DB2 Query Management Facility

IBM

Introducing DB2 QMF

Version 8 Release 1

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> **Note!**
>
> Before using this information and the product it supports, be sure to read the general information under
> "Notices," on page 53.

First Edition (January 2004)

This edition applies to IBM DB2 Query Management Facility, a feature of Version 8 Release 1 of IBM DB2 Universal
Database Server for z/OS (DB2 UDB for z/OS), 5625–DB2, and to all subsequent releases and modifications until
otherwise indicated in new editions.

Contents

Chapter 1. Overview of QMF™

DB2® Query Management Facility (QMF) is a tightly integrated, powerful, and reliable tool that performs query and reporting for IBM®'s DB2 relational database management system family. It offers an easy-to-learn, interactive interface. Users with little or no data processing experience can easily retrieve, create, update, insert, or delete data that is stored in DB2.

New packaging of DB2 QMF offers simplified selection and pricing to more easily match the on demand information needs of any enterprise, whatever end user and DB2 Universal Database™ platforms may be in use.

- **DB2 QMF Enterprise Edition** DB2 QMF Enterprise Edition provides the entire DB2 QMF family of technologies, enabling enterprise-wide business information across end user and database platforms. It consists of these platforms:
  - DB2 QMF for TSO/CICS®
  - DB2 QMF for Windows®
  - DB2 QMF for WebSphere®
  - DB2 QMF High Performance Option (HPO)
  - DB2 QMF Visionary
- **DB2 QMF Distributed Edition** DB2 QMF Distributed Edition provides components to support end users functioning entirely from Web or Windows clients to access enterprise databases. This edition consists of:
  - DB2 QMF for Windows
  - DB2 QMF for WebSphere
  - DB2 QMF Visionary
- **DB2 QMF Classic Edition** DB2 QMF Classic Edition supports end users who work entirely from traditional mainframe terminals and emulators (including IBM Host on Demand) to access DB2 UDB databases. This edition consists of DB2 QMF for TSO/CICS.

QMF offers a total solution that includes accessing large amounts of data and sharing central repositories of queries and enterprise reports. It also allows you to implement tightly controlled, distributed, or client/server solutions. In addition, you can use QMF to publish reports to the Internet that users can view with their favorite Web browser.

Application developers can use DB2 QMF for TSO/CICS, DB2 QMF for Windows, or DB2 QMF for WebSphere to prototype and build applications

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rapidly. You can even build applications without programming or compiling with DB2 QMF Visionary. Benefits can include higher productivity, increased efficiency, and lower costs.

As companies have taken advantage of the productivity benefits offered through QMF, they have identified the need for performance management tools within the QMF environment. DB2 QMF High Performance Option is provided to enhance performance management and to facilitate the administration of QMF. This set of integrated performance tools consists of QMF HPO/Manager and QMF HPO/Compiler.

QMF Version 8.1 runs on the z/OS® platform. QMF for Windows runs on Microsoft® Windows® 98, ME, NT 4.0, XP, 2000, and Server 2003. QMF for WebSphere runs under any WebSphere Application Server enabled platform.

Users can access a wide variety of data sources with QMF, including operational or warehouse data from many platforms: DB2 UDB for z/OS, Windows, and the Internet. With DB2 Information Integrator™, you can access non-relational data, such as IMS™ and VSAM, as well as data from other vendor platforms.

DB2 QMF for TSO/CICS

DB2 QMF for TSO/CICS Version 8.1 includes significant enhancements:
- Long Auth ID, current SQL ID, and table names up to 128 characters in length is now supported.
- Fully integrated support for the CLOB, BLOB, and DBCLOB large object data types has been added.
- The size of global variables specified on the Set and Get Global commands has been extended from 55 to 2000 characters.
- The installation process has been streamlined; there is less post SMP/E work.

To read about all the enhancements for DB2 QMF for TSO/CICS, see "DB2 QMF for TSO/CICS enhancements" on page 7.

DB2 QMF for Windows

With DB2 QMF for Windows, you can reuse existing QMF host objects (queries, forms, and procedures) or create new objects from the Windows environment. You can also integrate query results with a variety of Windows desktop tools, such as spreadsheets and desktop databases. New in Version 8.1, QMF for Windows features OLAP analytics, and DB2 QMF Visionary for building executive dashboards. For a complete listing of new DB2 QMF for Windows features, see "DB2 QMF for Windows enhancements" on page 8.

DB2 QMF for Windows includes a robust Windows-based API to automate database querying, updating, and report distribution tasks, so that you can centralize control over resource consumption.

DB2 QMF for Windows also supports the following key functions:
- TCP/IP
- SQL - ODBC
- Creating and editing QMF forms and procedures
- Full-screen table editor for updating enterprise data

DB2 QMF for WebSphere

DB2 QMF for WebSphere is the DB2 QMF family's browser-based portal to business information on-demand. Users can connect easily via an intranet or the Internet to share many of the query, reporting, and OLAP functions found in DB2 QMF for Windows. Native support for DB2 UDB security and centralized control over end user permissions help protect database resources. For more information, see "DB2 QMF for WebSphere (new)" on page 10

Performance, administration, and control- DB2 QMF High Performance Option

Database administrators can use the DB2 QMF High Performance Option (HPO) feature as an all-in-one tool to:
- Control resource usage
- Manage QMF objects
- Track object usage
- Delete obsolete objects
- Compile queries and reports into COBOL programs for improved performance

DB2 QMF HPO makes your database information a valuable, well-managed part of your company's assets.

DB2 QMF HPO consists of two major components:
- QMF HPO/Manager
- QMF HPO/Compiler

QMF HPO/Manager

The QMF HPO/Manager consists of a group of functions that improves governing and object management capabilities, including a preemptive governor to analyze QMF queries. The governing capabilities allow you to establish controls that protect production applications, while delivering "on demand" information. Many governing parameters are included:

- Scheduling by time of day or day of week
- Fetching the maximum number of rows
- Allowing and disallowing SQL verbs and QMF commands
- Controlling resource consumption based on the use of QMF commands and SQL statements

QMF HPO/Compiler

The QMF HPO/Compiler lets you convert queries and reports into efficient programs in OS/VS COBOL or COBOL II. This conversion reduces:

- CPU consumption
- DB2 catalog contention
- DB2 Optimizer overhead
- Security concerns, because converted programs use static Structured Query Language (SQL) in place of dynamic SQL

DB2 QMF Visionary

You can create applications that will allow your users to easily access enterprise data, and you do not have to do any programming or compiling. On screen wizards will guide and aid you in creating the applications.

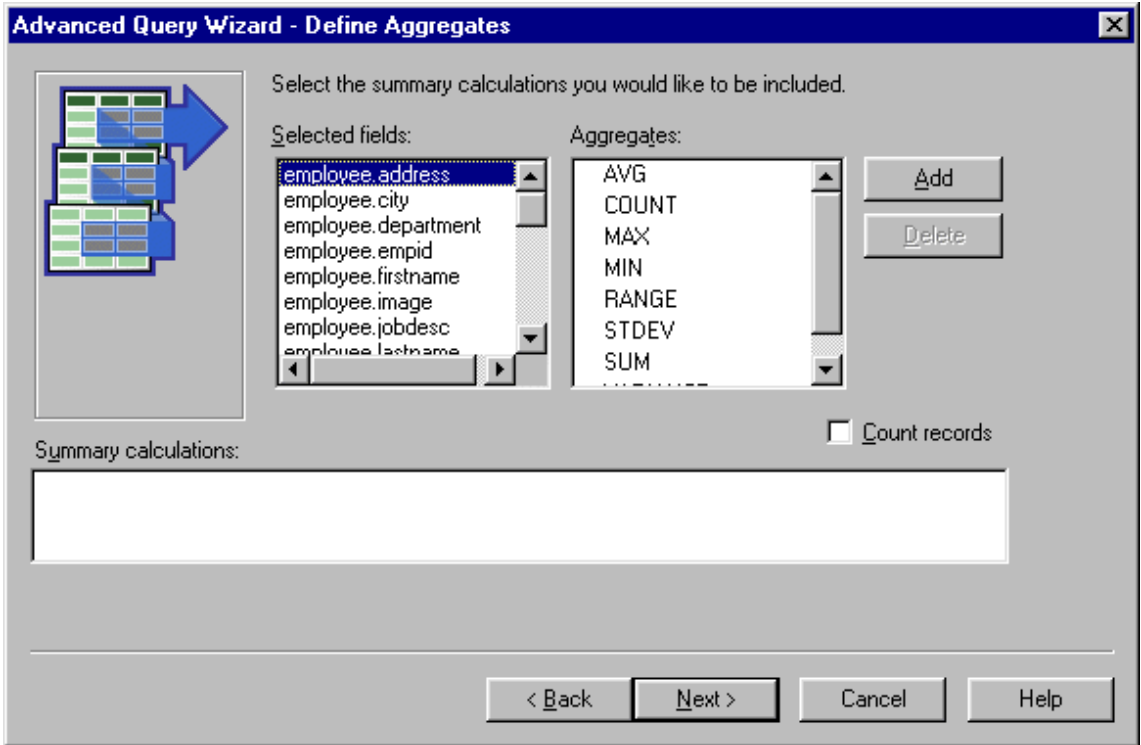*Figure 1. The Advanced Query Wizard - Define Aggregates screen in DB2 QMF Visionary*

DB2 QMF for Windows free 60 day evaluation

When you purchase and install DB2 Universal Database, you can choose to install DB2 QMF for Windows Version 8.1 for a trial period. DB2 QMF for Windows can be downloaded as a free 60-day evaluation from the DB2 QMF Web site: www.ibm.com/software/data/qmf/support.html.

Chapter 2. What's new in DB2 QMF Version 8 Release 1

DB2 QMF has been dramatically enhanced with new data visualization, solution building, Web-enablement, and solution-sharing capabilities.

DB2 QMF Version 8.1 enhancement highlights

The DB2 QMF on-demand platform provides users across the enterprise with:

- Support for the DB2 Universal Database Version 8 functionality including IBM DB2 Cube Views, long names, Unicode, and enhancements to SQL
- The ability to easily build OLAP analytics, SQL queries, pivot tables, and other business analysis and reports with simple drag-and-drop actions
- Visual data appliances such as executive dashboards that offer visually rich interactive functionality and interfaces specific to virtually any type of information request
- A database explorer for easily browsing, identifying, and referencing database assets
- DB2 QMF for WebSphere, a tool that lets any Web browser be a zero-maintenance thin client for visual on-demand access to enterprise DB2 business data
- Simplified packaging for easier ordering

DB2 QMF for TSO/CICS enhancements

DB2 QMF for TSO/CICS now offers these significant enhancements to core functionality including:

User enhancements

- Names up to 128 characters in length are supported for Auth ID, current SQL ID, and table names. Table column names can be up to 30 characters long. Support is based on whatever length the database allows. Support includes larger data-entry fields and the display of names in QMF dialog screens.
- The CALL statement can be issued from the SQL Query panel to run a DB2 stored procedure. Output parameters will be placed in QMF substitution variables defined by the user. Result sets will have all the features of a result set returned from a query.
- Fully integrated support for the CLOB, BLOB and DBCLOB large object data types has been added. LOB data can be displayed in reports from tables containing LOB columns.

- A new edit code 'M' displays the associated column metadata in lieu of column data. Edit code 'M' is the default edit code for LOB data types.
- A new PRINT command option allows users to suppress carriage control characters in the report output format when a print device name is not supplied.
- The size of global variables specified on the Set and Get Global commands has been extended from 55 to 2000 characters.
- The new global variable DSQEC_SP_RS_NUM allows you to specify a particular result set if a DB2 stored procedure returns multiple result sets.
- Several new DB2 UDB for z/OS Version 8 SQLCODES are supported.

Administrator enhancements

- An improved installation process and less post SMP/E installation work
- New global variable DSQEC_CC provides flexibility in setting the CC (carriage control) keyword.

Publication changes: *Installing and Managing DB2 QMF for TSO/CICS* refers only to the z/OS platform. Users should refer to QMF Version 7.2 publications for VM and VSE platform specific information.

DB2 QMF for Windows enhancements

DB2 QMF for Windows now provides significant new data visualization capabilities, as well as many other enhancements including:

Support for IBM DB2 Cube Views Version 8.1
- OLAP analytics are made simple for novices with no knowledge of OLAP.
- Drag and drop actions are supported to create dynamic OLAP reports in minutes and slice, dice, and drill into analytical data.
- You can build multiple levels of summary and drill-down to related data simply by dropping onto a layout.
- You can quickly create multiple viewpoints of data by positioning side dimensions, top dimensions, and measures.
- You can format long complex reports for prining on common office printers.
- You can save reports for centralized sharing with other DB2 QMF for Windows and DB2 QMF for WebSphere users across the enterprise.

A new database explorer

- You can visually navigate and inspect enterprise database assets including database servers, databases, tables, views, queries, reports, and DB2 stored procedures.
- You can instantly analyze object dependencies such as which tables are accessed by a given query.
- You can create customizable folders of favorites for easy navigation to frequently used resources.

New query and report building capabilities with emphasis on visual drag and drop
- A visual query builder displays tables, columns, and SQL in an easy to manage layout.
- You can create new across reports and pivot tables with multiple levels of grouping on the horizontal and vertical axes.
- The layout designer allows for easy manipulation of query results such as rapidly creating derived columns from returned columns.
- Conditional formatting of query results allows for specified values or thresholds to be automatically highlighted with colors or other attributes.

Other enhancements
- SQL Expression Builder updates to support new SQL functions in DB2 UDB for z/OS Version 8
- A new internal expression language for supporting complex conditions, form calculations, and custom definitions; removal of the requirement to install Object REXX
- Support importing and exporting as XML which includes generating a simple XSAL stylesheet (on export) that defines rows and columns
- Support for long names in DB2 UDB for z/OS Version 8.1 and DB2 QMF for TSO/CICS Version 8.1
- Automatic migration or creation of catalogs to support long names (and related operations such as rebinding host variables with increased lengths) which provides for faster transition from prior versions of DB2 QMF and DB2 Universal Database
- Support to non-DB2 data sources as database servers including ODBC-compliant data sources such as spreadsheets, and removal of the requirement for a data source to support a QMF catalog
- A new option to allow users to automatically submit the same user information (ID, password, and account) to each server accessed, eliminating multiple logons wherever user information is the same across servers

- Error explanations that are linked to DB2 error message dialogs, providing users with comprehensive reference sources on any error message encountered
- A common Unicode document file format for exported files, which allows for ANSI and Unicode versions of DB2 QMF for Windows to read documents written by either version, and which enhances the sharing of documents with DB2 QMF for WebSphere
- More flexible administrator distribution of database access privileges publish server definition files (SDFs) via FTP and HTTP, which allows for the ability to administer DB2 QMF for WebSphere usage from the DB2 QMF for Windows Administrator module
- The ability to automatically resissue special register values in SET statements when reconnecting to a database
- A security enhancement that provides administrators with the option to enforce the use of a particular QMF permissions catalog at all times, either on the accessed database server or another database server
- New options that allow query results to display in the native CCSID of the database
- Support for additional DRDA® ACRs

DB2 QMF for WebSphere (new)

DB2 QMF for WebSphere, a completely reengineered version of Web-based data access, is the DB2 QMF family's browser-based portal to business information on-demand. DB2 QMF for WebSphere supports every IBM WebSphere platform and makes Web browsers *zero maintenance* clients for DB2 UDB without plug-ins or special downloads. Users can connect easily via an intranet or the Internet to share many of the query, reporting, and OLAP functions found in DB2 QMF for Windows and DB2 QMF for TSO/CICS. Native support for DB2 UDB security and centralized control over end user permissions help protect database resources.

Features of this new offering include:
- A completely redesigned and enhanced multi document interface with more functionality
- Support for IBM DB2 Cube Views Version 8.1 allowing drag and drop development of OLAP analysis
- Drag and drop grouping and formatting of query results
- Support for QMF prompted queries, QMF form functionality, charting formats, DB2 UDB for z/OS Version 8.1 and DB2 QMF Version 8.1 long names, high-volume, unattended batch reporting, and QMF linear procedures.

- An SQL expression builder similar to the expression builder of DB2 QMF for Windows
- User edit routines written in Java™ that allow task automation, and a Java class API and Web service API for application integration on Web Application Servers
- Administrative and governing functions integrated with the DB2 QMF for Windows Administrator to provide for unified management of both Windows and Web-based users

DB2 QMF Visionary (new)

- You can rapidly build and deploy powerful visual information appliances such as executive dashboards without programming or compiling.
- You can simultaneously display data from multiple sources in intuitive formats and images such as geospatial maps, charts, graphs, stop lights, meters, pick lists, familiar objects, and custom graphics.
- You can provide access to all the data users need for the entire spectrum of job functions or skill levels.

DB2 QMF High Performance Option (HPO) enhancements

- Any environment, application, or client that is capable of launching DB2 stored procedures can now automatically generate DB2 stored procedures.
- Long names are now supported in DB2 UDB for z/OS Version 8 and in the DB2 QMF for TSO/CICS object catalog.

Chapter 3. QMF gives you broad data access

Thousands of companies across many industries have based their business intelligence on QMF. QMF lets you create and share mission-critical business knowledge throughout the enterprise and deploy robust, reliable, and scalable business intelligence. You can access any DB2 data or beyond with DB2 Information Integrator, and integrate it with Windows desktop tools or the Internet. QMF's multi-platform options help you to get the most out of your investment no matter where your data is stored. It does not matter whether your data is operational or informational (data warehouse or data mart).
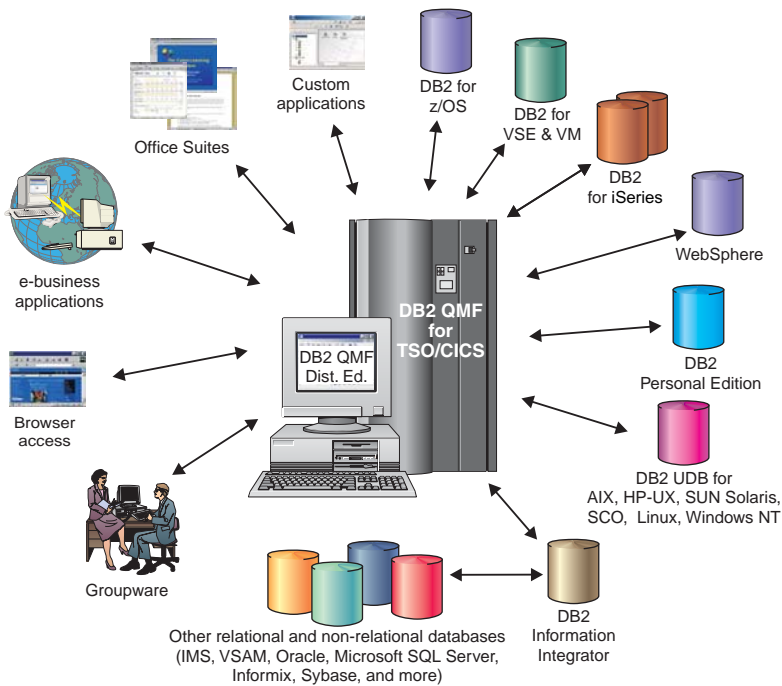

Figure 2. The many sources of data that DB2 QMF for TSO/CICS and DB2 QMF Distributed Edition can access and integrate

Chapter 4. QMF connections to Business Intelligence

QMF works with the following DB2 Business Intelligence solutions:

- DB2 Intelligent Miner Scoring
- DB2 Spatial Extender
- DB2 Warehouse Manager
- DB2 Cube Views

DB2 Cube Views

DB2 Cube Views is the latest generation of OLAP support in DB2 UDB and includes features and functions that make the relational database a first-class platform for managing and deploying multidimensional data across the enterprise. Data architects can provide faster, easier, and more manageable OLAP solutions regardless of the particular OLAP tools and technologies used. OLAP is a core component of BI. OLAP gives users the ability to interrogate data by intuitively navigating from summary to detail data. All OLAP solutions rely on a relational database management system (RDBMS) to source and dynamically query data and to support drill-through reports.

DB2 Cube Views help integrate BI applications with the data warehouse by sharing the metadata between the relational database and business intelligence applications. You can model the data in the warehouse once, and deploy that model with every application.

Version 8.1 of DB2 QMF for Windows and DB2 QMF for WebSphere support DB2 Cube Views. No extensive knowledge of OLAP is required to preform real-time data analysis. You can drag multiple objects onto predefined layouts to quickly create dynamic OLAP reports. You can open existing OLAP queries using the Database Explorer, create new OLAP queries using the OLAP Query Wizard, and work with the OLAP query results using the OLAP Query Results Explorer.

DB2 Spatial Extender

DB2 Spatial Extender is incorporated into DB2 Universal Database. DB2 Spatial Extender enables you to gather spacial data, such as geographic data, and attach non-spatial business data attributes to it. Spatial data can help you with business decisions on:

- Where to open new stores based on potential customers
- What telephone cables to repair first based on frequency of customer calls

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QMF connections to Business Intelligence

- Which communities you should direct your advertising campaign to based on home prices

DB2 QMF for Windows' user interface for spatial maps have these features:
- Spatial maps display in a separate window
- A drop-down menu is available for map objects
- Property and history information can be obtained for map layers
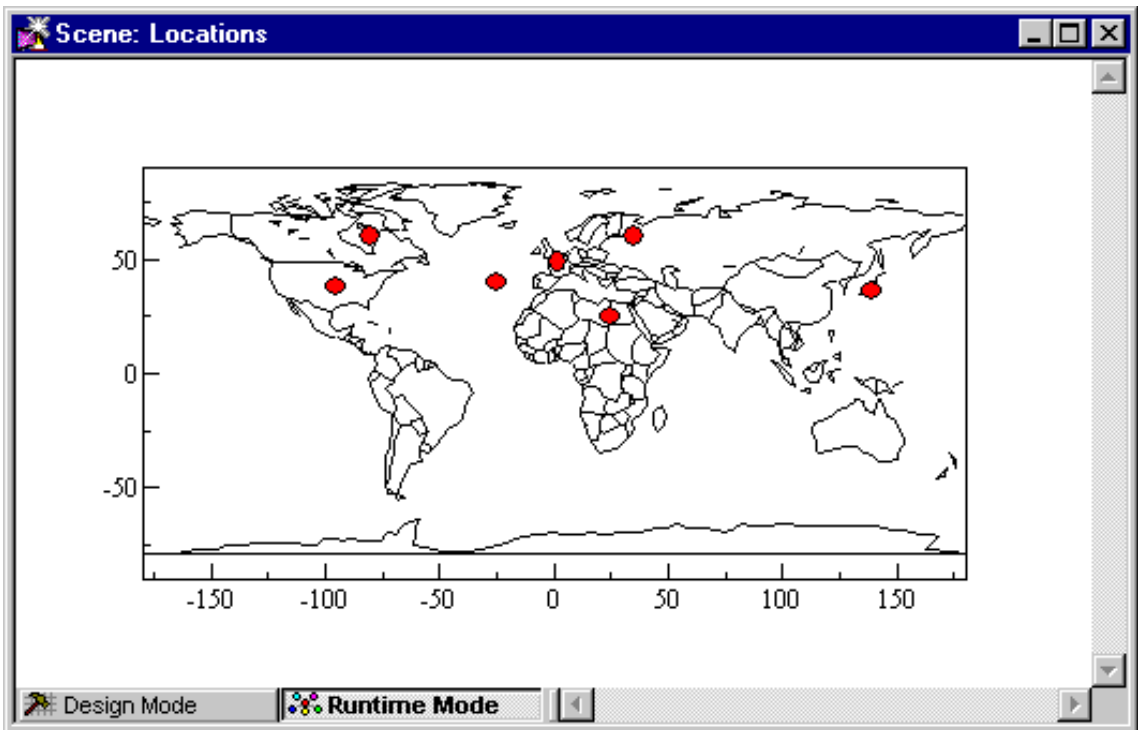- Map icons are available with an informational tooltip

Figure 3. A world map that displays business locations

DB2 Warehouse Manager

DB2 Warehouse Manager provides an infrastructure that helps you build, manage, and access data warehouses. You can integrate other BI tools such as Information Catalog Center and the information catalog, an end-user level metadata repository.

You can register DB2 QMF for Windows objects, such as spreadsheets, reports, and queries, in the DB2 Warehouse Information Catalog. This allows the object to be listed in and launched from the DB2 Warehouse Information Catalog

DB2 Intelligent Miner™ Scoring

You can use Intelligent Miner Scoring functions to import certain types of mining modules into a DB2 table, apply the models to data within DB2, and receive scoring results. DB2 QMF for Windows provides these Intelligent Miner Scoring functions:

- Q.PredictClusterID
- Q.PredictClusConf
- Q.PredictClusScore
- Q.PredictClass
- Q.PredictClassConf
- Q.PredictValue

For more information on DB2 Intelligent Miner, see *Using DB2 Intelligent Miner for Data*.

The example below shows a simple query that uses IM Scoring:

```
SELECT A.Name
       Q.PredictClass('DemoBanking',
              REX2XML(2,'COLATTVAL',",
                     A.Type, A.Age, A.Siblings, A.Income)
              ) As RiskClass
FROM BankCustomers A
```

This query refers to the arbitrary table, BankCustomers, which contains information about customers of a bank. For each customer, the scoring function computes a value that might be a classification of credit risk. This prediction is implemented by the scoring function Q.PredictClass. The first argument, DemoBanking, is the name of a mining module. The second argument is the input data, constructed by REC2XML.

The query results contain simple values such as:

Table 1. Sample IM Scoring query results

Name	Risk class
Joe Padeni	high
Susan Sztuba	high
Callie Atchue	low

The Q.PredictClass function returns a VARCHAR. In the example, it produces

a high or low value. A mining model contains the patterns and formulas needed to predict clusters, classes, or numeric values. These patterns are read by the user defined function in order to compute predictions.

Chapter 5. QMF provides results in four easy steps

QMF gets the data that you need from a relational database and presents it in an effective report or chart. As shown in the illustration below, data access and presentation are simple with QMF objects. After you format your data as desired, you can browse or print it.

4. Browse/Print formatted data

3. Customize the format of the data

2. Database obtains the answer set

1. Build and save your question

Report

Form

Query

Data

Web

Chart
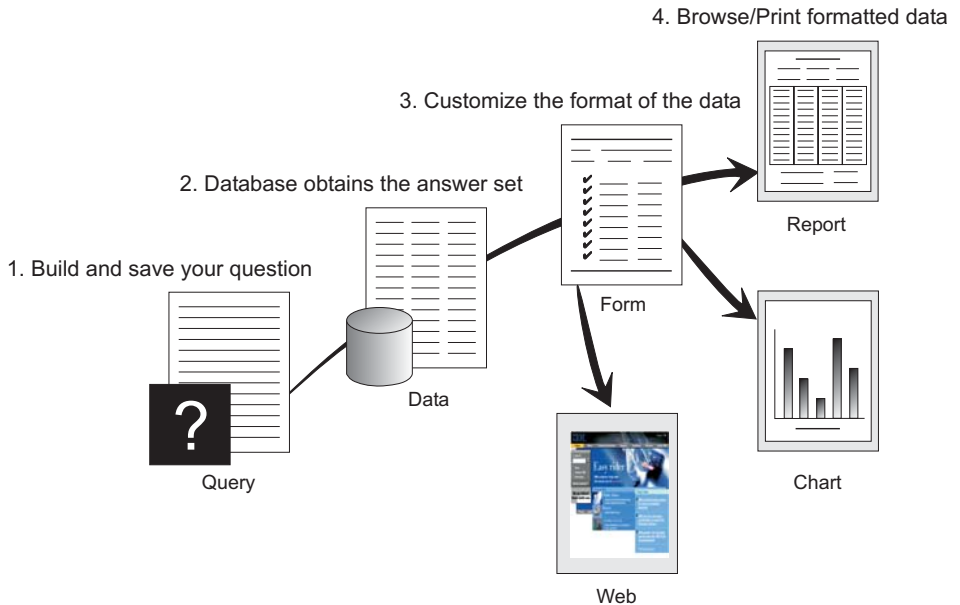
(1) When you need information from your database, build and save your question in a QMF query. Your query acts as a request to the database to get specific information. (2) QMF sends the query to the database in structured query language (SQL), and the database creates the answer set. (3) QMF uses a default report format so that you can see the results quickly. To see the data in a more tailored format, you can use various form specifications to customize your report. (4) You can then browse, print, chart, or export the formatted results. Or, you can include the results in your own custom application.

Chapter 6. QMF offers different query styles

QMF offers three different query styles: OLAP, Prompted Query, and SQL:

OLAP query

OLAP queries are multidimensional queries that slice, dice, and rotate information. These queries augment or replace more complicated, relational queries. In DB2 QMF for Windows, there is an OLAP Query Wizard that can help you build OLAP queries.

At the QMF for Windows main window, select **File**, **New**, **OLAP query** to open the QLAP Query Wizard. Use the wizard to:

- Select a server
- Specify cube filtering criteria
- Select a cube
- Lay out and modify the OLAP query

When the wizard closes, the OLAP window layout opens:

Table 2. OLAP window layout

Object explorer	Layout designer	Query results grid
The object explorer pane, on the left, lists the columns, dimensions, and measures defined for the cube.	The layout designer dialog box is a palette onto which you can: • Drag columns from the object explorer • Select a column for the top group (ACROSS row) • Select a column for the side group (GROUP or AGGREGATION rows) • Modify the layout of the OLAP query interactively by dragging columns to and from the object explorer to the layout designer. These columns contain no data.	The OLAP query results grid is uploaded interactively from changes made with the layout designer. The OLAP query results grid contains the data columns selected for the OLAP query in the order determined by the layout designer.

Prompted Query

An easy-to-use query method that prompts you for the necessary information while building a query. The illustration below shows a partial QMF prompted 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 you need and checks to ensure that the statement you build is valid.

You can use the Show SQL function key from the Prompted Query panel to see the equivalent of your prompted query in SQL. Show SQL is an easy way to learn SQL. In addition, you can build a prompted query and convert it to SQL with the QMF CONVERT command. After you convert a prompted query to SQL, you can choose to add additional SQL capabilities.

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

Structured Query Language (SQL)

A language that describes your requests for data in the database.

SQL statements consist of verbs and clauses that describe aspects of the data request in more detail. If you are already familiar with SQL, QMF makes it easy for you to issue SQL statements to the database by using the SQL Query panel. You can issue any dynamic SQL statement from the query panel. The DRAW command displays model or prototype SELECT, INSERT, or UPDATE queries. You can build on these queries if you do not know the exact syntax of an SQL statement.

The illustrations below show a simple query and a complex query.

Simple SQL Query

```
SQL Query                              MODIFIED  LINE    1

 SELECT NAME, YEARS, SALARY
   FROM Q.STAFF
   ORDER BY NAME
```

Complex SQL Query

```
SQL Query                              MODIFIED  LINE    1

 (SELECT ID, NAME, SALARY
    FROM Q.STAFF
    WHERE SALARY>12000
UNION ALL
SELECT ID, NAME, SALARY
    FROM Q.STAFF
    WHERE DEPT=38)
UNION
SELECT ID, NAME, SALARY
    FROM Q.STAFF
    WHERE JOB='SALES'
```

Chapter 7. QMF creates reports and charts to fit many business needs

Use QMF to present your data effectively and quickly in a wide variety of reports and charts. QMF provides extensive control over how you place or present your data.

QMF for Windows

QMF for Windows Version 8.1 includes a Report Wizard which opens when you have query results in the active window. The Report Wizard helps you find the dialogs that you need to create a classic or visual report. Classic reports are character based reports that are created using forms. Visual reports contain graphics and formatted text using layout templates.

Table 3. QMF for Windows Report Wizard

Field	Description
Report Wizard Type page	• Select Create a new report to create a new classic or visual report. The Report Wizard New Report page opens. • Select Use an existing report stored at a server to open an existing report that has been saved at the database server. The Report Wizard Open from Server page pens. • Select Use an existing report stored at a file to open an existing report that has been stored in a file. The Report Wizard Open from file page opens.
Report Wizard New Report page	• Select Create a visual report to create a new visual report. Specify whether the new report will be generated using the formatting that has been applied to the current query results or very basic, default formatting. The report opens in the Visual Report window. • Select Create a classic report to create a new classic report. Specify whether the new report will be generated using the formatting that has been applied to the current query results or very basic, default formatting The report opens.

Table 3. QMF for Windows Report Wizard (continued)

Field	Description
Report Wizard Open from Server	Specify the database server, the owner, and the name of the visual report or a form for at traditional report that you want to open. You can use the List button to search the database to see a list of the visual reports or forms that are on the database server.
Report Wizard Open from file	Specify the name of the file or use the Browse button to search for the file.

QMF Report Center

QMF Report Center is a user interface that launches centrally shared queries and QMF reports and sends the results to spreadsheets, desktop databases, and browsers. It is installed along with QMF for Windows and QMF for Windows Administrator.

Important QMF Report Center features are:

- Queries and reports can be stored and run against multiple DB2 UDB database servers
- Lists of favorite reports can be created and sent to the Favorites folders on your desktop
- Administrators can set governing limits to restrict users from running large reports at specific times, and can control access to queries and reports to control distribution

QMF for WebSphere

Users can connect easily via an intranet or the Internet to share the query, reporting, and OLAP functions found in QMF for Windows. With the database explorer, you can navigate and inspect enterprise database assets including database servers, databases, tables, views, queries, reports, and DB2 stored procedures. You can also create folders of favorites for easy navigation to frequently used resources.
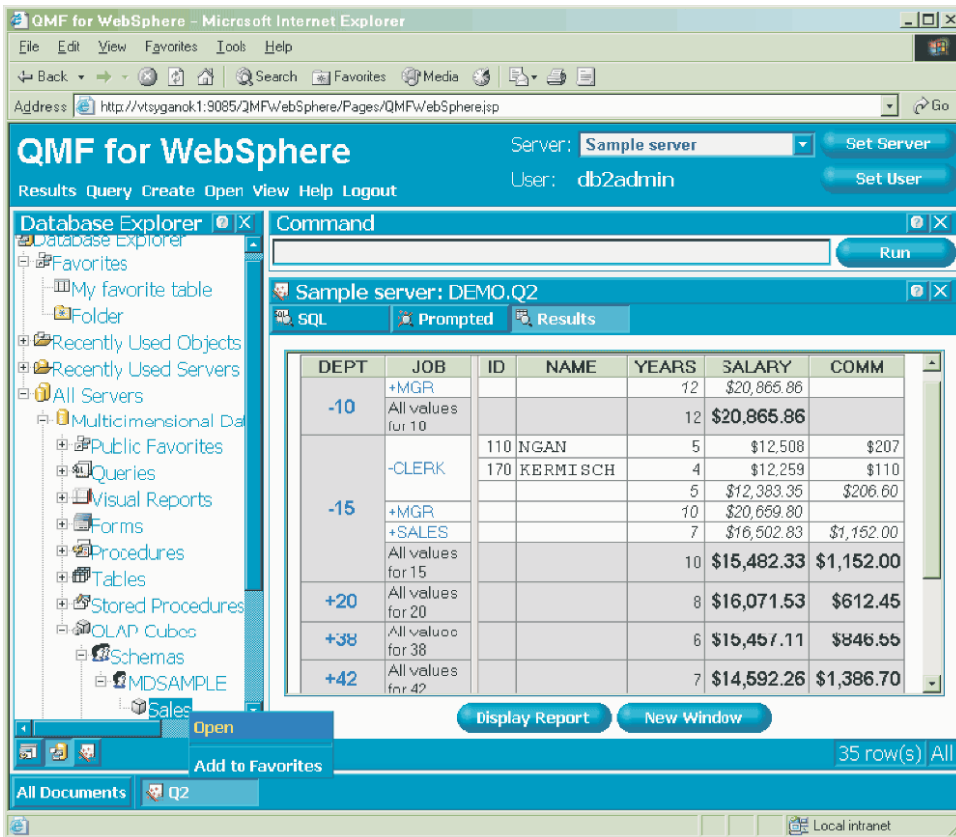
Figure 4. Database Explorer in DB2 QMF for WebSphere showing QMF objects that reside on the database server, Sample server

Reports on the Internet

You can specify HTML output for reports that you create with QMF. This allows you to display your reports in an HTML compatible web browser either in an intranet or on the Internet. QMF adds an HTML header and inserts tags to display the report in its original QMF format in the web browser. HTML reports are most useful when working with LOB data. In QMF for Windows, you can export a LOB as a bitmap, then save it as an HTML file in the Export Data dialog box. The .htm file can be displayed as an HTML address for HTML reports and web pages.

TSO/CICS reports

QMF lets you determine what is important for your reports and gives you the
capability to format it the way you want. A sample of a report that you can
produce using the form function in QMF is shown below.

```
   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


                             COMPANY NAME
```

Customized reports

Creating custom reports with QMF is easy; you can start with a template
report that has default column headings and a tabular layout. Tailor the
default report with QMF forms that control different detail areas of the report.

Using QMF forms, you can do the following tasks:
- Group information into categories
- Generate summary columns
- Add page headings and footings
- Change column headings
- Perform calculations on your data and display the results
- Display data as freeform text
- Place tabular data from one row on more than one line
- Combine text lines with tabular data
- Produce address labels, form letters, and detailed reports

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

You can save the form for future use, or as a prototype for creating another
report; just save the report under a new name.

The following example shows a typical QMF report form.

Entry areas A through J correspond to the entry areas on the
FORM.MAIN panel in QMF. If all the columns in the form are not visible on
the panel, you can scroll forward and backward to see the ones 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
```

With these entry areas, you can do the following:
A Assign column headings
B Choose how to process columns
C Adjust indentation of columns
D Adjust width of columns
E Specify formatting of columns
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 the control column
   changes
J Specify the formatting of repeated values within a control break

Charts for success

Query results can be displayed in a graphical format using Lotus 1-2-3 or Microsoft Excel in charts or viewed in a browser. The Java charting component is installed with QMF for Windows, QMF for WebSphere, and QMF Visionary; however, Lotus 1-2-3 or Microsoft Excel must be installed separately in order to display charts.
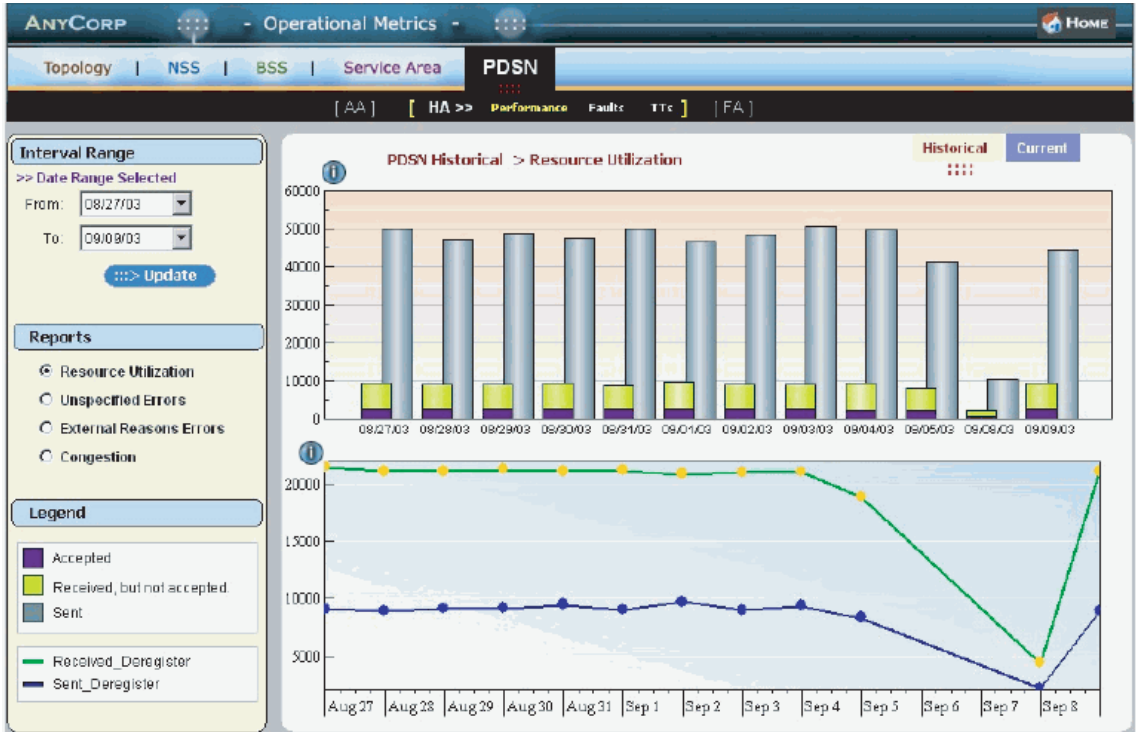

Figure 5. A dual graph report created in QMF Visionary for an executive briefing

QMF for TSO/CICS

You can use IBM's Graphical Data Display Manager (GDDM) and Interactive Chart Utility (ICU) for presenting your data in these charts and graphs in QMF for TSO/CICS:

- Bar
- Pie
- Line
- Tower
- Polar
- Histogram
- Surface
- Scatter

Here is a sample chart that you can define and produce using QMF:
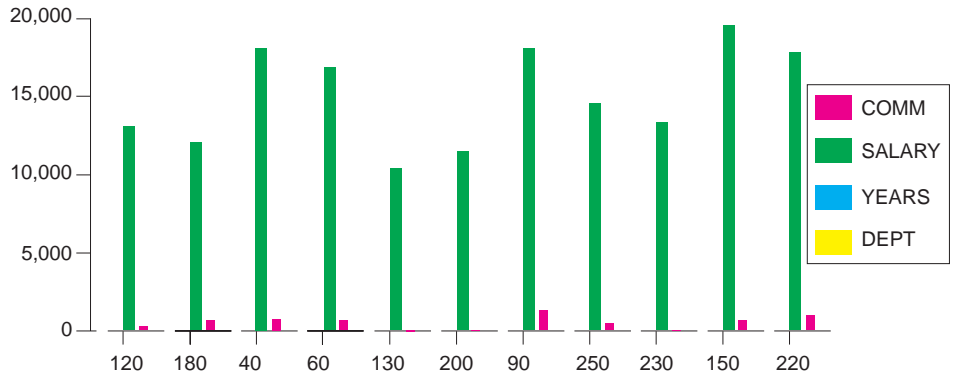
DB2 QMF for WebSphere

DB2 QMF for WebSphere is a browser-based portal to business information on demand. DB2 QMF for WebSphere supports every IBM WebSphere platform and makes Web browsers zero-maintenance thin clients for on demand access to enterprise DB2 UDB data. Users can easily connect via an intranet or the Internet to share many of the query, reporting, and OLAP functions found in DB2 QMF for Windows and DB2 QMF for TSO/CICS.

Creating a chart is easy. After running your query or procedure, select **Results--> Display Chart**. The Chart Options dialog box opens. Select Java, Lotus 1-2-3, or Microsoft Excel from the Application drop-down menu. Then, select the type of spreadsheet to create, for example, area, bar, column, line, pie, or scatter. Select a source, define your chart's attributes, click OK, and the exported chart data displays in a browser or spreadsheet application.
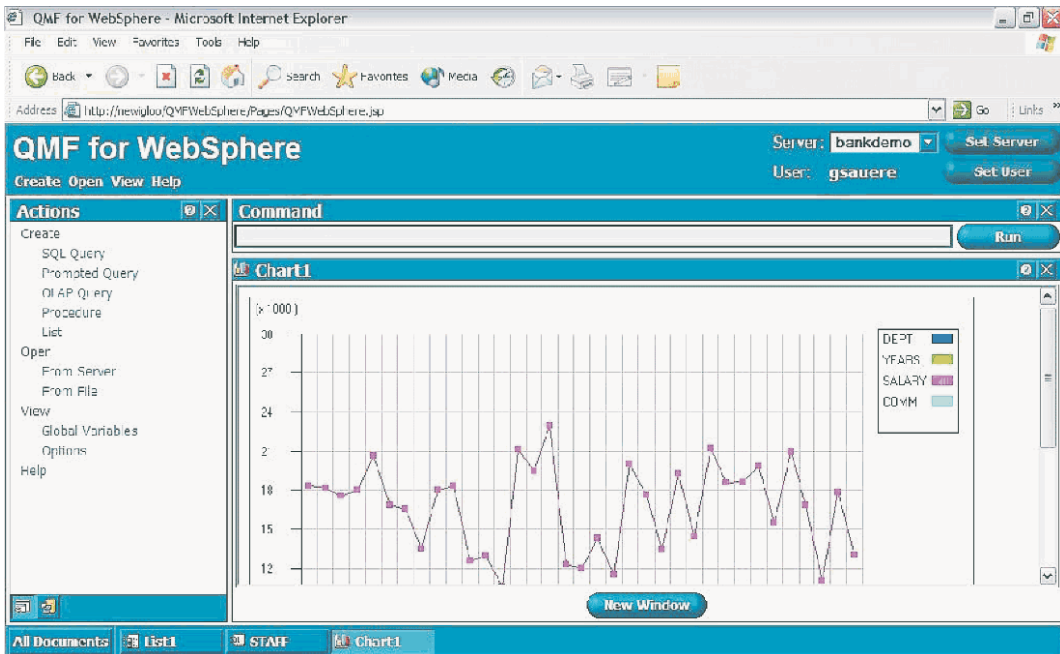
Figure 6. A QMF for WebSphere line chart displayed in a browser

Chapter 8. QMF extends its power to your applications

QMF provides two interfaces, a command interface and a callable interface, that allow you to integrate QMF functions into your existing applications. You can build sophisticated application suites by using the callable interface and a variety of supported programming languages.

Command interface

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

Callable interface

The callable interface lets you integrate QMF functions by using different programming languages or ISPF. The languages you can use include COBOL, PL/I, REXX, C, RPG, and Assembler H.

Using REXX in QMF

For more robust programming needs, use the simple, but powerful, REXX programming language. QMF supports REXX in the z/OS environments. REXX is an interpreted programming language. It runs immediately without compilation, and is directly available from within QMF forms and procedures. Outside QMF, applications written in REXX can use QMF's query and report-writing function through the callable interface.

QMF does not need to be running when a REXX program is started; a REXX program can initiate a QMF session through the callable interface. By directing commands to QMF for execution, a REXX program can run queries, create reports, export and import data, or start an interactive table editing session with QMF's Table Editor. A REXX program can end the QMF session and continue processing the information. Using the callable interface, you can also start an application while you are running QMF. Your application can run QMF commands, queries, or procedures and retrieve the results. For example, your application can generate a letter to each employee that is based on a combination of job type and years of service.

ObjectREXX

IBM ObjectREXX (Restructured Extended Executor) is an interpreted script language (programming language) developed by IBM, which is available for the mainframe and Windows environments. It is designed for ease of learning

and use and to make programming accessible to non-programmers. It offers powerful character-manipulation, automatic data typing, manipulation of words, numbers, and names, and debugging capabilities.

In QMF for Windows procedures, IBM ObjectREXX (ObjectReXX) handles simple and complex calculations, logic, column definitions, detail variations, and conditions.

ObjectREXX functions have the following syntax:

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

where *0* to *n* expression arguments can exist (*n* is the maximum number of comma-separated expressions allowed by ObjectREXX).

Creating QMF procedures

Linear procedures and procedures with logic are two ways to run a series of instructions in QMF. Linear procedures contain only QMF commands. Procedures with logic use the full power of REXX within the QMF environment.

Following is an example of a QMF procedure that contains REXX statements.

```
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 ***
```

You can create procedures with logic that include any REXX command or function and make calls to the operating system or other available environments. In a procedure with logic, you can perform conditional logic, make calculations, or pass commands back to the host environment. You can even include both QMF and REXX variables, so you can change the behavior of your procedure without rewriting it. Assign new values to the variables by

entering values from the RUN command when the procedure is started, or by prompting the user for input values using REXX Say and Pull statements.

The QMF procedure object helps you automate common tasks. A QMF procedure can contain many different QMF commands. You can run all of the commands in sequence by issuing the RUN PROC command.

Users can be prompted for variable data while running a procedure to customize the results.

Suppose that you need the same type of information or report each week. You can create and save a procedure that uses saved queries, forms, and procedures repeatedly. Or, you can substitute variables to make variations for different results. To make things easier and increase productivity, you can customize a function key to run a procedure with a keystroke.

QMF provides a special procedure that is called a system initialization procedure. It allows you to customize default values that QMF uses and run commands or other procedures automatically when QMF starts up. You can include any QMF command in the system initialization procedure.

In QMF Version 8.1, you can develop stored procedures to run from QMF. QMF provides a stored procedure environment through the DB2 QMF High Performance Option (HPO) feature. See *Using DB2 QMF* for information on how to develop the stored procedures to run from QMF.

Customizing QMF commands and function keys

Within applications you develop using QMF, you can customize the QMF command set and function keys to suit the needs of your application users. You can store customized commands and function keys for individual users in their profiles.

QMF's powerful command synonym function allows you to rename QMF commands and create your own installation-specific commands to suit your specific needs. A user with several different printers in his installation must specify the printer name, length and width of the page, and other parameters each time he needs to print a report or chart. Using QMF, he can create a command synonym called PRINT that invokes the proper printing application and routes the output to the appropriate printer with the specified page size and parameters.

Customizing other QMF functions

The ability to customize does not stop at commands and function keys. You can also customize the following functions:

- Change edit codes to format data
- 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 the user 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

QMF provides a default governor exit routine that limits processor use for a query, as well as the number of rows that are returned from the database. You can replace this default governor exit routine with your own customized routines to control resource utilization or to gather QMF usage information. You can use the QMF HPO/Manager feature for a sophisticated system that includes the following features:

- An object manager and governor to track and control QMF session activity
- An online monitor that tracks QMF activities in real time
- A query analyzer
- A preemptive governor

Using variables in queries and forms

Variables allow you to produce a variety of reports using the same form. A query can also use variables to retrieve or change different data each time the same query is run.

A variable is a symbolic name that represents values in a query, form, or procedure. QMF offers two types of variables: substitution variables and global variables. You can use both types of variables in queries, forms, and procedures.

Substitution variables keep their values only for the duration of a command; global variables keep their values for the duration of a QMF session.

Chapter 9. QMF's Table Editor makes database updates easy

The Table Editor is available in DB2 QMF for TSO/CICS and in DB2 QMF for Windows.

You can easily search the database for information and add or update data in the database by using the QMF interactive Table Editor. The Table Editor has three modes: SEARCH, ADD, or CHANGE.

The Table Editor enables quick searching, adding, deleting, and updating of rows in any accessible table without requiring you to write a unique application. The Table Editor also supports default column values when a default is available. The following screen shows a representative panel.

```
ADD                   USERID.PERS

                                                      1 to 7 of 7
ACCTNO. . . . . . . . (_15002__)
COMPANY . . . . . . . (_S & J Supply Co._____)
STREET. . . . . . . . (_948 C Street_____)
CITY. . . . . . . . . (_Boston_____)
STATE . . . . . . . . (_MA_)
ZIP . . . . . . . . . (_06000__)
NOTES . . . . . . . . (_-_____>
```

Editing data is as easy as typing over the values on the Table Editor panel. Confirmation panels help ensure security and integrity by prompting the user before making any updates final. For extra security, you can also use column-level authorization to control exactly which columns of a table a user can view or change.

In QMF for Windows, you can edit a table at a database server by making changes to cells displayed in query results. QMF for Windows determines the table to edit from the SQL text for the query. You can update the results of most queries that you can run with QMF for Windows.

Chapter 10. QMF provides user profiles and online help

This chapter tells you to how to personalize your QMF profile and system initialization procedure, and display online help.

Personalizing your QMF profile and your system initialization procedure

You can personalize your own QMF profile with individual preferences for working with QMF. For example, you can choose whether you want QMF to convert all input to uppercase letters, and you can specify which language, SQL, QBE, or PROMPTED, you want to use. You can also specify a printer name with print parameters for printing reports and charts.

QMF provides a system initialization procedure to allow system administrators to set QMF global variables and run QMF commands at start up. You can override the global settings that are defined in this procedure at any time.

Using Help

The online help provided from any QMF panel provides information to support QMF.

From the main help menu, you can choose topics such as *What's New, Learning about QMF, QMF Commands*, and more. There is no need for additional training. A new user can use *Learning about QMF* as a training tool to get up and running quickly, or as a reference during a QMF session.

QMF also provides messages and help for SQL codes, which includes both an explanation of the message and a recommended user response.

Chapter 11. QMF provides performance and administration features

QMF supports your performance management needs and provides features that help you manage and control your QMF query environment.

QMF's governor exit controls the number of rows returned from the database. The governor exit routine supplied for CICS (DSQUEGV3) controls how many rows a user can retrieve from the database. The governor exit routine supplied for TSO, ISPF, and native z/OS (DSQUEGV1) controls how many rows a user can retrieve from the database or the processor time used running a QMF command.

The DB2 QMF High Performance Option (HPO) feature builds on QMF's performance and QMF control capabilities.

DB2 QMF for Windows manages your queries from the Windows environment, DB2 QMF for WebSphere provides on demand access from an intranet or the Internet, and DB2 QMF HPO/Manager controls queries from the TSO/CICS environment.

QMF HPO/Manager

QMF HPO/Manager is a family of utilities for managing and administering QMF. The QMF HPO/Manager comprises these integrated components:
- Governor Module
- Activity Log
- Online Facilities

Governor Module

This completely replaces the QMF sample governor and is the direct interface into 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 now produce lists of QMF objects that are based on the content of the object. Object Manager has a new list filter that allows you to locate queries that contain references to

specific table names, column names, SQL verbs, and so on. Object Manager supports the migration and copying of objects to and from and QMF Version 8.1 It recognizes and appropriately handles the new columns in the OBJECT_DIRECTORY.

All Q.PROFILES environment values are supported, including CICS/MVS and CICS/VSE and CMS.

Governor

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

Monitor

The monitor supplies a real-time user interface to QMF session activity information. It accepts administrator commands and passes them to the Governor Module.

Query analyzer

The query analyzer provides preemptive governing capabilities. It traps queries before DB2 processes them, and estimates their resource consumption. Query Analyzer can cancel queries that it judges 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 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 objects by using the Object Manager 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 below) 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
- -------- -------- --- -------- ----------------- ---------- ----------- - -
  96/09/02 07:47:52 BEG                                    0              0
  96/09/02 07:47:52 RUN VNDRSTRW MODELING                 0              0
  96/09/02 07:48:01 *** VNDRSTRW MODELING               100 00 00 00 23 0 Y
  96/09/02 07:48:01 *** VNDRSTRW MODELING              1733 00 00 03 69 0
  96/09/02 07:48:01 *** VNDRSTRW MODELING              3330 00:00:07:20 0
****************************** BOTTOM OF DATA ******************************
```

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 with database activity.

QMF HPO/Compiler

QMF HPO/Compiler is a family of system utilities for generating, preparing, and running report programs for QMF. The QMF HPO/Compiler performs these tasks:

- The HPO/Compiler 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 OS/VS COBOL and VS COBOL II 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 Common Server 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, the end user is prompted to supply any run-time variable values. If the report is to 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.

QMF for Windows

QMF for Windows resource limits are checked before a query leaves the workstation. The query never reaches a database server for evaluation if a resource limit is violated. There are some QMF for Windows resource limits that are invoked after the query is running, such as rows returned, or database sever timeouts. QMF for Windows resource limits do not overrule any database sever specifications.l There are four steps to setting up QMF for Windows governing:

1. Create a resource limits group
2. Create a schedule that identifies when the resource limits specified for the group will be in effect
3. Specify the individual resource limits that will be effect during the schedule
4. Assign users to the resource limits group

User profiles are part of QMF for Windows governing, the feature that helps you manage database server resource consumption. User profiles are used in conjunction with resource limits to control a user access to a database server. When a user connects to a database server, QMF for Windows (or QMF for WebSphere or QMF Report Center) locates the correct user profile for a user ID, versifies their enrollment status, and determines which resource limits group to use.

QMF for WebSphere

QMF for WebSphere Administrator is used to perform various administrative tasks for QMF for WebSphere users. The tasks that can be performed using QMF for WebSphere Administrator are:

- Select a server definition file
- Set user information for connecting to a database server
- Test a database server connection
- Install and uninstall packages
- Grant and revoke permissions to use packages
- Edit the servlet properties file
- Backup or restore your configuration

Chapter 12. QMF accommodates your international business needs

QMF can accommodate business needs distributed all over the world. There are 19 languages from which you can choose (see the map below). The number of national languages you can select depends on the platform under which you are running QMF. Each language is a separately-orderable feature called a National Language Feature, or NLF. An NLF enables users to enter QMF commands, view help and other information, and perform QMF tasks in a language other than English.

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

In a QMF NLF session, you can choose to save or export a form in either the language of the current QMF session or in English. A QMF session running in another national language can import a form that was saved in English. QMF translates the form into the presiding language of that session. QMF supports the double-byte character set.

Regardless of the presiding NLF language, you can issue QMF commands in English by setting the QMF command language global variable. This global variable acts as a switch that lets you issue commands either in the presiding language of the QMF session that you are running or in English.
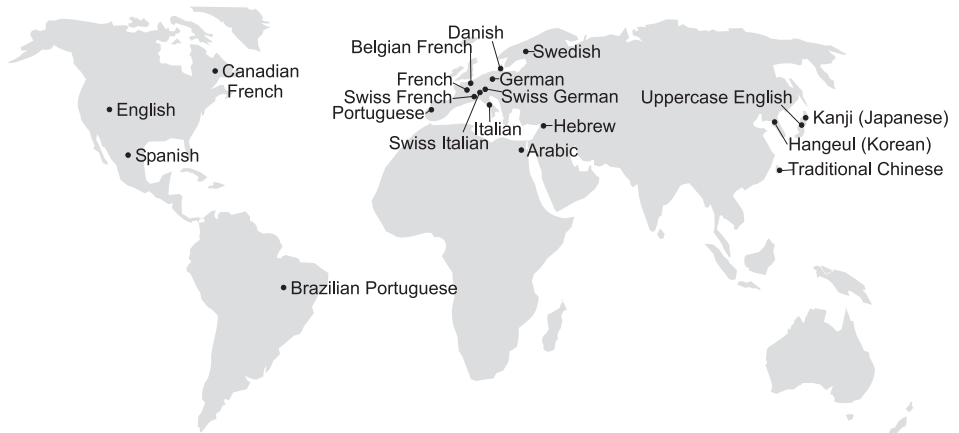
Chapter 13. Product specifications

The following are minimum requirements for supporting QMF and its family of products. For further information, please contact your IBM representative or the IBM Support Service Center (toll-free) at 1-800-237-5511 in the United States or any of its territories.

Prerequisite knowledge

Using DB2 QMF contains basic QMF information; you should understand the concepts in that guide before you use QMF. *Using DB2 QMF* contains the necessary steps to get started with QMF and descriptions of how to use SQL queries. It contains detailed scenarios that show you how to build queries and forms, and it contains detailed information about Query-By-Example.

Machine requirements

Server hardware requirements are the same as the requirements needed to run DB2 Information Integrator, or DB2 Universal Database.

Workstation hardware requirements are the same as the requirements needed to run the Windows software as described in "Software requirements" on page 50.

DB2 QMF for Windows and DB2 QMF for WebSphere for DB2 workstation databases requires approximately 10 MB of free disk space on each Windows workstation, a minimum of 64 MB of RAM, and a 386- or higher processor.

DASD or tape

QMF for TSO/CICS can access all storage devices that the operating system and DB2 support.

Data communications devices

QMF for TSO/CICS can display on all terminals that GDDM supports.

Virtual storage considerations

Storage requirements vary depending on the operating environment. See the Program Directory for DB2 QMF, or consult your IBM representative for hardware and software requirements.

Software requirements

Prerequisite products for supporting QMF vary by operating system. Your IBM representative can help you determine if you have the correct hardware and software to support QMF and related IBM products.

QMF for Windows runs on:
- Microsoft Windows 98
- Microsoft Windows NT 4.0
- Microsoft Windows 2000
- Microsoft Windows ME
- Microsoft WIndows XP
- Microsoft WIndows Server 2003

Operating environment for DB2 QMF HPO features

The QMF HPO/Compiler for z/OS runs only under TSO/ISPF, but generates programs that run under TSO/ISPF, batch, or CICS.

The QMF HPO/Manager for z/OS runs only under TSO/ISPF (with the exception of the enhanced Governor Module supplied with the feature, which runs under TSO/ISPF, batch, or CICS). See your IBM representative for specific recommendations on using QMF HPO/Manager.

Chapter 14. Customer service and technical support

Central service for QMF and its features is provided through the IBM Support Service Center. The toll-free numbers are 1-800-237-5511 and 1-800-IBM-4YOU in the United States or any of its territories.

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Printed in USA