, including charts, graphs, and maps. You can also save report formats as templates, applying them to different sets of query results to maximize reuse.

For more information, see "Reporting features" on page 21.

Dashboards
Dashboards provide a dynamic means of reviewing critical enterprise data. Unlike reports, which tend to contain a fixed amount of information, dashboards have the ability to deliver real-time information on demand, as needed by the dashboard user. QMF provides built-in methods of displaying query results, capturing user input, passing information to and from the dashboard, implementing and streamlining navigation, defining relationships between visual elements, and pointing to underlying data sources.

For more information, see "Dashboard capabilities" on page 26.

Analytical functions

QMF offers over 140 analytical functions, providing the repertoire of capabilities that you need to allow users with divergent needs to analyze trends and obtain summary-level information.

For more information, see "Analytical functions" on page 28.

Data editing capabilities

QMF provides built-in table editing capabilities that allow you to intuitively add, delete, and change entire rows or individual cells within a table.

For more information, see Chapter 4, "Data editing capabilities," on page 31.

Application development interfaces

QMF offers a variety of application interfaces to allow you to seamlessly integrate QMF functions with either new or existing applications. You can also create, edit, and run sophisticated procedures to carry out a variety of tasks.

For more information, see Chapter 5, "Application development interfaces," on page 33.

Performance, resource control, and auditing functions

QMF provides governing capabilities that allow you to set resource consumption limits by user or group, which allows role-based versus individual restrictions to be created. Activity logs provide built-in usage auditing capabilities, including several ready-to-use reports, so that you have a snapshot of each user's system activity at any given time.

For more information, see Chapter 6, "Performance and resource control," on page 37.

Multiplatform access to data

You can configure QMF access to a wide variety of data sources, allowing you to create a unified business intelligence solution for your organization no matter how disparate your data sources may be. Additionally, after you create queries, reports, and dashboards, these objects can be deployed on virtually any platform.

For more information, see Chapter 7, "Portability and multiplatform access," on page 41.

Ease of use and administration

The cost and complexity of implementing business intelligence solutions often results in a one-size-fits-all design for reports, dashboards, and other content. QMF stands out in the business intelligence market because it allows you to precisely tailor these objects to the operational needs as well as the security privileges of specific individuals or groups across your enterprise. Built-in wizards and other user assistance make QMF easy to learn and use, while drag-and-drop operations simplify the creation of objects.

For more information, see Chapter 8, "Ease of use and administration," on page 45.

Multilingual capabilities

QMF supports many national languages, speeding deployment of your content and giving your business a global edge.

For more information, see Chapter 9, "National language support," on page 53.

QMF is cost-effective because it is not priced per user. This pricing structure allows you to deploy content to as many users as you want at no additional cost, thus reducing your total cost of ownership.

Products in the QMF family

The QMF product family consists of the following products:

- DB2 QMF for TSO and CICS®
- DB2 QMF High Performance Option
- DB2 QMF for Workstation
- DB2 QMF for WebSphere®

There are three QMF editions from which to choose:

DB2 QMF Enterprise Edition
This edition enables enterprise-wide access to business information across end-user and database platforms. It consists of the entire QMF family of products. This edition is offered for a monthly license fee.

DB2 QMF Classic Edition
This edition supports end users who work entirely from traditional mainframe terminals and emulators to access databases in the IBM DB2 family. It consists of DB2 QMF for TSO and CICS only. This edition is offered for a monthly license fee.

DB2 QMF Enterprise Edition Value Unit Edition
This edition offers the entire family of QMF products at a one-time charge price. This edition must be must be installed on a z/OS system that is running in a logical partition (LPAR) that qualifies for the System z® New Application License Charges pricing program, known as zNALC. For more information about zNALC and qualified applications, see the following web page:

http://www.ibm.com/systems/z/resources/swprice/mlc/znalc.html

DB2 QMF Classic Edition Value Unit Edition
This edition offers DB2 QMF for TSO and CICS at a one-time charge price. This edition must be must be installed on a z/OS system that is running in a logical partition (LPAR) that qualifies for the System z New Application License Charges pricing program, known as zNALC. For more information about zNALC and qualified applications, see the following web page:

http://www.ibm.com/systems/z/resources/swprice/mlc/znalc.html

DB2 QMF for TSO and CICS

QMF for TSO and CICS provides powerful data access, manipulation, presentation, and application development functions that scale to many different database knowledge levels and can be customized in many ways to meet specific business needs. QMF for TSO and CICS is tightly integrated with the z/OS system architecture, which provides a fluid yet secure environment whereby applications, data, and business processes have access to existing resources managed with great flexibility, higher levels of utilization, and lower overall costs.

Customers running DB2 QMF for TSO and CICS are well positioned to deal with the exponential explosion of data, with the capability to sense and respond to market shifts and changing demands as they occur.

DB2 QMF High Performance Option for TSO and CICS

QMF High Performance Option is a multifaceted tool that helps database administrators manage QMF objects and performance in the TSO and CICS environments. DB2 QMF HPO consists of two major components:

- QMF HPO/Manager

  Using QMF HPO/Manager, you can govern (pre-emptively and in real time) ad-hoc and dynamic query and reporting activities. With easily collected, detailed information, you can more precisely control CPU resource usage at varying levels, according to any number of schedules applied to QMF user groups.
- QMF HPO/Compiler

  Using QMF HPO/Compiler, you can track and identify heavily used queries and reports and then automatically convert them into efficient COBOL programs. Most query and reporting jobs can be greatly streamlined to reduce resource consumption and improve performance.

DB2 QMF for Workstation

QMF for Workstation is a desktop application that provides an environment within which business intelligence objects such as queries, reports, and dashboards can be created, managed, and used. QMF for Workstation extends QMF functionality to the Windows, Linux, and Macintosh operating systems.

QMF for Workstation offers multiple interfaces that help you build relational and multidimensional queries according to your level of SQL expertise. When query result data is returned, an assortment of intuitive editors can help you analyze, aggregate, and format the query results. You can also create and easily distribute content that can vary in format from classic page-based reports to more visually rich and interactive formats such as executive dashboards.

QMF for Workstation's administrative features make it easy to configure connectivity to data sources and protect resource consumption on a per-user and per-group basis.

DB2 QMF for WebSphere

DB2 QMF for WebSphere is the DB2 QMF family’s browser-based portal to business information on-demand. As a Web application, QMF for WebSphere provides a substantial subset of the QMF for Workstation query and reporting capabilities using a pure HTML, thin-client deployment model.

QMF for WebSphere makes it easy to provide the most frequently used QMF query and reporting capabilities to a large number of users quickly and easily. The thin-client model eliminates the need to install or maintain any additional software on multiple user machines. You can access QMF for WebSphere from any machine that has a Web browser. Support is provided for a variety of Web browsers across a number of platforms.

QMF for Workstation versus QMF for WebSphere

QMF includes a rich client (QMF for Workstation) and a thin client (QMF for WebSphere) component.

The component you use depends on business and technical requirements specific to your situation. While all administrative functions (and a lot of the user functions) available in QMF for Workstation are also available in QMF for WebSphere, there are some noteworthy differences.

The following list highlights functionality available in QMF for Workstation only. **Note**: Most of these functions provide users the capability to design more robust reporting and dashboard solutions and enhance product usability.

Enhanced visual design capabilities
QMF for Workstation includes a visual designer for both reports and dashboards. With little or no coding experience, users can employ the visual designer to enhance the appearance and usability of reports and dashboards. Users can graphically place charts, selectors, and controls on a report canvas or dashboard design editor. Users can embed static content such as text, graphics, hyperlinks, and supporting information (data-driven or static). These elements can also be embedded in traditional tabular reports or interactive dashboards.

Accessibility conformance
QMF for Workstation conforms to accessibility standards and guidelines, including robust support for keyboard shortcuts.

Bidirectional data transformation
QMF for Workstation supports bidirectional (BIDI) data transformation. BIDI refers to supporting data processing of text in two directions, right-to-left (RTL) and left-to-right (LTR). By including BIDI support, QMF for Workstation is able to correctly display bidirectional text.

Use of the host operating system scheduler
QMF for Workstation includes support for using the host operating system's scheduler, in addition to the scheduler provided with the product. This allows for additional flexibility when scheduling tasks such as generating and distributing managed reports. With QMF for WebSphere, users are not able to use the host operating system scheduler. QMF for WebSphere users must use the scheduler that is included with the product.

Enhanced drill-down editing capabilities
QMF for Workstation provides enhanced capabilities, such as zoom editing and column dragging. The zoom editing presents the user with the capability to zoom in for a more detailed view of data on a scene or on a data point in a layout.

Customizable perspectives and views
QMF for Workstation provides the capability to customize workbench views. Users can move views around within the workbench, docking them in different locations to suit their preferences.

Additionally, QMF for Workstation users can customize the workbench by adding and removing views from the various perspectives. This allows users to establish standardized views and perspectives that suit their design needs.

Document editing capabilities
QMF for Workstation provides the capability to edit data in documents. For example, users can set font size and style as well as add color to text in documents.

Support for REXX programming language
QMF for Workstation supports the REXX programming language, so

advanced "power users" can develop and implement scripts that address complex and repetitive tasks and functions.

Targeted printing capabilities
QMF for Workstation supports targeted printing. Using QMF for Workstation, users can print a single document of interest. For example, users can perform a File > Print operation on a specific report or query result and get the output for that single piece of data.

Table editing support in the data analysis grid
QMF for Workstation provides table editor support in the data analysis in grid. This support is not provided in QMF for WebSphere.

Seamless procedure-run EXPORT command
QMF for Workstation provides seamless support for procedure-run EXPORT commands. Users can run procedures to export data in various formats directly to their machines. QMF for WebSphere users can also use procedures to run EXPORT commands, but the process requires the user to download and save data through a download wizard.

What's new in Version 10 Release 1

The QMF family brings you even more business intelligence functionality in Version 10 Release 1, while at the same time providing improvements on traditional features and functions, to bring you even better value. New improvements in QMF for Workstation and QMF for WebSphere allow you to reach a larger business audience than ever before, while QMF on the TSO and CICS platforms continues to provide robust features and functions. Continued interoperability between the host and distributed platforms through the use of the QMF object catalog allows you to repurpose legacy objects, such as queries and procedures, for users with little or no data processing knowledge.

See one of the following topics for more information about Version 10.1 enhancements:

- "Enhancements to DB2 QMF for Workstation and DB2 QMF for WebSphere"
- "Enhancements to QMF for TSO and CICS" on page 10
- "Enhancements to QMF High Performance Option" on page 13

Enhancements to DB2 QMF for Workstation and DB2 QMF for WebSphere

QMF for Workstation and QMF for WebSphere Version 10 allow you to do more with your existing QMF investment than ever before. Built-in data visualizations and graphical page-based reports extend QMF usage from the traditional technical user to a broader community of business end users. A new metadata layer simplifies the underlying data model, empowering non-technical users with self-service reporting capability, and extends access to DB2 for z/OS across the enterprise.

This topic explains each enhancement.

Forecasting capabilities

QMF includes a new forecasting capability. You can use forecasts to help predict future values based on historical results. Forecasting helps you better prepare for changes in economic or competitive conditions by incorporating an analysis of time series historical data.

Visual queries
QMF includes the capability to construct visual queries using Structured Query Language (SQL) statements.

Analytical query capabilities
QMF supports analytical queries. With analytical queries you can combine data from multiple queries (from the same or differing data sources) into one result set. You can add multiple queries and tables to the analytical query tree structure, generating a comprehensive result set that encompasses data from many different sources.

Repository caching
QMF supports repository caching. With repository caching configured, the system saves the content of the repository (dashboards, visual applications, queries, visual reports, and so on) to the memory on the workstation client or on the web server (if you are using QMF for WebSphere). Subsequently, the next time you access the repository objects, information is retrieved from memory (without sending a request to the repository), thereby reducing the retrieval time.

Drill-down paths
QMF includes drill-down path functionality. With drill-down paths you can "drill down" or navigate to several different levels of query results. Each level is represented by a different display mode chart, and each display mode chart can be fully customized.

New preference for configuring 24-hour date and time rollover conversion
QMF includes a new preference setting that allows the user to specify whether to allow Java to convert and express 24-hour rollover time as the next day in result sets and visual projects.

Prompt hierarchies
QMF now includes a new type of object called a *prompt hierarchy*. Prompt hierarchies are a unique type of QMF object that are stored independent of a given query. This allows them to be used by multiple query objects. A prompt hierarchy can present a hierarchy of values, with unlimited levels of detail.

Additional support for Google Maps
QMF now supports GoogleMapPolyline, GoogleMapPolygon, and GoogleMapObject object types.

Active directory single sign-on support
QMF now supports Active Directory (AD) single sign-on. Single sign-on is a characteristic of access control that uses centralized authentication servers for determining whether a user's sign-on can be used to access multiple applications and systems.

Support for DB2 temporal data in the query diagram and prompted query views
QMF now supports DB2 temporal data management technology in it's query diagram and prompted query views.

A new **Time Period** button has been added to the Prompted Query and Diagram Query editors. Users can use the button to add a "FOR" specification to a query to support tables that have been configured for temporal data.

New QMF Classic perspective and support for RUNTSO command

The QMF Classic perspective provides an interface that is very similar to the QMF TSO/CICS interface. Because the interfaces are so similar, QMF for TSO and CICS users will have little difficulty applying their skills in the QMF for Workstation environment.

Users can also now issue the RUNTSO command to invoke QMF for TSO as a DB2 for z/OS stored procedure. The procedure name is Q.DSQQMFSP. Upon invocation, users pass the name of a query or procedure to run on QMF for TSO. Output returns to the workstation in a result set. Up to 21 result sets can be specified for a QMF procedure.

Automatic generation of dashboard and report URLs

A new Web Link wizard has been added for creating web links to QMF objects that can be opened directly in web browsers.

Additional reformatting capability for SQL queries

A new capability has been added for specifying any integer between 10 and 1000 for the line width of SQL queries. QMF uses hardcoded line width of 79 characters. This enhancement enables users to circumvent the way QMF reformats a query's text.

Enhanced refresh capabilities for data-driven components

A new event action has been added for refreshing a component in a visual dashboard by invalidating a query cache. This event action reruns the query and the results are displayed in the refreshed component.

New Launch LOB event action

A new capability has been added for opening LOB data from an object of a visual dashboard. The new Launch LOB event action allows you to select an object of a visual dashboard based on the table containing LOB data and display this data. This action can be applied only to the objects that are contained in the data template.

JavaScript API support for visual dashboards embedded in a web page

A new JavaScript function has been added that allows users to set dashboard global parameters when a dashboard is open in HTML IFRAME via the GetObject command.

New global variable (DSQEC_RUN_MQ)

A new global variable named DSQEC_RUN_MQ has been added to control the manner by which statements in a multi-statement query are run.

New global variable (DSQAO_HOME_WORKSPACE)

A new global variable named DSQAO_HOME_WORKSPACE has been added. This new global variable contains the key to the user's home workspace if it exists.

Support for launching a QMF batch job from the environment

For details about this enhancement, see *Installing and Managing DB2 QMF for TSO and CICS*.

Dashboard capabilities

QMF Version 10.1 offers support for graphical dashboards, allowing users to rapidly create and deploy interactive reports that present the results of QMF

queries using visually intuitive graphs, layouts, grids, and tables. For more information, see "Dashboard capabilities" on page 26.

Enhanced graphical capabilities

Several graphical enhancements have been added, including:

- Dozens of new charts and visual elements for use within QMF reports
- Support for geospatial presentation within reports and dashboards

  QMF supports data in the widely recognized Open GIS format. In addition, QMF dashboards support embedded Google maps.
- Ability to deploy visual reports and interactive dashboards in PDF, pure HTML, or Flash formats in both QMF for Workstation and QMF for WebSphere
- Ability to embed queries, reports, or dashboards within third-party Web pages, Web applications, or custom-developed Web-based solutions

  When embedded, users see only the content, allowing it to be integrated with no trace of the QMF user interface.

For more information about visual design capabilities, see Chapter 3, "Reports, dashboards, and analytics," on page 21.

Broader support for analytical functions

QMF graphical reports, charts, maps, graphs, and dashboards now support over 140 functions, covering data manipulation, analytics, statistics, geospatial, and general mathematical operations. For more information on data analysis capabilities, see "Analytical functions" on page 28.

Enhanced security

Several security enhancements have been added, including:

- Optional repository-based security, which permits administrators to secure repository content using an LDAP-defined or internally-defined user or group directory
- The ability for administrators to optionally secure repository objects using the database account of a given user

  For example, if you create an object, you can assign permissions that limit others from viewing, opening, editing, running, or deleting your objects. Database administrators retain full control of all objects.
- Ability for administrators and users to limit access and usage of objects on a per-user or per-group basis

  This feature extends across the entire array of QMF objects, from workspaces to individual data series on a given report or dashboard.

Ability to associate different locations with the same logical data source

QMF now includes the ability to define environments that automatically redirect users to specific data sources appropriate to their operations. For example, consider an organization that uses DB2 for z/OS for transactional data and Informix® for inventory information. Each region of the company uses distinct DB2 subsystems and Informix databases for its area. The company can now define environments for each region and set the location of the unique databases in each environment. Once set, all regions can share the same set of queries, reports, and dashboards, and all are automatically routed to draw data from the databases defined in their individual operational environments.

Ability to define entity relationship diagrams

QMF administrators can now define entity relationship diagrams (ERDs) for each relational data source that will be accessed by QMF users. These diagrams allow you to graphically indicate the various connections that may exist between distinct tables and views in your databases. By defining ERDs in QMF, you make it much easier for end users to create their own ad-hoc queries. Users can simply select from the available ERDs, choose columns of interest, and add aggregation and filtering functions as needed. An unlimited number of ERDs can be defined and organized under an arbitrary folder taxonomy.

Support for exporting data in Microsoft Excel format

QMF Version 10.1 offers the capability to export data in the XLS file format.

Enhancements to QMF for TSO and CICS

QMF for TSO and CICS Version 10.1 offers the following features and improvements:

Stored procedure interface to QMF for TSO

A new interface allows you to start QMF for TSO as a DB2 for z/OS stored procedure. With this new feature, any software program that can call a DB2 for z/OS stored procedure can now start QMF for TSO and receive report output back in up to 20 result sets. For more information about this interface, see "Stored procedure interface to QMF for TSO" on page 33.

Query enhancements

Query enhancements include:

- Support for multiple SQL statements in a single SQL query

  Each SQL query can now contain multiple statements that involve database maintenance, such as UPDATE, INSERT, ALTER, CREATE, DROP, EXPLAIN, and others. Statements that return results, such as SELECT or CALL, remain limited to one per SQL query, as does the CREATE PROCEDURE statement.

  A new global variable, DSQEC_RUN_MQ, allows you to set whether multiple SQL statements will be allowed. When multiple statements are allowed, all of the statements in the query are issued as a single unit of work. If one statement in the query fails, database changes made by statements prior to the failing statement are rolled back and subsequent statements are not run. Some statements, such as SET, apply to aspects of the QMF session and therefore are not rolled back in the case of a failure.

  Substitution variable values and responses to confirmation prompts apply to all SQL statements in the query.

- Support for running QMF SQL queries over 32 KB long

  The maximum size of an SQL query that can be run by the RUN QUERY command has been increased to 2 MB for SQL queries directed to DB2 for z/OS and 65 KB for SQL queries directed to DB2 for iSeries® or DB2 for Linux, UNIX, and Windows. You can activate this feature by setting the DSQEC_SQLQRYSZ_2M global variable. SQL queries directed to DB2 for VM and VSE remain limited to 8 KB.

  QMF continues to support a query size of 32 KB for prompted and QBE queries, unless the database to which the RUN QUERY command is directed does not support SQL statements of this size.

Improved report performance and resource control

Report performance and resource control enhancements include:

- 64-bit virtual storage area for spill data in QMF for TSO

A new 64-bit virtual storage area handles QMF for TSO data that is no longer needed in active storage. This new storage area precludes the need to allocate a spill file in TSO and enables broader support for data types that require larger amounts of storage, such as XML.

A new TSO program parameter, DSQSPTYP, activates this support; a new global variable, DSQEC_EXTND_STG, allows you to specify the amount of extended storage for QMF to acquire.

- Increased maximum length for data rows in QMF reports

  Prior releases of QMF for TSO and CICS had a 32 KB limit on the length of a single data row returned in a QMF report. A new global variable, DSQEC_TWO_GB_ROW, allows you to set support for row lengths up to 2 GB, with the following restrictions:

  – You cannot create a table with a maximum record size that is greater than the page size. DB2 stores records within pages that are 4 KB, 8 KB, 16 KB, or 32 KB in size. Thus, if you are retrieving data from one table only, the row length is still limited to 32 KB.
  – When a table contains a column with LOB data, the data in the LOB column is truncated at 32 KB in query results as well as during display and print operations. The row containing the LOB data can still be up to 2 GB long, however.

  The maximum row length remains at 32 KB when you export or import data in QMF, IXF, or HTML format. However, you can use XML format to export or import character data; this format supports record lengths of up to 2 GB.

- Independent governing of database activity generated by user commands

  The QMF packages have been restructured so that modules that handle database activity driven by end-user commands are now separate from modules that handle database activity driven by SQL internal to QMF. This new structure allows you to isolate the following groups of QMF commands for individual governing by the DB2 resource limit facility:

  – RUN QUERY (SELECT queries of any type), DISPLAY TABLE (when the CONFIRM option is YES), EXPORT TABLE, PRINT TABLE, BOTTOM, TOP, FORWARD, BACKWARD, RIGHT, and LEFT
  – SAVE DATA and IMPORT TABLE
  – RUN QUERY (when the query includes INSERT, UPDATE, or DELETE statements)
  – EDIT TABLE (Add mode)
  – EDIT TABLE (Change mode when the SAVE parameter has been set to IMMEDIATE)
  – EDIT TABLE (Change mode when the SAVE parameter has been set to END)
  – ERASE

- Ability to set concurrent access resolution options from within QMF

  This enhancement adds the DSQEC_CON_ACC_RES global variable, which allows you to specify how QMF should resolve locks on data that it is attempting to access. Values for the new DB2 Version 10 bind option, CONCURRENTACCESSRESOLUTION, are supported through this global variable, as is the existing SKIP LOCKED DATA option.

Enhancements to QMF commands and support of SQL statements

Enhancements to QMF commands and support of SQL statements include:

- Optional confirmation prompting with the DISPLAY TABLE command

QMF now provides a CONFIRM parameter for the DISPLAY TABLE command. When CONFIRM is set to YES and the estimated resource to complete the command exceeds the allocated resource defined in the DB2 resource limit facility, QMF displays a panel prompting the user to decide whether to cancel the command.

- Support for implicit casting on the SAVE and IMPORT commands

  If the database to which the SAVE or IMPORT command is directed offers support for implicit casting, QMF no longer requires that the columns in the data to be saved or imported have the same data types and lengths as the columns in the existing table that is being replaced or appended.

- Optional default for the OWNER parameter of the QMF LIST command

  This enhancement adds a new global variable, DSQEC_LIST_OWNER. This variable allows you to specify a default database authorization ID for the OWNER parameter of the LIST command, eliminating the need to specify this parameter each time the command is issued. You can set the variable to any valid database authorization ID, or specify ALL to list all objects that you are allowed to access, regardless of owner. If no value is specified for the variable, the OWNER parameter defaults to the current database authorization ID, as in prior QMF releases.

- Ability to restrict which commands cause the Last Used timestamp on an object to be updated

  In previous releases, the timestamp in the LAST_USED column of the Q.OBJECT_DIRECTORY table in the QMF catalog was updated whenever an object was referenced by any of the following commands:
  - CONVERT
  - DISPLAY
  - EXPORT
  - IMPORT
  - LAYOUT
  - PRINT
  - RUN
  - SAVE

  This timestamp is displayed in the Last Used field on QMF database object lists that are generated by the LIST command. This feature provides a new global variable, DSQEC_LAST_RUN, which allows you to default to the timestamp behavior of prior releases or restrict the timestamp to updates by RUN, SAVE, and IMPORT commands only.

- More parameters on SQL CALL statements

  This enhancement increases the number of parameters that QMF allows on an SQL CALL statement from 32 to 63.

- Additional support for DB2 special registers

  This enhancement allows you to use the SET statement in a QMF SQL query to set the CURRENT SCHEMA and CURRENT REFRESH AGE special registers in DB2 for z/OS.

Broader support for data types

Enhancements to QMF's support for DB2 data types include:

- Increased support for XML data

  Rows that contain XML data can now be up to 2 GB. This new limit is also supported when you import or export data in XML format.

- Broadened support for decimal floating-point data

QMF has been enhanced to provide full support for the decimal floating-point (DECFLOAT) data type, provided that the processor on which QMF is running supports decimal floating-point instructions. QMF supports the long and extended formats of the DECFLOAT data type. If the processor on which QMF is running does not support decimal floating-point instructions, the edit code used for the data defaults to M and metadata is displayed in the report. For example, `DECFLOAT(16)` is displayed in place of long-format values and `DECFLOAT(34)` is displayed in place of extended-format values.

- Support for increased precision for the TIMESTAMP data type

  This enhancement supports greater precision allowed by DB2 for z/OS Version 10 for the TIMESTAMP data type. The number of digits representing fractional seconds can now be from 0 to 12.

- Support for the new TIMESTAMP WITH TIME ZONE data type

  This enhancement provides QMF support for the new DB2 Version 10 data type TIMESTAMP WITH TIME ZONE. This new data type extends the TIMESTAMP data type to include the time zone information. The time zone is the time difference, in hours and minutes, between the local time and Coordinated Universal Time (UTC), formerly known as Greenwich Mean Time (GMT).

Improvements in QMF forms

This enhancement provides a new global variable, DSQDC_COL_LABELS, which controls whether the column heading shown in QMF forms defaults to the database label assigned to the column or the name of the column in the table from which it was selected. Database labels are used by default.

Improved diagnostic capabilities

Additional information is now provided for QMF errors associated with SQL codes issued by the database manager. For these errors:

- The SQL Communications Area (SQLCA) is now displayed at the end of the QMF message help panel that describes the error.
- A new global variable, DSQDC_POS_SQLCODE, allows you to set notification of positive SQL codes at varying levels of detail.

For additional detail on any of these enhancements, see the appropriate information in the QMF Version 10 library.

Enhancements to QMF High Performance Option

Version 10.1 of the DB2 QMF High Performance Option for TSO and CICS:

- Fully supports query enhancements available in QMF for TSO and CICS Version 10.1

  You can use QMF HPO to work with queries that are up to 2 MB in length as well as queries that contain multiple SQL statements.

- Provides an option to save the complete text of SQL queries

  QMF HPO Version 9 allowed you to save up to 3 KB of the SQL query text to the activity log. A new configuration option allows you to set whether you want to save the complete text of the query or truncate the text at a particular length. Query text that has been saved in the activity log can be displayed from the HPO Object Manager. This enhancement also applies to HPO Monitor, which saves the text in an independent VSAM file.

Chapter 2. Query functions

Depending on your QMF environment, QMF offers a number of different query methods to help you access and manipulate the data you need. This topic describes these methods.

When the query results are returned, you can format the data into reports, charts, graphs, maps, or dashboards. See Chapter 3, “Reports, dashboards, and analytics,” on page 21 for more information.

Choose one of the following subtopics for more information:

Relational queries

QMF offers different query methods depending on the user's level of SQL knowledge.

The query diagram designer in QMF for Workstation allows users to develop complex queries graphically, eliminating the need to write SQL. Users simply drag and drop database tables (real or virtual) and wire columns together to form joins between them, as shown in the figure below.

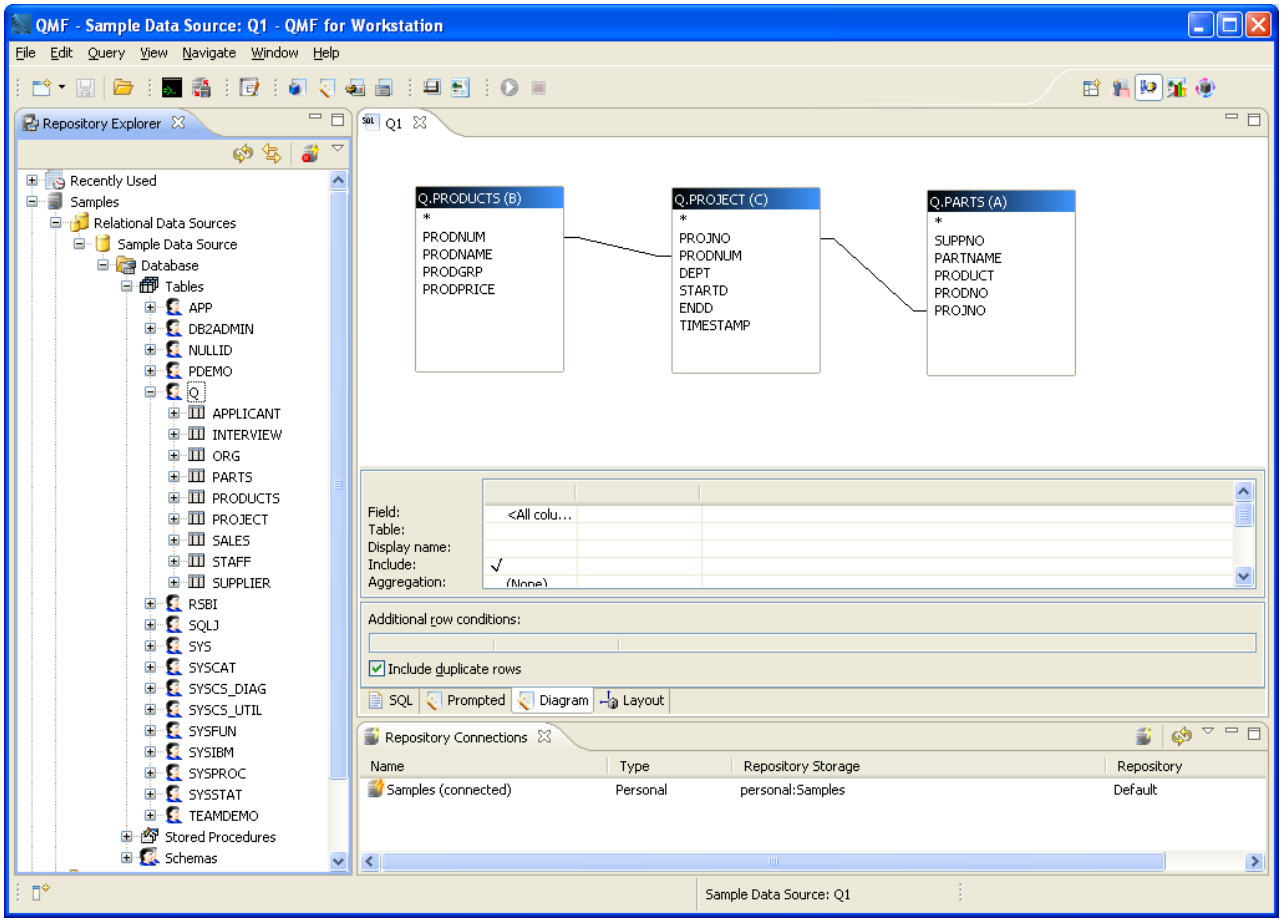


Figure 1. The query diagram designer in QMF for Workstation

Columns for display can be selected by double-clicking table fields; the companion column detail area allows users to select aggregations and ordering options, as well as row filters. Users can display the automatically-generated SQL at any time and move between the diagram, SQL, and prompted query views, or develop the query using all three types of views.

Prompted queries

Prompted Query is an easy-to-use query method available in all QMF environments. The Prompted Query dialog prompts you for the necessary information to build a query. Prompted Query is designed for the beginner and occasional QMF user who wants to build a query but does not know SQL. QMF guides you through the steps and checks to ensure that the statement you build is valid.

The layout of the panels, dialogs, and pages that request the information for a prompted query is similar in QMF for TSO/CICS and QMF for Workstation/WebSphere. Once you become familiar with one interface, you can use another without wasting time learning a new method.

Figure 2 on page 17 shows a sample prompted query in QMF for Workstation. To see SQL statements that are equivalent to the prompted query in QMF for Workstation and WebSphere, simply click the SQL tab at the bottom of the interface window. Being able to see the SQL as it is generated can help users learn

SQL.

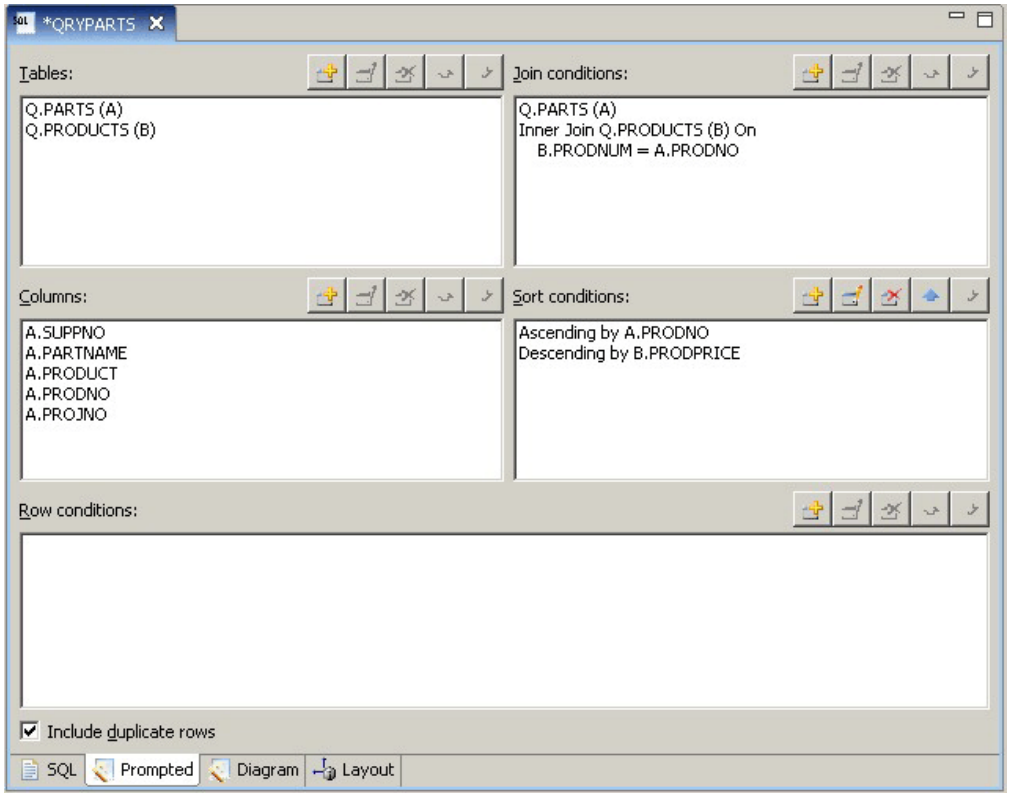


Figure 2. Sample prompted query in QMF for Workstation

Figure 3 shows a partially completed prompted query in QMF for TSO and CICS. To see the equivalent SQL statements, you can use the SHOW SQL command or function key after the prompted query is built.

```
PROMPTED QUERY                                  MODIFIED  LINE    1

  Tables:                        +-----------------------------------------+
    Q.STAFF                      |              Row Conditions             |
                                 |                                         |
  Columns:                       | Begin a condition by selecting one column, |
    NAME                         | or by entering an expression or function. |
    DEPT                         |                                1 to 8 of 8 |
    JOB                          |   *  Q.STAFF                            |
    SALARY                       |   2.   ID                               |
    COMM                         |   3.   NAME                             |
                                 |   4.   DEPT                             |
  Row Conditions:                |   5.   JOB                              |
  > If...                        |   6.   YEARS                            |
                                 |   7.   SALARY                           |
  *** END ***                    |   8.   COMM                             |
                                 |                                         |
                                 |   Expression (A+B, and so forth)...     |
                                 +-----------------------------------------+
                                 | F1=Help  F5=Describe  F7=Backward       |
                                 | F8=Forward  F12=Cancel                  |
                                 +-----------------------------------------+
```

Figure 3. Sample prompted query in QMF for TSO and CICS

Not only can you see the generated SQL, you can also modify it if necessary. In QMF for Workstation and QMF for WebSphere, you always have live access to the

SQL statements by clicking the SQL tab. In QMF for TSO and CICS, you can convert the query to SQL using the CONVERT command and then continue to modify the SQL if necessary.

SQL queries

QMF for TSO and CICS, QMF for Workstation, and QMF for WebSphere all provide ways for experienced users to issue SQL statements directly to the database.

If you do not know the exact syntax of the SQL statement you need or you just want to save time, you can have QMF for TSO and CICS as well as QMF for Workstation draw a sample SELECT, INSERT, or UPDATE query for the table you are working with, and then change this sample query as necessary.

QMF for Workstation offers additional help in creating syntactically correct SQL queries with a colorized SQL editor that includes Content Assist and Parameter Hint features. The Content Assist feature supplies lists of all the elements (such as keywords, separators, clauses, current table and column names, and other elements) that can occur in a specific place in your SQL statement based on what you have already specified. The Parameter Hint feature supplies information about the parameters required by the current function in your SQL statement.

SQL queries can include multiple SQL statements, allowing you to accomplish many different database tasks with a single query. The text of the query is limited only by the length of SQL statement that the database to which the query is directed is capable of running. In the TSO and CICS environments, SELECT, CALL, and CREATE PROCEDURE statements must be used alone in a SQL query.

Multidimensional queries

QMF for Workstation and QMF for WebSphere support multidimensional analysis through the use of OLAP queries. OLAP queries are multidimensional queries that can present your cube data in a wide variety of views. You can drill up, down, or across through a user-defined set of dimensions and levels by using the built-in OLAP explorer. You can then use the OLAP query diagram to create a new OLAP query, or open an existing query and modify it to obtain different views of the cube data.

A multipane OLAP editor provides side-by-side views of the cube and the OLAP query that you are creating, as shown in Figure 4 on page 19. Dimensional filtering allows you to include only the data that you want to analyze, increasing the efficiency of retrieving data from larger cubes. Hierarchical dimensional filtering allows you to filter dimension levels in relation to the cube contents. For example, a view of the second quarter can be filtered across all years or merely across a designated list of years. At any given time, you can view the underlying SQL or MDX statements that have been automatically generated in response to a query that you have created graphically.

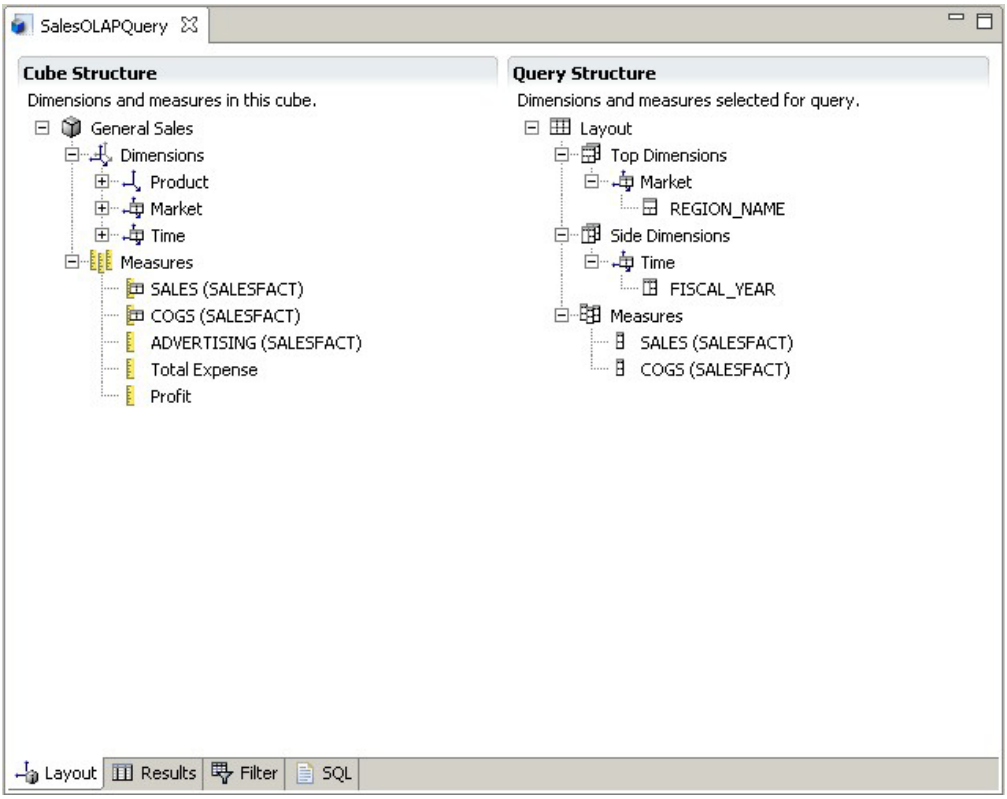


Figure 4. The multipane OLAP editor, which provides two different views of an OLAP query

As with relational queries, QMF for Workstation and WebSphere offer multiple methods of constructing multidimensional queries. You can browse available cube models and construct queries by graphically dragging and dropping dimensions and measures of interest into your queries and immediately see the results of your selections. Although no coding knowledge is required to browse and construct OLAP queries, experienced users can open the Multidimensional Expressions (MDX) editor and directly enter or edit the query's underlying MDX statements. You can also switch between the MDX and graphical editors, building the query by using a blend of both methods.

You can format OLAP query results directly in the query results editor, which provides many options, including the ability to:

- View summary information for a measure or dimension
- View only totals for a measure or summarized dimension
- View detailed data for a summarized dimension
- Resize columns
- Change the font or format for a measure or dimension

OLAP cube data can be displayed in both QMF for Workstation and QMF for WebSphere, and can be directly incorporated into visual reports and dashboards by using QMF for Workstation's OLAP-aware charts, graphs, and dimension slicers.

Chapter 3. Reports, dashboards, and analytics

This topic describes QMF's extensive data formatting capabilities, which help you transform raw data into the insight you need to make critical business decisions. From standard tabular reports to graphical reports and charts, graphs, or maps, QMF challenges and extends the traditional notion of reporting, making your communication and presentation more precise, effective, and powerful. In addition to traditional page-based reports, dashboard capabilities can be used to present live operational data in a variety of creative combinations.

For more information, see one of the following subtopics:

Reporting features

This topic describes reporting features available in QMF. With these features, you can create graphical reports, charts, maps, and graphs, as well as standard tabular reports.

Graphical reports

QMF for Workstation has an extremely flexible visual design environment for both graphical reports, which include text and graphics, and dashboards. Graphical reports, also called visual reports, can show many business indicators at one time in visually rich formats.

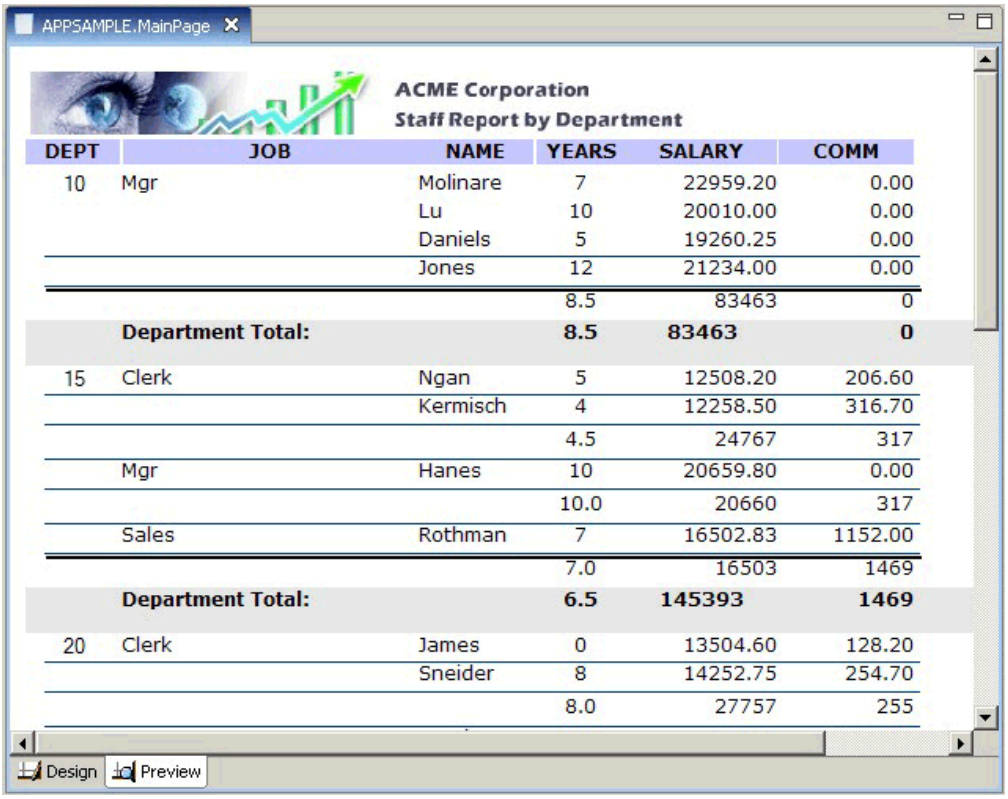
With no coding knowledge, you can give life to your ideas with nearly any visual format that you can imagine. QMF for Workstation's visual designer allows you to graphically place charts, selectors, and controls on the report canvas and embed content such as text, graphics, hyperlinks, and supporting information, whether data-driven or static. These elements can also be embedded in traditional tabular reports or interactive dashboards.

The visual designer allows you to:

- Control virtually any visual attribute on a report, chart, graph, map, or dashboard.
- Include conditional formatting in queries, reports, and dashboards.

  Conditional formatting allows you to specify conditional expressions that control both the display of the data as well as the behavior of a query, report, or dashboard element (what it does when clicked or changed, based on the underlying data). For example, you can use conditional formatting to highlight in red any fields that indicate that year-end sales have fallen below a particular figure.
- Specify calculation expressions to generate columns from columns stored in the database.
- Group, aggregate, and summarize data.

Figure 5 on page 22 shows an example of a visual report in QMF for Workstation.



DEPT	JOB	NAME	YEARS	SALARY	COMM
10	Mgr	Molinare	7	22959.20	0.00
		Lu	10	20010.00	0.00
		Daniels	5	19260.25	0.00
		Jones	12	21234.00	0.00
			8.5	83463	0
	Department Total:		**8.5**	**83463**	**0**
15	Clerk	Ngan	5	12508.20	206.60
		Kermisch	4	12258.50	316.70
			4.5	24767	317
	Mgr	Hanes	10	20659.80	0.00
			10.0	20660	317
	Sales	Rothman	7	16502.83	1152.00
			7.0	16503	1469
	Department Total:		**6.5**	**145393**	**1469**
20	Clerk	James	0	13504.60	128.20
		Sneider	8	14252.75	254.70
			8.0	27757	255

Figure 5. Example of a visual report in QMF for Workstation

Charts, maps, and graphs

QMF for Workstation provides a graphical palette that contains 20 default charts and graph styles, listed below. QMF for TSO and CICS provides a subset of these styles using IBM's Graphical Data Display Manager (GDDM®) and Interactive Chart Utility (ICU).

- Line charts
- Bar charts
- Pie charts
- Column charts
- Scatter charts
- XY charts
- Stock charts
- Candlestick charts
- Timeline charts
- Event band charts
- Multivariate charts
- Linear maps (geospatial)
- Hierarchical charts
- Organization charts
- Cluster graphs
- Tree charts

- Spiral charts
- Simple form layouts
- Matrix layouts
- Horizon charts

In addition, query results can be automatically sent to Microsoft Excel for viewing in pivot charts. Microsoft Excel must be installed separately to take advantage of this feature.

Tabular reports

Tabular reports in QMF for Workstation present data with default breaks and sections. An intuitive full-page designer with run-time views and design views side by side is provided to help you design the forms that control the look and the sectional content of the report. Figure 6 shows an example of a tabular report in QMF for Workstation.

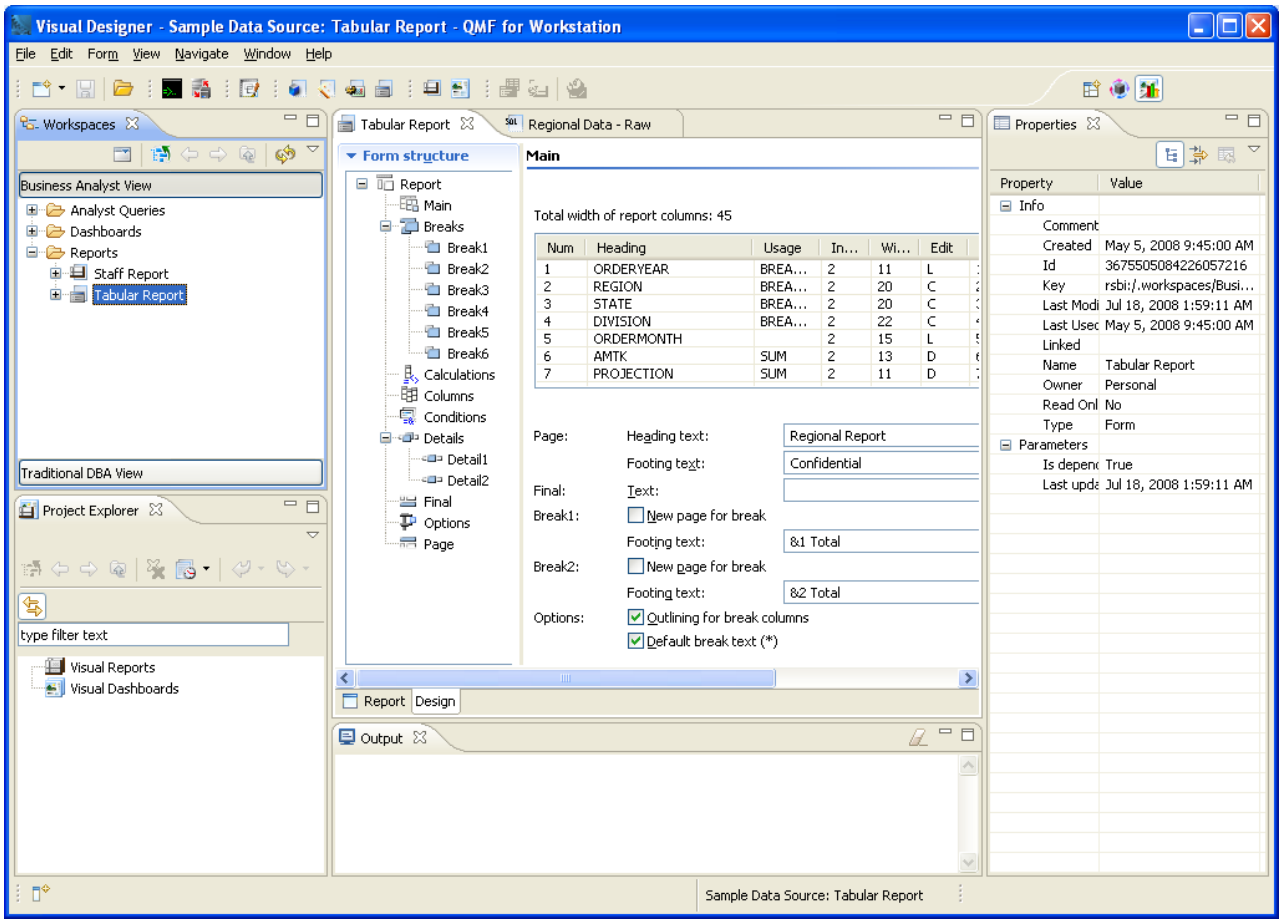


Figure 6. A tabular report in QMF for Workstation

Creating custom tabular reports with QMF for TSO and CICS is easy; you can start with a template report that has default column headings and a default layout. Then you can tailor the default report with formatting specifications that control different areas of the report.

Figure 7 shows a report produced in QMF for TSO and CICS that groups salaries in each department by job.

REPORT LINE 1 POS 1

	<---------- JOB ---------->			
	<-- CLERK -->	<--- MGR --->	<-- SALES -->	<-- TOTAL -->
	SUM	SUM	SUM	SUM
DEPT	SALARY	SALARY	SALARY	SALARY
10		$83,463.45		$83,463.45
15	$24,766.70	$20,659.80	$16,502.83	$61,929.33
20	$27,757.35	$18,357.50	$18,171.25	$64,286.10
38	$24,964.50	$17,506.75	$34,814.30	$77,285.55
42	$22,014.50	$18,352.80	$18,001.75	$58,369.05
51	$27,829.80	$21,150.00	$37,111.00	$86,090.80
66	$10,988.00	$18,555.50	$56,532.70	$86,076.20
84	$13,030.50	$19,818.00	$33,298.50	$66,147.00
	$151,351.35	$217,863.80	$214,432.33	$583,647.48

ABC Mechanical, Inc.

Figure 7. A tabular report in QMF for TSO and CICS

Using QMF for TSO and CICS forms, you can change text, spacing, and alignment on virtually any area of the report. You can also:

- Group, aggregate, and summarize data.
- Define new columns not originally present in the query results.
- Perform calculations on your data using either simple operators or REXX expressions.
- Define conditional formatting, which allows you to define data-dependent formatting variations for the report.
- Fix columns in a large report so that you can easily compare later columns against earlier ones.

When you make changes to a QMF form, you can see the results immediately on the report without having to repeatedly fetch information from the database.

The QMF form object is composed of the following nine panels on which you indicate your report formatting specifications.

FORM.MAIN
Used to specify the basic format for the report

This form panel is shown in Figure 8 on page 25.

FORM.BREAKn
Allows you to specify text before and after breaks in a report

There are six break panels (FORM.BREAK1 through FORM.BREAK6), allowing you to specify summary text for up to six breaks in the report.

FORM.CALC
Allows you to specify up to 999 calculation expressions in a report

FORM.COLUMNS
Allows you to specify the format of columns in the report as well as how to format the data in each column when that data appears in a chart

FORM.CONDITIONS

Used together with FORM.DETAIL to specify conditional formatting in the report

Conditional formatting allows you to create expressions that control when the formatting variations that have been specified in FORM.DETAIL are to be used in the report. If the condition evaluates to true, the formatting specifications associated with that condition are applied to the report.

FORM.DETAIL

Allows you to create up to 99 formatting variations, each associated with a condition that you specify on the FORM.CONDITIONS panel

FORM.FINAL

Controls the content and placement of final text in a report

FORM.OPTIONS

Allows you to fix the position of columns in the report, which divides the report into a fixed area and a scrollable area, so that you can easily compare multiple columns in a large report

This panel also allows you to summarize data across columns in the report as well as make other detailed formatting adjustments.

Figure 8 shows formatting options available on FORM.MAIN, the main panel of the QMF form. If all the columns in the form are not visible on the panel, you can scroll forward and backward to see those you want.

```
FORM.MAIN                                              MODIFIED

COLUMNS:                Total Width of Report Columns: 23 + (N X 15)
          A                                  B       C       D       E       F
NUM  COLUMN HEADING                    USAGE    INDENT   WIDTH   EDIT   SEQ
---  ------------------------------  -------  ------   -----   -----  ---
  1  DEPT                            GROUP    2        6       L       1
  2  JOB                             ACROSS   2        5       C       2
  3  SALARY                          SUM      2        11      D2      3

  PAGE:       HEADING  ===>        G
              FOOTING  ===> COMPANY NAME
  FINAL:      TEXT     ===>        H
  BREAK1:     NEW PAGE FOR BREAK? ===> NO
              FOOTING  ===> DEPT. &2 TOTALS     I
  BREAK2:     NEW PAGE FOR BREAK? ===> NO
              FOOTING  ===>
  OPTIONS:    OUTLINE? ===> YES      DEFAULT BREAK TEXT? ===> NO       J

 1=Help        2=Check     3=End     4=Show        5=Chart       6=Query
 7=Backward    8=Forward   9=       10=Insert     11=Delete     12=Report
 OK, FORM.MAIN is displayed.
 COMMAND ===>                                            SCROLL ===> PAGE
```

Figure 8. Formatting options on the FORM.MAIN panel

With these entry areas, you can do the following tasks:

A Assign column headings.

B Specify a usage code for the column, which indicates how to group, summarize, or aggregate the data in the column. For example, you can choose to summarize data across the rows in a report in addition to within each column.

C Adjust the indentation of each column.

D Adjust the width of each column.

E Specify an edit code for the column, which indicates how values in the column are to be formatted.

QMF provides default edit codes for each data type as well as an edit exit interface to allow you to create your own codes and associate them with formatting routines. For example, you can format values in scientific versus decimal notation or control the sign and separators for monetary values.

F Change the sequence of columns.

G Specify a heading and footing for the top and bottom of each page.

H Specify the final text at the end of the report.

I Enter footing text to use when the value in a designated control column changes.

J Specify the formatting of repeated values within a designated control break.

You can apply the same formatting specifications to different sets of query results, saving you time and helping you to maintain reporting consistency across your organization.

For more information about QMF for TSO and CICS forms, see *DB2 QMF Reference*.

Dashboard capabilities

A *dashboard* is an interface that integrates data from a variety of sources and provides a unified display of relevant contextual information. Unlike reports, which tend to contain a fixed amount of information, dashboards have the ability to deliver real-time information on demand, as needed by the dashboard user. For example, an executive might need to see an operational summary across all business units. Real-time color coding of data (for example, red, yellow, and green) can be used to draw the executive's attention to areas of concern. Clicking on problematic areas immediately produces dynamic reports that reveal the information underlying each area of concern.

Dashboards can present both interactive and persistent data. They are typically designed to run interactively, but are not required to do so. The data that is presented in a dashboard can be obtained from querying multiple data sources across the enterprise and displaying it in a wide range of visual images, including graphs, maps, charts, and custom graphics.

You design dashboards using the visual designer in QMF for Workstation, which allows you to get started in a few simple steps:

1. Drag a dashboard object from the graphical palette and arrange it on the dashboard canvas.
2. Set appearance and font by using the **Properties** view.
3. Add queries and graphical objects (such as date selectors and charts) to your dashboard and define relationships between these objects by graphically wiring the objects together and specifying their relationships.

All elements that can be used in visual reports can be used to create a dashboard as well. The following figure shows the dashboard design environment:

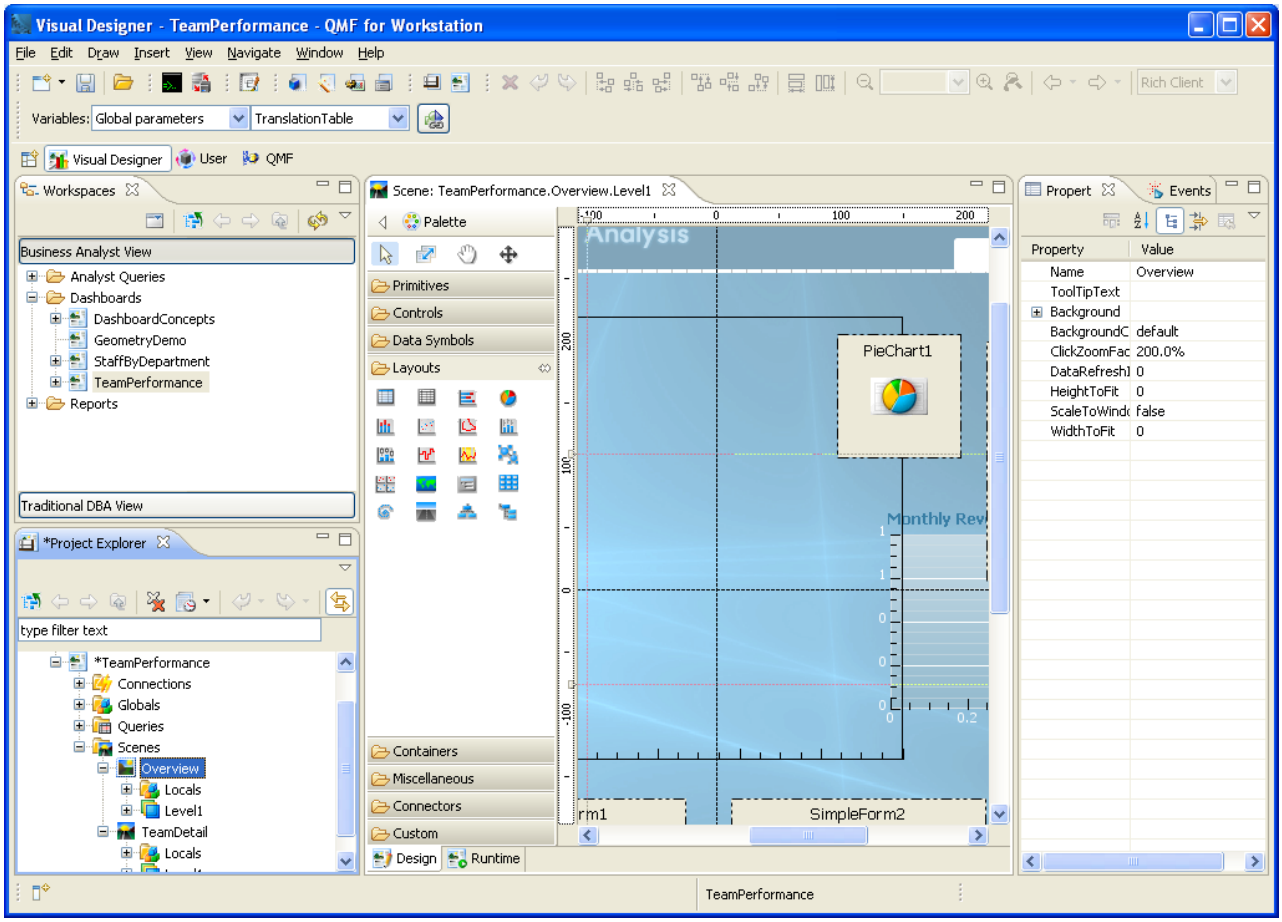


Figure 9. The dashboard design environment in QMF for Workstation

As you create your dashboard, QMF provides built-in ways to:

Display query results
You use layout objects or control objects such as the List and Combo controls to display query results. You can explore the different display options and decide which options best suit the kind of analysis you want to show.

Capture user input
You can capture user preferences by using standard user interface controls.

Pass information to and from the dashboard
You can use parameters to pass information that has been acquired from user actions. This information can then be used to tailor the information displayed within the dashboard.

Implement navigation features
You can use navigation features to allow users to move around the dashboard to get to new information.

Display and present information visually
You can drag and drop visual elements on the dashboard canvas and define relationships between them.

Point to data sources
As you create your dashboard, you specify the data sources that are referenced in the queries that your dashboard uses.

After you create a dashboard, it can be viewed in both QMF for Workstation and QMF for WebSphere applications. The run-time view of a dashboard that is currently being designed is shown in the following figure:

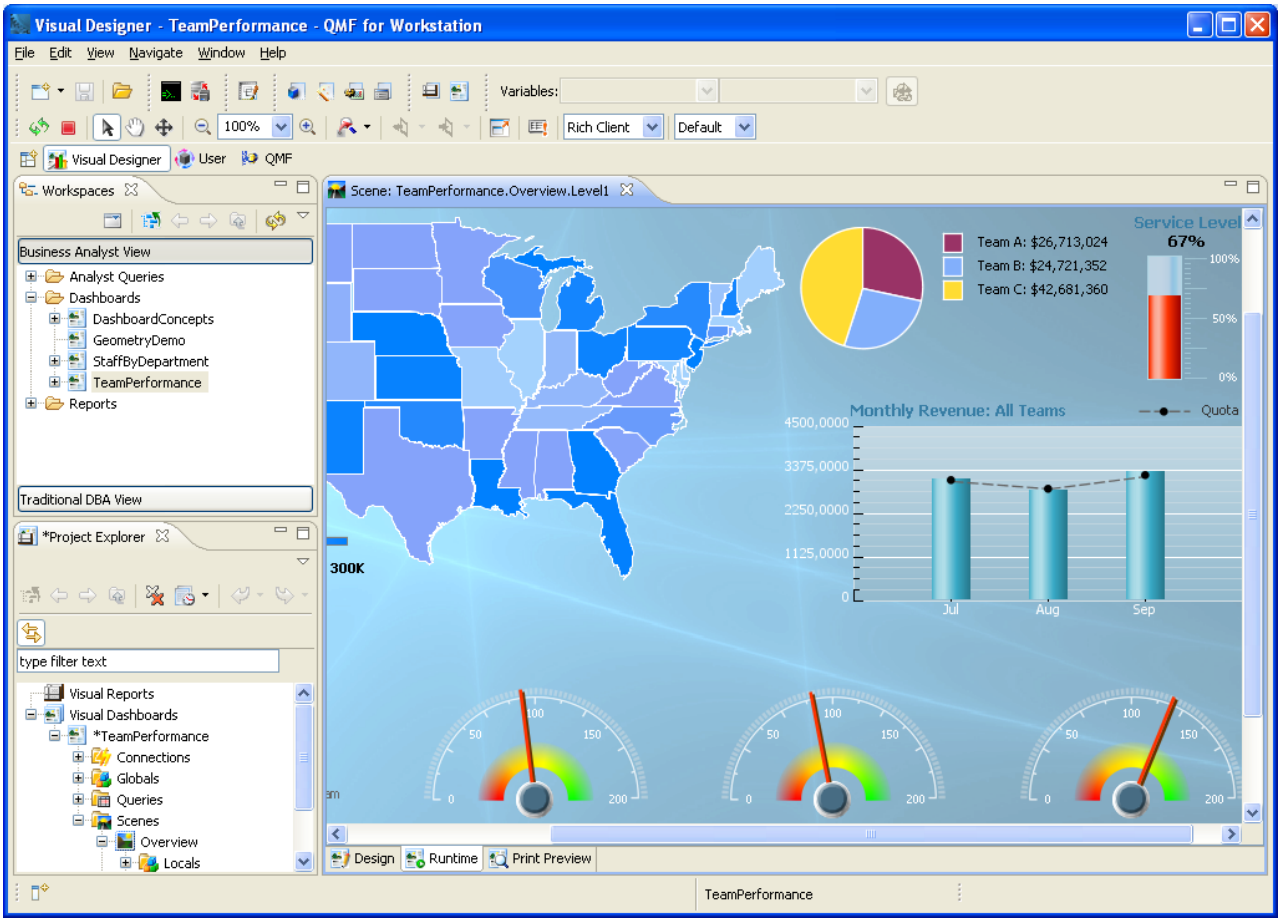


Figure 10. Run-time view of a dashboard that is currently being designed in QMF for Workstation

Analytical functions

Report formatting and presentation alone mean nothing unless you are able to extract meaningful insight from your data. QMF for Workstation's analysis capabilities go beyond traditional reporting to help you truly gain the insight that you need to drive your organization forward. A repertoire of over 140 built-in functions allows you to tailor reports and dashboards at an extremely detailed level. Types of built-in functions supported include:

Arithmetic functions
: Calculate values based on the specified function

Color functions
: Help you customize visual presentation of reports and dashboard objects

Conversion functions
: Convert the parameter value from its current data type to another data type

Data formatting functions
: Reformat data values to and from database and operating system formats

Date and time functions
Return specific elements of date and time values

Hierarchical functions
Identify a parameter value's position in hierarchical representations such as organization charts

Information functions
Return information on specified data objects

Logical functions
Return values based on logical operations performed on parameter values

Math and trigonometric functions
Calculate values based on the specified mathematical function

Measured functions
Express a given value as a specified unit of measure

Security function
Specifies the name of the security list that will be used to tailor visual report or visual dashboard content based on the security level of the user

Spatial functions
Used when mapping spatial data

Statistical functions
Used to perform standard statistical analysis on supplied parameter values

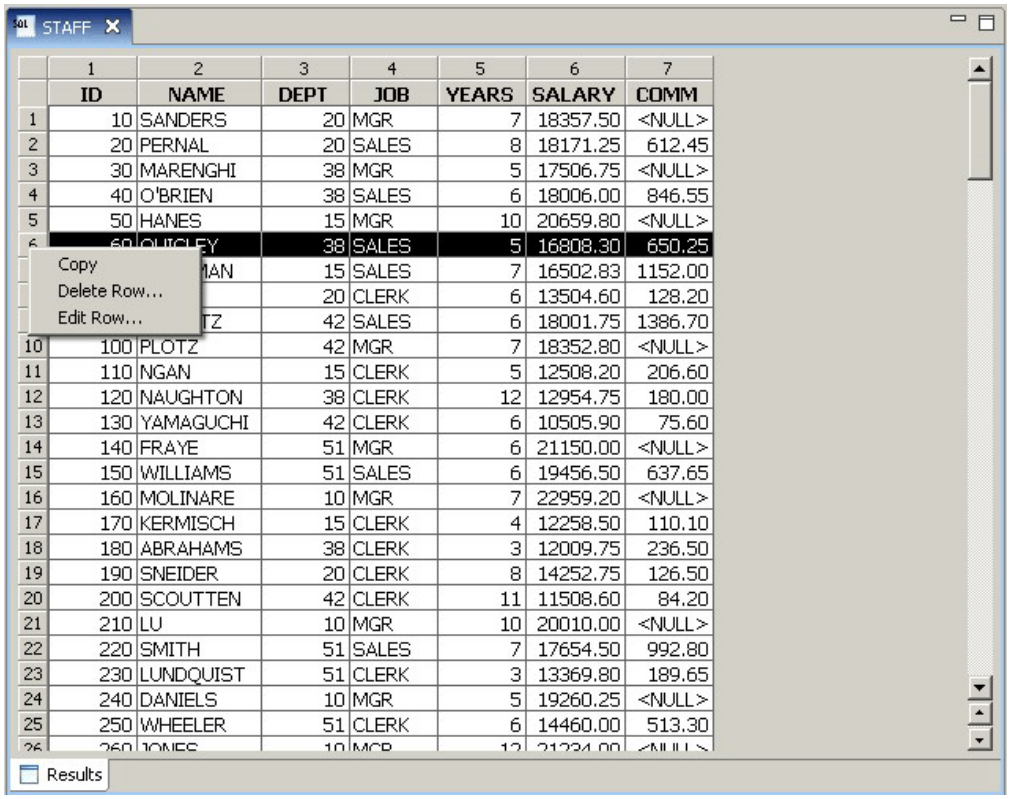
Text functions
Format and manipulate textual data or return specific information on supplied data sources

Chapter 4. Data editing capabilities

DB2 QMF for TSO and CICS and DB2 QMF for Workstation both include a table editing interface that allows users to easily and intuitively update data in database tables.

In QMF for Workstation, you can select a table from your workspace, then insert or delete rows or update specific columns or entire rows.

Figure 11 shows the table editing interface in QMF for Workstation.



	1	2	3	4	5	6	7
	ID	NAME	DEPT	JOB	YEARS	SALARY	COMM
1	10	SANDERS	20	MGR	7	18357.50	<NULL>
2	20	PERNAL	20	SALES	8	18171.25	612.45
3	30	MARENGHI	38	MGR	5	17506.75	<NULL>
4	40	O'BRIEN	38	SALES	6	18006.00	846.55
5	50	HANES	15	MGR	10	20659.80	<NULL>
6	60	QUIGLEY	38	SALES	5	16808.30	650.25
7	70	RO...AN	15	SALES	7	16502.83	1152.00
8	80	...	20	CLERK	6	13504.60	128.20
9	90	...TZ	42	SALES	6	18001.75	1386.70
10	100	PLOTZ	42	MGR	7	18352.80	<NULL>
11	110	NGAN	15	CLERK	5	12508.20	206.60
12	120	NAUGHTON	38	CLERK	12	12954.75	180.00
13	130	YAMAGUCHI	42	CLERK	6	10505.90	75.60
14	140	FRAYE	51	MGR	6	21150.00	<NULL>
15	150	WILLIAMS	51	SALES	6	19456.50	637.65
16	160	MOLINARE	10	MGR	7	22959.20	<NULL>
17	170	KERMISCH	15	CLERK	4	12258.50	110.10
18	180	ABRAHAMS	38	CLERK	3	12009.75	236.50
19	190	SNEIDER	20	CLERK	8	14252.75	126.50
20	200	SCOUTTEN	42	CLERK	11	11508.60	84.20
21	210	LU	10	MGR	10	20010.00	<NULL>
22	220	SMITH	51	SALES	7	17654.50	992.80
23	230	LUNDQUIST	51	CLERK	3	13369.80	189.65
24	240	DANIELS	10	MGR	5	19260.25	<NULL>
25	250	WHEELER	51	CLERK	6	14460.00	513.30
26	260	JONES	10	MGR	12	21234.00	<NULL>

Figure 11. The table editing interface in QMF for Workstation

In QMF for TSO and CICS, you can easily use the Table Editor to edit individual rows or sets of rows that meet certain criteria. The Table Editor has three modes:

SEARCH
Allows you to search for the row or set of rows that you want to change

ADD Allows you to insert rows into the table

CHANGE
Allows you to update or delete rows in the table

Figure 12 on page 32 shows the ADD panel of the Table Editor, with a row being inserted into a table named SUPPLIERS, owned by user KRISTI.

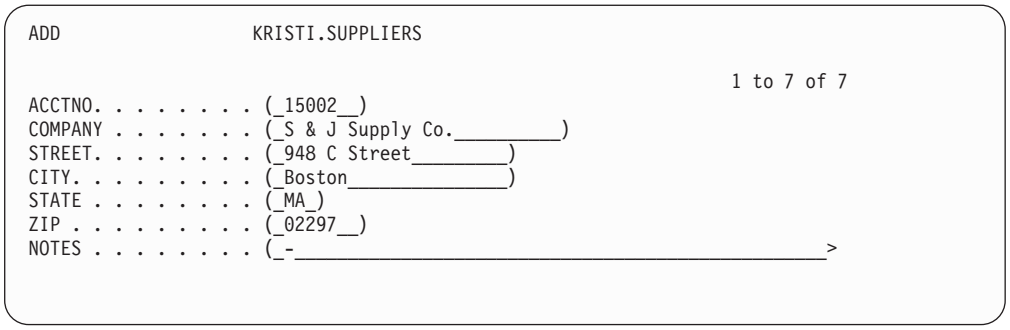


Figure 12. ADD panel of the Table Editor in QMF for TSO and CICS

Editing data is as easy as typing over the values on the Table Editor panel while you are in Change mode and pressing the Change key. In both Add and Change mode, you can choose to apply your edits immediately or batch multiple edits into a single transaction.

Default confirmation panels help to ensure security and integrity by prompting the user before making any updates final. You can set global variables that control the types of updates for which the confirmation panels are displayed. For extra security, you can also use column-level authorization to control exactly which columns of a table a user can view or change.

Chapter 5. Application development interfaces

QMF provides the capability to seamlessly incorporate product functions and features into your business applications. Both QMF for TSO and CICS and QMF for Workstation and WebSphere offer application programming interfaces.

In addition to application programming with QMF, you can also write sophisticated procedures on any QMF platform.

See one of the following subtopics for more information:

- "Interfaces to QMF for TSO and CICS"
- "Interfaces to QMF for Workstation and WebSphere" on page 34
- "Using procedures as applications" on page 34

Interfaces to QMF for TSO and CICS

QMF for TSO and CICS provides several ways to integrate QMF functions seamlessly into existing applications. This topic describes these interfaces.

Stored procedure interface to QMF for TSO

The stored procedure interface to QMF for TSO allows any software program that can call a DB2 for z/OS stored procedure, such as QMF for Workstation and WebSphere, to start QMF for TSO, run a predefined QMF query or procedure, and receive up to 20 reports back as result sets. This interface allows users who might be unfamiliar with QMF for TSO to do meaningful work with the program and provides seamless access to features and resources that might exist only on the system where QMF for TSO is running. Network traffic, and therefore processor time and total cost of ownership, are kept to a minimum because send and receive operations are reduced to a single CALL and return. The interface is made available through a REXX stored procedure that must run in a WLM-managed address space.

To start QMF for TSO as a stored procedure, you issue a CALL statement with predefined syntax. Input parameters passed on the CALL statement include the name of a QMF query or procedure that performs the required QMF tasks, as well as trace settings and the national language in which you want QMF for TSO to run. QMF authenticates the authorization ID under which the WLM-managed address space was started, then runs the query or procedure and returns the required output. The query or procedure that runs after QMF starts must exist in the QMF object catalog on the DB2 for z/OS subsystem in which the stored procedure interface was installed. QMF returns any messages from the stored procedure run in an output parameter.

Similar to QMF for TSO batch mode, the stored procedure interface runs the query or procedure noninteractively, allowing users to multitask.

Callable interface

You can build sophisticated application suites by using the QMF callable interface and a variety of supported programming languages.

The callable interface lets you integrate QMF functions into ISPF applications or applications written in any of the following programming languages:

- C
- COBOL
- FORTRAN
- High-Level Assembler
- PL/I
- REXX

For example, a REXX program can initiate a QMF session through the callable interface. By directing commands to QMF for execution, the REXX program can run queries, create reports, export and import data, or start an interactive table editing session with QMF's Table Editor. The REXX program can then end the QMF session and continue processing the information. REXX is also available for use in QMF forms and procedures.

Using the callable interface, you can also start an application from within an existing QMF session. Your application can run QMF commands, queries, or procedures and retrieve the results. For example, your application could generate a letter to each employee that is based on a combination of job type and years of service.

Command interface

The command interface allows you to use QMF services from an Interactive System Productivity Facility (ISPF) dialog. You can integrate QMF for TSO and CICS functions within ISPF dialogs so that users see only ISPF menus.

Interfaces to QMF for Workstation and WebSphere

You can incorporate QMF for Workstation and QMF for WebSphere functions into your business applications in three ways:

- Use QMF for WebSphere to embed queries, reports, and dashboards within Web applications, portlets, or custom Web pages.
- Use Java APIs and Web service APIs to incorporate QMF for Workstation features into Java-based workstation and Web applications.
- Automate QMF for Workstation functions by using the Command Library Interface, which provides a way to perform operations outside of the QMF user interface. For example, you could create an external, custom application that generates and exports reports. You can use the Command Library Interface to batch query and report operations, saving time and resources.

Using procedures as applications

A procedure is an object that enables you to perform multiple QMF tasks with a single RUN command. Procedures can take advantage of sophisticated data and object management and can help you make more efficient use of resources. Both QMF for TSO and CICS and QMF for Workstation and WebSphere offer procedures.

Procedures in QMF for TSO and CICS

Linear procedures and procedures with logic provide two ways to run a series of instructions in QMF for TSO and CICS. Linear procedures are available in both TSO and CICS environments and contain only QMF commands. Procedures with

logic are available in QMF for TSO and allow you to include REXX logic in addition to QMF commands. Figure 13 shows an example of a QMF procedure with logic.

```
PROC                              MODIFIED    LINE    1

 /* This procedure checks to see what day it is.  If it's
    Monday, it runs a query and prints a report.  If it
    isn't, a message is displayed informing the user.   */
 signal on error
 if date('w') = 'Monday' then
   do
     "RUN QUERY MYQUERY (FORM = MYFORM"
     "PRINT REPORT"
     "MESSAGE (TEXT='OK, MONDAY report has been created and sent to printer.'"
   end
 else
   do
     "MESSAGE (TEXT='Sorry, it is not Monday.  Report cannot be created.'"
   end
 exit 0      /*Exit without errors */
 error:
   "MESSAGE (TEXT = '"dsq_message_text"'"
   exit 8     /*Exit with error condition*/
 *** END ***
```

Figure 13. An example of a procedure with logic in QMF for TSO

Procedures with logic can include any REXX command or function and can also make calls to the operating system or other available environments. In a procedure with logic, you can use conditional formatting, make calculations, or pass commands back to the host environment. You can include both QMF and REXX variables, making the behavior of the procedure data-dependent without rewriting it. You can assign new values to the variables by entering values on the RUN command when the procedure is started or by prompting the user for values using REXX `say` and `pull` statements.

QMF provides a special procedure, called a system initialization procedure, that allows you to customize QMF parameters, variables, and session preferences at startup time. You can include any QMF command in the system initialization procedure, allowing you to tailor the QMF session to the operational needs of individual users or groups of users.

In addition to QMF procedures, you can also develop DB2 stored procedures that you can run with a CALL statement on the SQL Query panel in QMF for TSO and CICS. DB2 QMF High Performance Option (HPO) also provides a stored procedure environment.

Procedures in QMF for Workstation and WebSphere

In addition to the API functions explained in “Interfaces to QMF for Workstation and WebSphere” on page 34, QMF for Workstation provides built-in procedure development capabilities. For example, procedures can:

- Run queries
- Print reports
- Import data
- Export data
- Perform other functions

You can create, edit, and run procedures from both QMF for Workstation and QMF for WebSphere. Like other QMF for Workstation objects, procedures are stored in the repository and are accessible through the QMF for Workstation workspaces.

In QMF for Workstation procedures, you can use Open Object Rexx to handle simple and complex calculations, logic, column definitions, detail variations, and conditions. Open Object Rexx is designed for ease of learning and use and helps to make programming accessible to non-programmers. It offers:

- Powerful character manipulation
- Automatic data typing
- Manipulation of words, numbers, and names
- Debugging capabilities

Open Object Rexx functions have the following syntax:

```
function-name ([[expression] [,] [expression] [,] ...])
```

In this syntax, zero to *n* expression arguments can exist (where *n* is the maximum number of comma-separated expressions allowed by Open Object Rexx).

Open Object Rexx is available at http://www.oorexx.org/ and is a prerequisite for REXX support in procedures that run in the QMF for Workstation environment.

Chapter 6. Performance and resource control

The QMF product family is designed to handle the throughput of the zSeries® platform and can handle very large amounts of data. Built-in governing functions help you ensure that resource loads remain within defined parameters as data flow scales to handle greater operational demands.

Built-in and user-defined QMF resource limits help you manage resource consumption. By setting resource limits, you can control a user's access to data sources.

In QMF for Workstation and QMF for WebSphere, you implement resource limits for users by using the administrative interface of either application. The resource limits implemented in either interface apply to all users of both QMF for Workstation and QMF for WebSphere.

In QMF for TSO and CICS, you implement resource limits by using one of the following:

- Built-in governor logic, which is explained in *Installing and Managing DB2 QMF for TSO and CICS*
- The DB2 QMF HPO/Manager, which is explained in the following topics:
  - "Monitoring and governing QMF activity"
  - "Optimizing resource-intensive operations" on page 39

Both the built-in governor logic in QMF for TSO and CICS as well as the governing functions available in QMF for HPO can be used in conjunction with the DB2 resource limit facility.

Monitoring and governing QMF activity

QMF HPO/Manager is a family of utilities for managing and administering QMF for TSO and CICS operations. The QMF HPO/Manager comprises the following integrated components:

- Governor module
- Activity log
- Online facilities

Governor module

This module replaces the default governor exit routine provided with QMF for TSO and CICS and is the direct interface to QMF processing for the QMF HPO/Manager. This enhanced governor module is more than a QMF governor because it services the following facilities:

- Object manager

  The object manager tracks QMF session activity. It records information about the commands and objects and writes this information directly to the activity log.

  You can also produce lists of QMF objects that are based on the content of a specific object. The object manager has a list filter that allows you to locate queries that contain references to specific table names, column names, SQL verbs, and so on. The object manager supports the migration and copying of objects to and from QMF for TSO and CICS. It

recognizes and appropriately handles columns in the QMF for TSO/CICS Q.OBJECT_DIRECTORY table.

- Governor

  The governor controls QMF session activity. It obtains thresholds and controls from resource groups in the same way as the QMF for TSO and CICS default governor, but provides a wider and more flexible set of controls. These controls enforce the proper use of resources in QMF sessions operating under TSO and CICS.

- Monitor

  The monitor supplies a real-time user interface to information about QMF session activity in TSO and CICS. It accepts administrator commands and passes them to the HPO governor module.

- Query analyzer

  The query analyzer provides preemptive governing capabilities. It traps queries before DB2 processes them and estimates their resource consumption. The query analyzer can cancel queries that are estimated to be too resource-intensive.

Activity log

The activity log provides a repository for QMF session activity and QMF object usage information. The governor module writes directly to the activity log data sets. You must run a batch job periodically to copy the activity log data sets to the activity log tables. You can use the activity log's JCL function to create the JCL to run this batch job.

Online facilities

The online facilities help organize and simplify the administration and management of QMF HPO. You can review and manipulate QMF for TSO and CICS objects by using the object manager's online facilities. Two types of actions are supported: those that operate on one object and those that can operate on a set of objects.

The QMF HPO/Manager helps you isolate production applications from query and reporting activities. A session activity list (shown in Figure 14) gives administrators essential facts about database activity, the number of rows that are fetched, and processor time consumption.

```
DB2A -- Session Activity List ---------------------------------ROW 1 TO 5 OF 5
COMMAND ===>                                                  SCROLL ===> CSR
RAAM018I--monitor data refreshed
Valid Actions Are...
B  Browse SQL Text
C  Cancel Current Action
rows that are fetched
TSOID : VNDRSTRW
Mode  : ONLINE                                                          C S
                   QMF Object   Object                                  A Q
A Date     Time    Act Owner    Name                     Rows     CPU     N L
- -------- -------- --- -------- ------------------ ---------- ----------- - -
  05/09/10 07:47:52 BEG                                    0             0
  05/09/10 07:47:52 RUN VNDRSTRW MODELING                  0             0
  05/09/10 07:48:01 *** VNDRSTRW MODELING                100 00 00 00 23 0 Y
  05/09/10 07:48:01 *** VNDRSTRW MODELING               1733 00 00 03 69 0
  05/09/10 07:48:01 *** VNDRSTRW MODELING               3330 00:00:07:20 0
****************************** BOTTOM OF DATA ******************************
```

Figure 14. A typical session activity list in the QMF HPO/Manager

Using the QMF HPO/Manager session activity list, QMF administrators can browse the SQL text associated with a query or cancel an active QMF command that is associated with database activity.

Optimizing resource-intensive operations

QMF HPO/Compiler provides utilities for generating, preparing, and running report programs for QMF. The QMF HPO/Compiler performs these tasks:

- Provides a stored-procedure development environment to create stored procedures
- Reduces resource contention by optimizing resource-intensive queries, forms, and procedures
- Converts dynamic SQL to static SQL, which helps reduce DB2 catalog contention and DB2 optimization overhead

  The compiled applications run faster and more efficiently, lowering your production costs.
- Converts queries, reports, and procedures into efficient COBOL programs, generating structured, stand-alone, documented source code that is easy to modify and portable to other platforms

  Using a COBOL precompiler, you can run the program on a personal workstation for use with DB2 for Linux, UNIX, and Windows or other database management systems.

The QMF HPO/Compiler contains a program generator and an end-user facility.

Program generator

The program generator is used by programmers to convert QMF reports (queries, forms, and procedures) into compiled programs. In addition, this facility can automatically register report programs with the end-user facility.

CICS programs are pseudo-conversational: they appear to the user as a continuous conversation, but actually consist of multiple tasks. As with TSO programs, you can generate two types of CICS programs: display programs and print programs.

End-user facility

The end-user facility is used to run compiled report programs. When programs are generated and prepared for running, they are automatically registered with the end-user facility. After programs are registered, the nontechnical user interface makes it easy to list, locate, and process reports.

After selecting a report, you are prompted to supply any run-time variable values. If the report will run in batch mode, JCL is automatically generated and optionally submitted. Otherwise, the interactive report is run online in the appropriate environment, TSO or CICS.

Chapter 7. Portability and multiplatform access

QMF provides features that help you make your business data portable wherever you need it. This topic describes these features.

See one of the following subtopics for more information:

- "Object portability"
- "Multiplatform access" on page 42

Object portability

In QMF for TSO and CICS, you can export QMF queries, query results, procedures, forms, and tables from QMF to TSO data sets or CICS data queues.

Reports can be exported in HTML format for fast and easy deployment to the Web. QMF adds an HTML header and inserts tags to display the report in its original QMF format in the Web browser. HTML reports are useful when working with LOB data.

Data and tables can exported either from temporary storage or from the database in the following formats:

- A QMF proprietary format
- IXF format
- XML format

Object formats are documented in *Developing DB2 QMF Applications* to allow QMF objects to be created or modified outside of QMF if necessary.

In QMF for Workstation and WebSphere, you can e-mail query results directly from the **File** menu. You can also export results to a database or file in one of the following formats:

- HTML
- PDF
- CSV
- IXF
- dBase III
- XML
- WQML
- TXT
- XLS

Visual reports and dashboards can be deployed in PDF, HTML, or Flash formats in both QMF for Workstation and QMF for WebSphere. With the advantages of a thin-client deployment model, QMF for WebSphere is the perfect vehicle for viewing reports. You can distribute visually rich projects by simply providing access to a single URL.

Multiplatform access

QMF offers platform-independent data access that helps you to get the most out of your investment no matter where your data is stored. This topic describes multiplatform access capabilities for each QMF environment.

QMF for TSO and CICS

QMF for TSO and CICS allows you to configure access to any database in the IBM DB2 family.

When you start QMF for TSO or CICS, the system from which you start the program is known as the *local* system. The DB2 database that resides on this system, where QMF is installed, is known as the *local database*. You can access objects that are stored in databases other than the local database in two ways in QMF for TSO and CICS:

- Use the QMF CONNECT command to connect to the remote database. This method is known as *remote unit of work*.

  Remote-unit-of-work connections can be initiated and accepted by QMF running on any of the following types of databases:

  – DB2 for z/OS
  – DB2 for Linux, UNIX, and Windows
  – DB2 for iSeries
  – DB2 for VM and VSE

  After the connection has been made, you can access and use data as well as QMF objects (queries, procedures, and forms) at the remote database in the same way as you would work with them locally.

  The DSQSDBNM program parameter, which you specify when you start QMF, allows you to connect to a remote database before the QMF home panel is displayed so that users do not have to issue the CONNECT command themselves.
- While using QMF on the system where you started the program, issue a QMF command that refers to a table or view by a three-part name that references the name of the remote database in which the data is stored. This method of access is known as *distributed unit of work*.

  Three-part names cannot refer to QMF queries, procedures, and forms that are stored in a remote database. To access these objects in a remote database, you must use the CONNECT command or the DSQSDBNM program parameter.

Installation paths in *Installing and Managing DB2 QMF for TSO and CICS* specify how to prepare a remote server for either remote unit of work or distributed unit of work access. Using either of these data access methods or a combination of the two, you can use QMF for TSO and CICS to seamlessly access data on any remote DB2 server anywhere in the world, giving your business a global edge.

QMF for Workstation

After you install QMF for Workstation, you create and populate a centralized repository. The repository contains all information necessary to connect users to data sources and perform query and reporting functions. Users can save their objects in the repository as well. You can configure QMF access to the following types of relational and multidimensional data sources

- DB2 running on any platform
- Informix

- OLAP services included in DB2 Data Warehouse Edition Version 9 or later (all editions)
- Other MDX-based OLAP servers that support XMLA connectivity
- Virtually all other JDBC-compliant data sources, including Oracle and SQL Server

Data access can be shared, personal, network-based, or Web-service-based.

Support for JDBC-compliant data sources includes support for all JDBC-level data types.

Configuring access to a data source involves the following steps:

1. Specify the location and type of JDBC driver that will be used to access the data source.
2. Specify the connection details appropriate for the data source being accessed (such as the host name, TCP/IP port, and database name).
3. Optionally configure permissions and resource limits to be applied when users access the data source.

The QMF for Workstation Administrator perspective makes these tasks efficient by providing wizards that help you to create the repository and configure each data source.

Data sources in the repository can be configured to access the QMF for TSO or CICS object catalog, allowing users to access any objects that are saved in the catalog and save any new objects to the catalog.

QMF for WebSphere

QMF for WebSphere supports any Web application server (on any platform) that is capable of hosting Java-based Web applications deployed through the use of EAR or WAR files. QMF for WebSphere can be accessed by virtually any JavaScript-capable Web browser running on any platform, and has been formally validated against the following browsers:

- Microsoft Internet Explorer Version 7 (or later)
- Mozilla Firefox Version 3.0 (or later)

Chapter 8. Ease of use and administration

The QMF product family provides several features that make QMF easy to deploy, use, and maintain. This topic describes these features.

See one of the following subtopics for more information:

Straightforward navigation and object design

QMF for Workstation offers an extremely intuitive, graphical drag-and-drop design environment for visual reports and dashboards. For example, the graphical query diagram view allows less-experienced users to join tables by dragging and dropping related columns, effectively "wiring" them together. The OLAP query designer allows you to drag and drop dimensions and measures of interest into queries and immediately see the results of those selections. Online assistance is available to help users create SQL and OLAP queries.

After the query is run, query results can be manipulated using a drag-and-drop, fully interactive data-analysis grid. This grid supports adding calculated columns (for example, adding a Total column that sums three columns in the query results). You can also use the grid to rearrange columns and group and aggregate the data, including using pivot functions.

Selecting from the graphical palette, you can also drag and drop charts, graphs, selectors, and other graphical elements onto the canvas and wire data to them, as appropriate. You can then size and position each element and manipulate properties such as format, color, and options. This capability allows you to customize items such as fonts, legends, and logos.

Clicked items carry their full context to the destination object or page. For example, by clicking on a pie slice that is embedded in a bar chart embedded on a regional map, data that characterizes region, sales month, and product ID can be automatically transferred to the destination object or page. After the data is transferred to the object or page, that data can be used to drive the drill-down charts and graphs that provide more information about the item. All graphical entities can be assigned drill-down actions so that you can customize what a particular part of a visual report or dashboard will do when it is clicked or dragged.

The Web client and desktop client environments share a common look and feel, which allows users to move from one interface to the other easily and reduces the need for additional training and its associated time and expense.

Navigation between queries, forms, procedures, and reports is quick and easy in QMF for TSO and CICS as well. The following temporary storage areas store objects while you work on them. You can quickly and easily navigate between the temporary storage areas by issuing the SHOW command, followed by the name of the temporary storage area.

QUERY Stores queries

DATA Stores query results

REPORT Stores query results as formatted by the report formatting specifications that are currently in the FORM temporary storage area

FORM Stores report formatting specifications

To navigate to different parts of the form object, you can issue the SHOW command followed by the name of the form panel that you want to see. The QMF form panels are described in "Tabular reports" on page 23.

CHART Stores query results as formatted by the chart formatting specifications that are currently in the FORM temporary storage area

PROC Stores procedures

PROFILE Stores specifications and preferences for aspects of a user's QMF session

QMF for TSO and CICS also provides a straightforward, iterative design environment for reports. The RUN QUERY command returns query results; users can then issue various SHOW FORM commands to display a set of default formatting specifications for each area of the report, then iteratively build on these specifications until the report is final.

Role-based user interfaces

QMF for Workstation is specifically designed to accommodate the roles that are found in organizations that rely on business intelligence software. *Perspectives* provide the views, menus, and wizards that are commonly used by a particular type of business intelligence user. The following perspectives are available:

Administrator
The Administrator perspective provides the views, menus, and wizards that enable a user with administrative privileges to create and maintain repositories.

Visual Designer
The Visual Designer perspective provides the views, menus, and wizards that are used to create visual reports and dashboards.

User The User perspective provides the views, menus, and wizards that are used to query data sources, access or construct reports, and view dashboards.

QMF The QMF perspective replicates the look and feel of QMF for Windows Version 8.

Users can switch between the four different perspectives according to how their security privileges are set.

In QMF for TSO and CICS, administrators control access to objects by granting SQL authorities and privileges for specific objects as necessary. Function keys and commands can be customized by user or group role; these definitions can then be referenced by each user's QMF profile during initialization so that the customized interface displays when the QMF session starts.

Virtual data sources that shield end users from complexity

Virtual data sources in QMF for Workstation and WebSphere allow administrators to optionally shield their users from the complexities of the underlying database structures, providing content designers with a simplified data model against which content can be created. Virtual data sources work by introducing a metadata layer that mediates between an administrator-defined, virtual data source and the underlying data sources that contain the physical tables and views. This streamlines the design process by replacing obscure column names with easy-to-understand alternatives and representing complex table joins as a single virtual table.

Administrators can define multiple virtual tables in a single virtual database, each of which draws data from one or more tables within differing data sources. To users, a virtual data source acts as a single database, allowing users to write queries against all tables contained within it, despite the fact that their underlying data resides in different data sources. Virtual data sources also insulate users from database schema changes, allowing database administrators to make changes to the underlying database schemas without affecting existing dashboards, queries, or reports.

Ability to customize the work environment

With QMF, you get all the business intelligence functions you need without sacrificing the ability to customize and tailor that function precisely to your operational needs. Both QMF for TSO and CICS and QMF for Workstation and WebSphere offer the ability to customize product functions and the user's work environment.

Customizing QMF for TSO and CICS

There are many ways to customize functions and preferences in QMF for TSO and CICS. For example, you can:

- Create QMF profiles for individual users or groups of users, which control preferences for printing, query interfaces, and other common QMF functions.

  For more information, see “Personalizing preferences for individual users or groups” on page 48.
- Create procedures and applications tailored to your specific business needs and then customize both QMF commands and function keys to allow users to run those applications.

  See “Tailoring commands and function keys to your business applications” on page 48 for how to customize QMF commands and function keys to run these applications.

  See Chapter 5, “Application development interfaces,” on page 33 for more information on how you can integrate QMF functions into your business applications.

- Use QMF program parameters and global variables both at startup time and in your business applications to customize settings for storage, tracing, operating mode (interactive or batch), and other aspects of the QMF operating environment.

  For more information, see "Customizing the QMF operating environment" on page 49.
- Create your own edit codes for QMF forms. These user-defined codes format the data in ways that are defined by an underlying data formatting routine that you create.

  For more information, see "Creating your own edit codes for formatting QMF reports" on page 49.

You can customize many other QMF functions in addition to those listed above. For more information, see "Customizing other QMF functions" on page 49.

Personalizing preferences for individual users or groups

QMF for TSO and CICS allows you to create QMF profiles for individual users or groups of users. The QMF profile settings specify preferences for the following QMF functions:

- The case in which input is passed to QMF
- Punctuation format for numeric data on reports
- Whether you want confirmation panels to appear to users before database changes are made
- Which query interface will be used by default
- Printer parameters, such as location and size of output
- The default table space or dbspace that will store the results of QMF SAVE DATA commands
- Tracing options that allow you to choose the functions that you want to trace and the level of detail at which you want to trace them

Users can update some fields of their profiles on their own by issuing the SHOW PROFILE command and typing over the values in the profile fields. Other fields, such as those that record which definitions to use for commands and function keys, are protected and can only be updated with an SQL UPDATE statement on the QMF control table that stores profile information.

Tailoring commands and function keys to your business applications

With QMF for TSO and CICS, you can customize commands and function keys to provide seamless integration between the QMF interface and applications specific to your business needs and operations. Customizing commands is as simple as creating a command synonym table in the database, entering execution instructions for those commands into the table, then updating the user's row in the QMF profiles control table to point to the name of the synonyms table.

A command synonym does not have to correspond to a single execution instruction; for example, you might create a command synonym called PRINT that invokes a printing application and routes the output to the appropriate printer with the specified page size and parameters.

After you create command synonyms, you can use the same basic process to assign the synonyms to function keys.

Customizing the QMF operating environment

QMF offers a broad range of global variables that not only record state information about the user's QMF session but allow you to customize and control QMF behavior as well. You can control and check almost any aspect of a user's QMF session using simple commands:

- The SET GLOBAL command allows you to dynamically change aspects of the QMF environment as well as to define your own global variables for use in QMF queries, procedures, and forms.
- The SHOW GLOBALS command displays the current values of all QMF and user-defined global variables.

QMF provides a default system initialization procedure that you can run by itself or within an application. The procedure can be customized to run any QMF command or any stored query that the user is authorized to run, prior to displaying the QMF home panel. You can therefore use this procedure to tailor the QMF session to the operational needs of individual users or groups of users.

A variety of QMF program parameters can also be used to customize QMF behavior, report storage, and aspects of the QMF session. For more information about the program parameters, see *Installing and Managing DB2 QMF for TSO and CICS*.

Creating your own edit codes for formatting QMF reports

QMF for TSO and CICS offers a wide range of edit codes in the QMF form panels to help you format the data in individual columns. If you need additional formatting capability, you also have the option of creating your own edit codes. You create your own edit codes by either customizing the default edit exit routine provided with QMF for TSO and CICS or writing your own routine, which passes information to and from QMF through the edit exit interface control block.

Installing and Managing DB2 QMF for TSO and CICS explains how to create your own edit codes and make them available to users.

Customizing other QMF functions

In addition to profiles, command synonyms, function keys, and edit codes, QMF for TSO and CICS also offers the ability to:

- Use the MESSAGE command to define a message that appears on a QMF object panel when your application ends.
- Use ISPF, GDDM, or another panel manager to do the following tasks:
  - Create application panels that run complex queries and produce customized reports.
  - Create panels that prompt users for necessary information, such as date and type of report wanted, so that a user with very limited knowledge of QMF can easily use QMF's query and report-writing facilities.
  - Create panels to provide your application with online help that is similar to the help that is provided by QMF for TSO and CICS.

Customizing QMF for Workstation and WebSphere

Administrators and content designers can customize the experience for their information consumers in a number of different ways in QMF for Workstation.

Customizing content with unlimited design options

QMF's visual design environment is extremely flexible, allowing users to graphically place charts, selectors, controls, and graphical primitives on the report canvas and embed static content such as text, graphics, hyperlinks, and supporting information (data-driven or static).

With 20 default charts and graphs, over 140 analytical functions, and broad visual palettes of dozens of primitives and other dashboard and report objects, there is much to choose from to accommodate any visual design need.

Designers can nest elements (queries, reports, and dashboards) within each other infinitely, allowing a level of detail that exceeds what would ever be required in an operational environment. QMF's dynamic object properties also provide full control of the data elements, down to the individual items in charts. Designers can also control the appearance and behavior of these items as a function of the data and user interactions.

Customizing workspaces by user or role

Users can create and tailor their own workspaces according to their needs and preferences, then share these workspaces with other users according to an administrator-defined set of security permissions. Additionally, all views can be customized based on user or role. Users can define workgroups and publish reports and other objects just to a particular workgroup.

Customizing dashboard behavior based on security privileges

Dashboards can be personalized by tailoring visibility and behavior of dashboard elements in accordance with the security privileges of the logged-on user.

For example, graphs and charts can be limited to specific users or groups, or fields can be defined as editable by some users or groups, yet read-only for others. Behavior can be modified using simple object property expressions.

For more information about security features in QMF, see “Flexible security models.”

Flexible security models

A very robust function set combined with the ability to easily query and format data calls for a highly flexible set of security features that is robust in its own right. This topic describes the security features available in QMF.

Authentication methods

QMF for Workstation uses the industry-standard LDAP protocol for user authentication. You can secure repository content using LDAP-defined or internally-defined user or group directories. QMF for Workstation also supports Active Directory, Microsoft's implementation of the LDAP directory service model.

In QMF for TSO and CICS, users are authenticated through the user IDs stored in the QMF profiles table. You can configure QMF for open authentication, in which users who don't have specific QMF user IDs in the QMF profiles control table can use QMF under a generic user ID, or restricted authentication, in which the user ID used to log onto QMF must match one of the unique IDs stored in the QMF profiles control table.

Additionally, in QMF for TSO, you can choose to have QMF authenticate users by using their database authorization IDs or their TSO logon IDs.

Administrator-controlled access

The QMF for Workstation interface allows you to make as much or as little viewable and available to your users as you want. For example, you can configure QMF to display only those objects for which the user has the appropriate security privileges or limit the display of a database table to a subset of columns that you want the user to see. Users can create and password-protect their own repositories so that they can navigate and easily manage the objects that they are allowed to access. A full range of security permissions (view, view/edit, and view/edit/delete) can be applied to every object in an object repository, including individual columns. For example, permissions can be configured so that a database table might show all columns to a faculty group, yet only show a subset of the columns to a student user group. A report can be structured so that it hides from the student user group a bar chart with cumulative test scores, yet displays it for members of the faculty.

QMF for TSO and CICS also allows great flexibility for configuring access to objects and data. For example, you can create views on tables that screen out sensitive columns or use the SHARE=NO parameter of the SAVE command to restrict sensitive queries, procedures, and forms. You can issue one or more SQL GRANT statements directly from the SQL query panel to grant select, insert, update, or delete privileges on tables or individual columns.

Security of Web clients

QMF for WebSphere's capability to operate over HTTPS connections ensures that client/server transmissions remain secure in all query, reporting, analysis, and dashboard operations.

Reuse

QMF's emphasis on reuse allows you to deploy a consistent look and feel in reporting across your enterprise when you need it, which saves time and reduces your total cost of ownership.

To allow users to spend more time gaining insight from your business data and less time retrieving, formatting, and presenting that data, the queries that retrieve the data and the specifications you use to format that data can be designed as templates that are applied to the data at run time. You can save these templates to a server for indexing and reuse them in different situations. For example, a query that was designed to output the salary history for the sales team can be reused to display salary history for technical support personnel in a different division. The format of the resulting report is not tightly bound to a given entity; it can be used with entirely different queries that retrieve the same types of data.

To allow for even greater flexibility, substitution variables can be used as placeholders that can be replaced with actual values at run time. You can set substitution variables, whose values are used for a particular SQL query at run time, or global variables, which can be set and then used by several objects (for example, queries, reports, or procedures) for the duration of the entire QMF session. In QMF for Workstation and WebSphere, variable values can be set to be retained between sessions or re-initialized to default values, entirely at the discretion of the content creator or administrator.

Scheduling queries, reports, and procedures

Using QMF for Workstation and WebSphere's built-in job scheduler or an external scheduling facility (such as the built-in Windows scheduling facility or Cron for UNIX and Linux), you can schedule queries, reports, and procedures to run on demand.

In QMF for TSO and CICS, you can use REXX or other application logic to run queries and perform other tasks in QMF batch mode so that resources are kept free during peak hours.

Reports in both QMF for Workstation and WebSphere and QMF for TSO and CICS can be submitted in a variety of ways – on demand, based on a workflow event, according to a predefined schedule, or based on conditional expressions you specify.

Built-in user assistance

Both topic-based and context-sensitive online help are available in all QMF environments. Additionally, wizards in QMF for Workstation and WebSphere guide creation of everything from repositories to individual objects.

Explanations and suggested actions for error messages are available in the online help for QMF for TSO and CICS. For errors associated with database SQL codes, the QMF error message help also displays the contents of the SQL Communications Area (SQLCA) so that you have all the important run-time information you need to help you troubleshoot potential problems.

In all QMF environments, you can optionally install sample tables and queries for use while learning or testing applications so that real-time data on production systems is unaffected by these activities. In addition to sample tables and queries, QMF for Workstation and WebSphere also provide sample reports and dashboards to help users learn how to create these objects. Cheat sheets for key tasks provide step-by-step instructions and make it easy to get started immediately.

All QMF product documentation is accessible from the QMF Version 10 library page in the information center.

Chapter 9. National language support

Global organizations require products that offer multilingual support for all staff to be as productive as possible. QMF for TSO and CICS and QMF for Workstation and WebSphere together support the languages shown in Figure 15.

Figure 15. National languages in which QMF is available

This topic lists the specific languages supported in QMF for TSO and CICS versus QMF for Workstation and WebSphere.

See one of the following subtopics for more information:

- "National language support in QMF for TSO and CICS"
- "National language support in QMF for Workstation and QMF for WebSphere" on page 54

National language support in QMF for TSO and CICS

The software and online help are available in the following languages for QMF in the TSO and CICS environments:

- Brazilian Portuguese
- Danish
- French, Canadian French, and Swiss French
- German and Swiss German
- Italian
- Japanese
- Korean
- Spanish
- Swedish

The QMF for TSO and CICS publications are available in the languages shown below. All English and translated publications are available in the IBM Publications Center in PDF format. They are also available in HTML format in the IBM

Information Management Software for z/OS Solutions Information Center. You can start at the QMF Version 10 library page in the information center to navigate to the information you need.

Table 1. Languages in which the QMF for TSO and CICS publications are available

Publication Title	Brazilian Portuguese	French	German	Japanese	Spanish
Introducing DB2 QMF	X	X	X	X	X
Installing and Managing DB2 QMF for TSO and CICS	X			X	
Using DB2 QMF	X		X	X	X
DB2 QMF Reference	X		X	X	X
Developing DB2 QMF Applications	X			X	
DB2 QMF Messages and Codes	X			X	

For applications that call QMF for TSO and CICS running from an NLF session, bilingual forms and commands are also supported. This feature allows wider portability of forms and applications among the QMF national languages.

National language support in QMF for Workstation and QMF for WebSphere

The software and online help are available in the following languages for QMF in the Workstation and WebSphere environments:

- Arabic
- Brazilian Portuguese
- Czechoslovakian
- Danish
- French, Belgian French, Canadian French, and Swiss French
- German and Swiss German
- Hebrew
- Italian and Swiss Italian
- Japanese
- Korean
- Portuguese
- Spanish
- Swedish
- Traditional Chinese

The QMF for Workstation and WebSphere publications are available in the languages shown below. All English and translated publications are available in the IBM Publications Center in PDF format. They are also available in HTML format in

the IBM Information Management Software for z/OS Solutions Information Center. You can start at the QMF Version 10 library page in the information center to navigate to the information you need.

Table 2. Languages in which the QMF for Workstation and WebSphere publications are available

Publication Title	Arabic	Brazilian Portuguese	French	German	Japanese	Portuguese	Spanish	Traditional Chinese
Introducing DB2 QMF		X	X	X	X		X	
Installing and Managing DB2 QMF for Workstation and DB2 QMF for WebSphere		X	X	X	X	X	X	X
Getting Started with DB2 QMF for Workstation and DB2 QMF for WebSphere	X	X	X	X	X	X	X	X

Appendix A. Accessibility features

Accessibility features help a user who has a physical disability, such as restricted mobility or limited vision, to use a software product successfully. Accessibility features are available in QMF in all of its operating environments.

See one of the following subtopics for more information:

- "QMF for TSO and CICS accessibility features"
- "QMF for Workstation accessibility features"
- "QMF for WebSphere accessibility features" on page 60

QMF for TSO and CICS accessibility features

The accessibility features in QMF for TSO and CICS enable users to:

- Use assistive technologies such as screen readers and screen magnifier software. Consult the assistive technology documentation for specific information when using it to access z/OS interfaces.
- Customize display attributes such as color, contrast, and font size.
- Operate specific or equivalent features by using only the keyboard. Refer to the following publications for information about accessing ISPF interfaces:
  - *z/OS ISPF User's Guide, Volume 1*
  - *z/OS TSO/E Primer*
  - *z/OS TSO/E User's Guide*

  These guides describe how to use ISPF, including the use of keyboard shortcuts or function keys (PF keys), include the default settings for the PF keys, and explain how to modify their functions.

QMF for Workstation accessibility features

This topic describes the accessibility features available in QMF for Workstation.

Standard keyboard equivalents

The keyboard is the most frequently used alternative for performing mouse functions. Keyboard equivalents use keyboard keys to perform mouse actions instead of using a mouse. For example, QMF for Workstation supports the following keyboard equivalents:

- Shortcut, or accelerator keys, to perform the most frequently used functions in pull-down menus without going to the menu. For example:
  - Ctrl+S to save
  - Ctrl+P to print
  - Ctrl+R to run a query

  Shortcuts display in the pull-down menu next to each function.
- Mnemonics, or access keys, are available to perform each function on a menu or dialog box. A mnemonic for a function is the underlined character in the function name and is used in combination with the Alt key to execute the function. For example:
  - Press Alt then F to open the File menu
  - Press Alt then O to open the Open dialog box

For more information, refer to the documentation for your operating system for a complete list of standard keyboard equivalents.

Standard keyboard navigation

Keyboard navigation refers to using keys instead of a mouse to move from item to item on your screen. The movement is usually in the order specified by the operating system or your application.

QMF for Workstation follows the standards with regard to the typical keys used for keyboard navigation, such as using the Tab key and Shift+Tab to move between controls, as well as arrow keys to move up, down, and sideways between items.

Operating system accessibility

Each operating system has a set of accessibility options that enables individuals with disabilities to customize system-wide settings.

QMF for Workstation:

- Inherits settings from the operating system.
- Does not interfere with keyboard accessibility features built into the operating system.

For more information, see the following page:

http://www.ibm.com/able/index.html

Assistive technology products

QMF for Workstation supports assistive technology products, such as screen readers and voice synthesizers.

Note: QMF for Workstation requires special navigation when using a screen reader with query results. See "Keyboard shortcuts QMF for Workstation" for more information.

Keyboard shortcuts QMF for Workstation

Table 3 lists keyboard navigation aids available in QMF for Workstation.

Table 3. Keyboard navigation aids in QMF for Workstation

To...	Do the following...
Obtain online help	Press F1 or Alt+H. **Note:** In online help, use the Tab key to navigate from link to link, then press Enter to open the link.
Add object or condition	1. Press the Tab key to navigate to the pane you need, such as in the Prompted Query dialog box. 2. Press the Tab key again to get to the "Add" icon. 3. Press the spacebar to display the "Add" dialog box.
Select multiple objects	1. Press the Tab key to get to the list box. 2. Press Shift+Arrow to select rows. 3. Press Shift+Enter to add the objects.
View object properties in an object list	1. Select the object from the object list. 2. Press Alt+Enter.

Table 3. Keyboard navigation aids in QMF for Workstation (continued)

To...	Do the following...
Use screen reader for query results - or - Use browser to display query results in high-contrast mode for the visually impaired	Option 1: 1. Run the query. 2. Press Alt+R to open the Results menu. 3. Select **Save to File**. 4. Select HTML file (*.htm) for **Save as type**. 5. Open the *.htm file in browser. Option 2: 1. Run the query. 2. Press Alt+R to open the Results menu. 3. Select **Display Report**. 4. Select the form type. 5. Press **OK**. 6. Press Alt+O to open the Form menu. 7. Select **Convert to HTML form**. 8. Check the **Include tabular data as HTML table** check box. 9. Press **OK**. 10. Press Alt+O to open the Form menu. 11. Select **View in Web browser** Option 3: 1. Run the query. 2. Press Alt+R to open the Results menu. 3. Select **Save to File**. 4. Select CSV file (*.csv) for **Save as type**. 5. Open the *.csv file in Microsoft Explorer or Lotus® 1-2-3®.
Edit (editable) rows in list box	1. Tab to the list box, such as the Global Variables dialog box. 2. Press the spacebar or move the arrow key to select the row. 3. Press F2 to activate edit mode. 4. Use the Tab key to move between columns and rows. 5. Press Enter to accept edits. 6. Press the Tab key to exit the listbox and move to the next control in the dialog.
Edit query results	1. Press Alt+E for the Edit menu. 2. Select **Find**. The Find dialog box opens. 3. Type the search text. 4. Press Enter. 5. Press Esc to close the Find dialog box. 6. Press Enter to edit the cell.
Change font for query results	1. Run the query. 2. Press Ctrl+A to select all. 3. Press Alt+R to display the Results menu. 4. Type F to display the font dialog box.

QMF for WebSphere accessibility features

This topic describes the accessibility features available in QMF for WebSphere.

Standard keyboard navigation

Keyboard navigation refers to using keys instead of a mouse to move from item to item on your screen. The movement is usually in the order specified by the operating system or your application.

QMF for WebSphere follows the standards with regard to the typical keys used for keyboard navigation, such as using the Tab key and Shift+Tab to move between controls, as well as arrow keys to move up, down, and sideways between items.

Operating system accessibility

Your operating system has a set of accessibility options that enables individuals with disabilities to customize system-wide settings to further enhance and improve their ability to use their computers. QMF for WebSphere inherits and does not interfere with the keyboard accessibility features that are set for the operating system.

Assistive technology products

QMF for WebSphere supports assistive technology products, such as screen readers and voice synthesizers, to deliver information in a more accessible manner.

Keyboard shortcuts in QMF for WebSphere

Table 4 lists keyboard navigation aids that are available in QMF for WebSphere.

Table 4. Keyboard navigation aids in QMF for WebSphere

To...	**Do the following...**
Move focus through each element	Press the Tab key to move forward or Shift+Tab to move in the opposite direction.
Emulate clicks on a link	Use the Tab key to navigate from link to link, then press Enter.
Emulate clicks on a button	Use the Tab key to navigate from button to button, then press the key.
Within a dialog, activate the default action	Press Enter.
Within a dialog, cancel the action	Press Esc.
Move focus to the command line	Press Alt+C.
Move focus to the main menu	Press the left Alt key. Navigate through the menu commands using the arrow keys.
Open context menus	Press the **Context menu** key if you have an extended keyboard. You can also press the right Ctrl key to open a context menu. Navigate through the menu commands using the arrow keys.

Appendix B. Product prerequisites, installation and configuration, and ordering information

This topic provides information you will need to take the next step in assessing which QMF edition is right for you.

See one of the following subtopics for more information:

- "Product prerequisites"
- "Installation and configuration information"
- "Ordering QMF"

Product prerequisites

For more information about requirements and prerequisites for storage, memory, hardware, and software to support products in the QMF family, see the appropriate information source below.

- For information about prerequisites for QMF for TSO and CICS, see the program directory, which is available from the following Web page: http://www.ibm.com/software/data/qmf/library.html
- For information about prerequisites for QMF for Workstation or QMF for WebSphere, see Installing and Managing QMF for Workstation and QMF for WebSphere.
- For information about prerequisites for the QMF High Performance Option, see QMF HPO User's Guide for TSO and CICS.

Installation and configuration information

You can find installation and configuration information for QMF in the following publications:

- For QMF for TSO and CICS: *Installing and Managing DB2 QMF for TSO and CICS*
- For QMF for Workstation and QMF for WebSphere: *Installing and Managing QMF for Workstation and QMF for WebSphere*
- For the QMF High Performance Option: *QMF HPO User's Guide for TSO and CICS*

Ordering QMF

All QMF editions are sold as features of DB2, as indicated in the table below.

Table 5. Editions of QMF and the DB2 products with which they are available

QMF edition	DB2 10 for z/OS (5605-DB2)	DB2 Version 9.1 for z/OS (5635-DB2)	DB2 10 for z/OS Value Unit Edition (5697-P31)	DB2 Version 9.1 for z/OS Value Unit Edition (5697-P12)
QMF Version 10 Enterprise Edition	X	X		
QMF Version 10 Classic Edition	X	X		

Table 5. Editions of QMF and the DB2 products with which they are available (continued)

QMF edition	DB2 10 for z/OS (5605-DB2)	DB2 Version 9.1 for z/OS (5635-DB2)	DB2 10 for z/OS Value Unit Edition (5697-P31)	DB2 Version 9.1 for z/OS Value Unit Edition (5697-P12)
QMF Version 10 Enterprise Edition Value Unit Edition (VUE)			X	X
QMF Version 10 Classic Edition Value Unit Edition (VUE)			X	

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