



Evaluation Guide

Integration Between Microsoft SQL Server 2008 and IBM® i

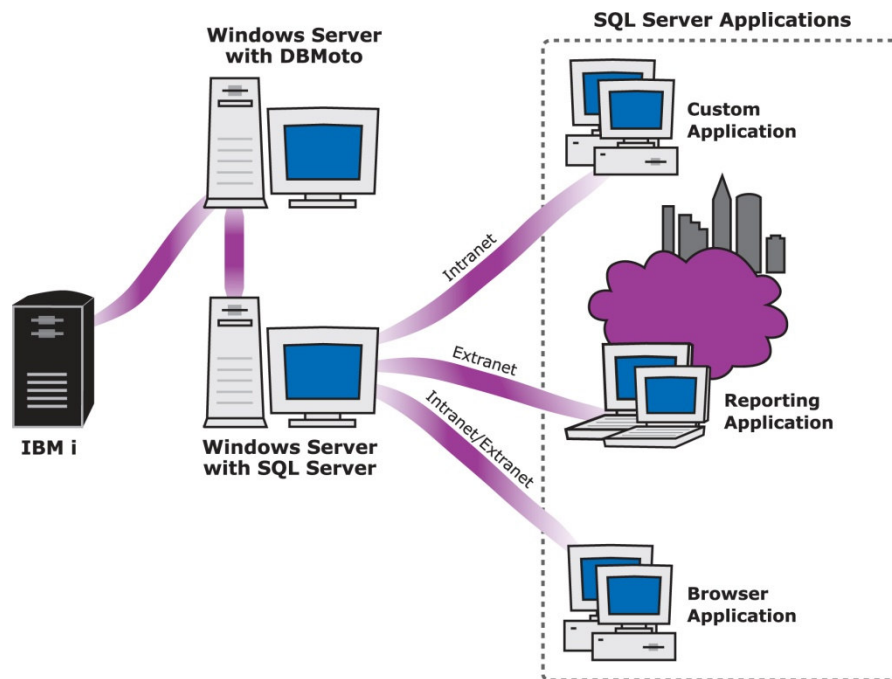
Products, tools and solutions from Microsoft and HiT Software for complete, transparent integration between corporate relational databases on multiple platforms

Contents

Introduction	3
Microsoft SQL Server 2008	5
HiT Software DBMoto	7
HiT Software Ritmo/i .NET Managed Provider	12
About HiT Software	15

Introduction

As the use of sophisticated development tools in the 1990s became widespread, Microsoft Windows® gained ground as the client or client-server environment of choice for accessing data stored in DB2® databases running on IBM® i (iSeries and AS/400) systems. Numerous applications, both custom and packaged, have been developed to use the de-facto standards for data access introduced by Microsoft®: ODBC, OLE DB and more recently .NET data providers.



In more recent years, many enterprises that use DB2 on IBM i as their corporate databases have introduced Microsoft SQL Server as an intermediate or satellite database: the corporate data store remains DB2, but data is moved to SQL Server as needed for business applications. The advantages of this approach are data security, where data is protected behind the SQL Server interface, and low Total Cost of Ownership that comes with the purchase and maintenance of a SQL Server installation over another IBM system. Additionally, Microsoft SQL Server 2008 is easy to install and manage via a powerful graphical user interface.

Components in the architecture described above:

IBM DB2 for i

The native database for IBM i.

Microsoft SQL Server 2008

Microsoft's complete data management and analysis platform **HiT Software DBMoto**

HiT Software's replication product for bi-directional replication between DB2 for i and SQL Server 2008

HiT Software Ritmo/i

A fully-managed .NET provider which allows immediate transparent access to DB2 for i from any application, custom or standard.

APPROACHES TO TRANSFERRING DATA FROM SYSTEM I TO SQL SERVER

Write an adhoc application

Writing an application which transfers data from IBM i to SQL Server achieves the desired result, but has the following limitations:

- ◇ Requires a significant investment of time by experienced programming staff to develop an application that is both expensive to implement and maintain.
- ◇ The solution is typically developed to solve a specific problem and therefore lacks flexibility and scalability.
- ◇ With the passage of time, costs for maintaining and updating the application can be expensive because of the evolution of the Windows and SQL Server environments.

Use SQL Server to create a linked server

Taking advantage of the ODBC and OLE DB standards to connect to DB2 for i, it is possible to create one or more linked servers in Microsoft SQL Server. This approach has the following limitations:

- ◇ Lack of flexibility once the linked server has been created for specific DB2 tables. Access is limited to only those specific tables.
- ◇ Performance is less than optimal because access to DB2 occurs via SQL Server requests.

Use SQL Server Integration Services (SSIS)

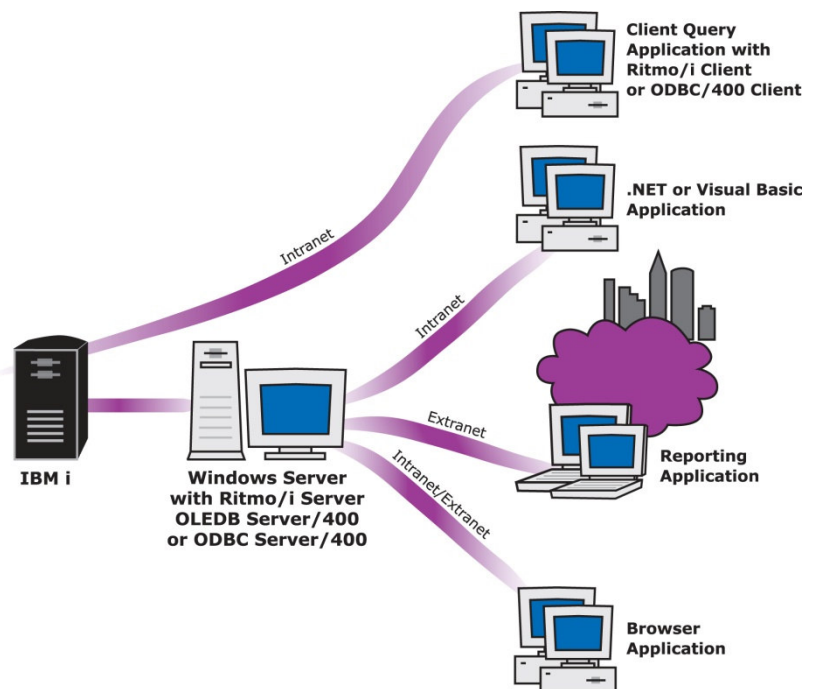
SQL Server offers a series of tools that allow you to import, export and transform data in one or more databases using the .NET or OLE DB standards. The limitations of this approach are:

- ◇ The process is not specifically designed for DB2 for i
- ◇ Affects SQL Server performance
- ◇ Data integration is not a real-time operation

Use a third-party product

The advantages of using a product such as HiT Software's DBMoto to replicate data from System i to SQL Server are:

- ◇ No programming necessary
- ◇ The process of configuring and running the replication is flexible and can be used for different DBMS.
- ◇ The replication setup allows for changes in both source and target databases.
- ◇ An intuitive graphical user interface provides easy replication configuration
- ◇ The IBM i server remains secure because DBMoto is completely non-invasive.



Microsoft SQL Server 2008 Your Data, Any Place, Any Time

With increasing amounts of structured (relational) and non-structured data such as documents and images enterprises find themselves having to manage large volumes of data. At the same time, new standards and rules of conformity require enterprises to store corporate data for longer periods. To address these issues, Microsoft SQL Server 2008 offers a secure, reliable, scalable data platform that allows organizations to:

- ◇ Run the most demanding mission-critical applications
- ◇ Accelerate development of cutting-edge applications
- ◇ Store and use any type of data
- ◇ Supply information that can directly impact action at all levels of the enterprise

Enterprise-level Data Platform

SQL Server 2008 provides a secure, reliable, easily-managed enterprise-level data platform.

DATA PROTECTION

Based on the strengths of SQL Server 2005, SQL Server 2008 offers a more secure data platform with the option to encrypt data in an entire database, file or log file without modifying existing applications. In addition, SQL Server 2008 simplifies adherence to standards by providing a complete set of functions for monitoring data, allowing organizations to respond to common questions such as “Which data has been restored?”

IMPROVED PERFORMANCE FOR THE EXECUTION OF DAILY OPERATIONS

The new data management framework based on criteria introduced in SQL Server 2008 allows organizations to manage data using rules and scripts. Thanks to this change, organizations can reduce the time set aside for daily maintenance by defining a set of common criteria for database-related activities such as query optimization, naming conventions, backup and restore, and index management. These criteria are applied and monitored automatically and can be published on all servers to create a uniform management framework across the organization.

IMPROVED APPLICATION RELIABILITY

With SQL Server 2008, organizations can take advantage of a more reliable platform for mission-critical applications. Thanks to the database mirroring feature, organizations that use SQL Server 2008 can easily improve the reliability of their applications. In addition, SQL Server simplifies application restoration in case of storage-level errors, and allows the addition of system resources like processors and memory without affecting applications.

OPTIMIZED, PREDICTABLE SYSTEM PERFORMANCE

The optimization of data platform performance and the guarantee of a predictable response for end users are two critical requirements for any type of organization.

SQL Server provides considerably more performance monitoring and tuning features to administrators by collecting all system performance data in a central repository.

Administrators are now able to view reports to compare and analyze current performance against prior performance. Furthermore, SQL Server 2008 allows organizations to provide coherent predictable responses to end users, thanks to the new resource governor which allows administrators to specify limits and priorities for different workloads, assuring uniform performance for simultaneous jobs.

Dynamic Development

Together with .NET Framework 3.0, SQL Server 2008 can speed development of cutting-edge applications.

THE BUSINESS ENTITY APPROACH TO DEVELOPMENT

The new ADO.NET Entity Framework allows developers to access data by defining business entities such as clients, orders and products instead of tables and columns. The introduction of LINQ also provides a way to execute queries and retrieve business entities natively from any .NET language. Using these services, developers can operate within a logical business model while administrators define a physical implementation of the model in table and column format.

DATA ACCESS FROM ANY LOCATION

SQL Server 2008 handles applications requiring only occasional connections to a network that also operate without network connections. Developers can create new generation applications that function with local storage and automatically synchronize with central storage for reference data and line-of-business applications.

Diverse Types of Data

SQL Server 2008 allows developers and administrators to save time thanks to its capability to archive and use diverse types of data, from documents to XML.

STORAGE AND USE OF MULTIPLE TYPES OF DATA

SQL Server was the first solution to support non-relational data with the introduction of OLAP services in SQL Server 7.0 and with support for XML in SQL Server 2005. SQL Server 2008 makes use of features in these earlier versions, and offers new data types which allow developers and administrators to store unstructured data such as documents and images.

GEOGRAPHICAL LOCATION DATA TYPES

Geographical information is increasingly important in many enterprise applications. SQL Server 2008 provides new geospatial data types to help developers and administrators create applications that are able to recognize geographical locations.

Detailed Business Information

SQL Server 2008 offers a more flexible infrastructure that can be scaled by IT staff to fit Business Intelligence criteria across the organization, manage reports or perform analyses at any level of complexity and, at the same time, guarantee user productivity via exceptional integration with Microsoft Office.

INNOVATIVE DATA WAREHOUSING FUNCTIONALITY

SQL Server 2008 allows organizations to scale and manage high numbers of users and significant amounts of data thanks to improved querying on large tables, as well as query optimization for data warehousing environments and improved I/O functionality for efficient, convenient data storage. Ultimately, SQL Server 2008 provides the means to integrate increasing volumes of data with Integration Services, a scalable integration platform, and to consolidate data in a data warehouse in real-time using change data capture technology.

SCALABILITY FOR BUSINESS INTELLIGENCE

With SQL Server 2008, users can easily create and distribute reports both inside and outside the organization. Furthermore, SQL Server Reporting Services allows users to create reports of any size or level of complexity with sophisticated formatting capabilities while SQL Server Analysis Services provides an analysis platform for thorough, scalable analyses based on uniform sets of key performance indicators and business parameters.

ADVANCED INFORMATION SHARING FEATURES

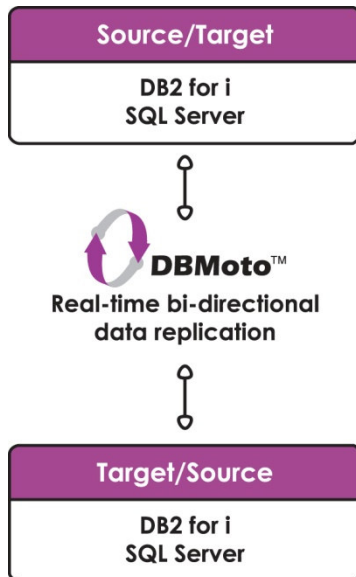
SQL Server 2008 allows users to easily read and share reports via Microsoft Office. Users can generate reports in Microsoft Word and Microsoft Excel formats, then publish them on Microsoft Office SharePoint® Server, allowing organizations to collaborate and share information.

For Further Information

Additional information on SQL Server 2008 is available at www.microsoft.com/sql.

HiT Software DBMoto

IDEAL FOR REPLICATING DATA FROM IBM I TO SQL SERVER 2008



The implementation of e-business, CRM and business intelligence applications and the adoption of client server technology is often impeded by the difficulties of reliable data replication. For example, corporate data residing in an IBM i environment, may need to be replicated to a more accessible database such as Microsoft SQL Server 2008.

Data Replication Solutions

Many enterprises have developed replication processes internally, often with the unintended effect of affecting network and server performance and the limitation of having only yesterday's data available. The entire database is replicated, even if not all data is needed, and the replicated data is often out of date.

DBMoto Solution

HiT Software's DBMoto is the first replication tool specifically designed for IBM i. DBMoto overcomes the limitation of scheduled updates to replicated data by supporting real-time incremental data replication, thereby creating an effective channel between corporate data and enterprise applications. With DBMoto, modifications to data on System i are instantly reflected in SQL Server. DBMoto is highly flexible and can be customized to your environment. With the intuitive wizard-based interface, replications rules and schedules can be set up in minutes.

MAIN FEATURES

- ◆ **Snapshot replication (Refresh)**
All selected records are scanned and replicated.
- ◆ **Real-time incremental (Mirroring)**
Based on the DB2 journal and the SQL Server transaction log,
- ◆ **Synchronization**
Real-time incremental replication where each system is both source and target.
- ◆ **Easy to use**
The entire replication process is configured using wizards and replications can be scheduled, executed and monitored using the Enterprise Manager graphical user interface.
- ◆ **Accessible**
DBMoto runs on Microsoft Windows, and the Enterprise Manager can be run from a remote system to facilitate configuration and management of replications
- ◆ **Independent from IBM i**
No programming is required on the IBM server and there is no need for proprietary naming or reserved fields in DB2.
- ◆ **Customizable**
Using Microsoft's VB.NET technology and replication events generated by DBMoto, you can write scripts to customize the replication process.
- ◆ **Flexible**
In addition to DB2 and SQL Server, DBMoto can be used for replications between all major databases. For a complete list, check HiT Software's web site at www.hitsw.com.

Selecting Data for Replication

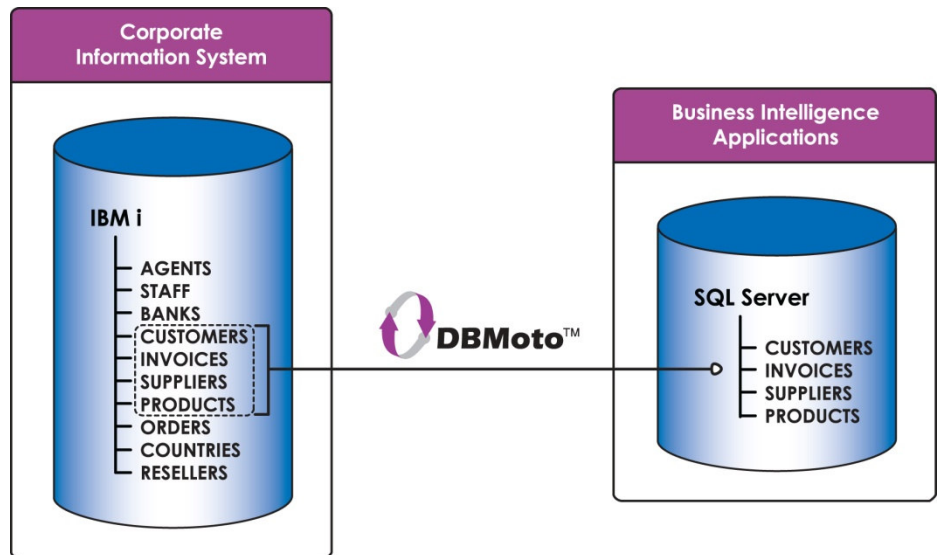
- ◇ Replication, either snapshot or incremental, applies to an entire table or to a part of the table as defined by the user. For each replication, data is selected in the Replication wizard by: Mapping the columns to replicate
- ◇ Filtering data using expressions
- ◇ Writing scripts to filter or modify data during replication

Examples of column mapping

- ◇ Code and Description columns only
- ◇ Social Security, telephone and fax columns only
- ◇ Code, Password and Email columns only

Examples of filter criteria

- ◇ Retail products only
- ◇ Clients with online services only
- ◇ European distributors only



Snapshot Replication

Snapshot replication reads all data (as specified by mapping and filtering) from the source table and transfers it to the target table. Snapshot replication can be launched directly from a menu, or scheduled at intervals specified by the user. Typically, snapshot replication is run once only during the initial phase of the replication process. It would be followed by incremental replication.

Incremental Replication

Real-time incremental replication examines the DB2 journal and the SQL Server transaction log for database changes since the last replication, then replicates only those changes to the target database. The interval between each log read is typically one minute, but this period can be adjusted by the user.

Replicating only those records that have changed allows:

- real-time replication
- minimum workload for the IBM server and the server running SQL Server.

Microsoft VB .NET Environment

DBMoto is the only real-time replication tool that provides a scripting environment. DBMoto includes a VB .NET environment which allows users to define functions, procedures and variables. VB .NET functions can be used in two ways:

- Mapping rules
- Replication events

Following an INSERT, UPDATE or DELETE operation on a record, DBMoto generates a VB .NET event. The event can be managed by VB .NET code

DBMoto has some built-in functions, but the user can define custom functions to manage their enterprise data as needed. DBMoto does not require the development of stored procedures or the adoption of proprietary syntax.

Journals and Logs

The DB2 journal and the transaction log provide a native tool for intercepting changes that have occurred in DB2 and SQL Server databases.

Each INSERT, UPDATE and DELETE operation is recorded in the journal or log. DBMoto automatically manages the journals, logs and receiver changes.

Performance

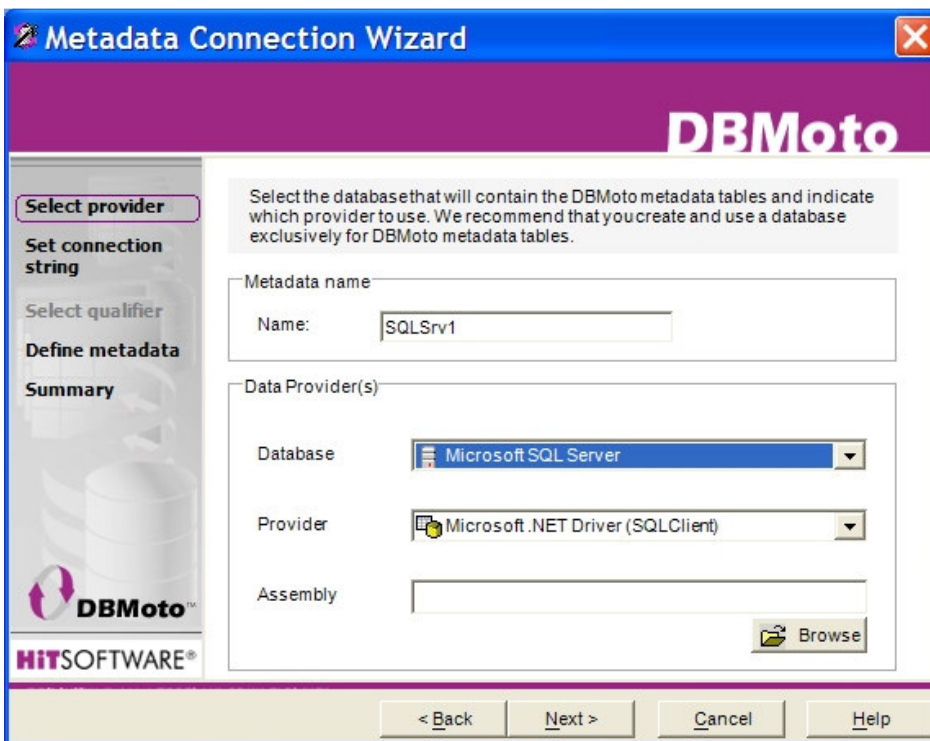
It is often thought that using journals can affect system performance. This may have been true with the early versions of AS/400 but the current DB2 for i5/OS versions manage transactions as effectively as SQL Server or other databases where it is not possible to disable the log.

Commit and Rollback The use of journals and logs provide transaction security. The most recent generation of IBM i programs support transactions with typical commands like Begin Transaction, Commit, Rollback and End Transaction. DBMoto provides full support for transaction management and the target database always represents a faithful copy of source data regardless of the final status of the transaction.

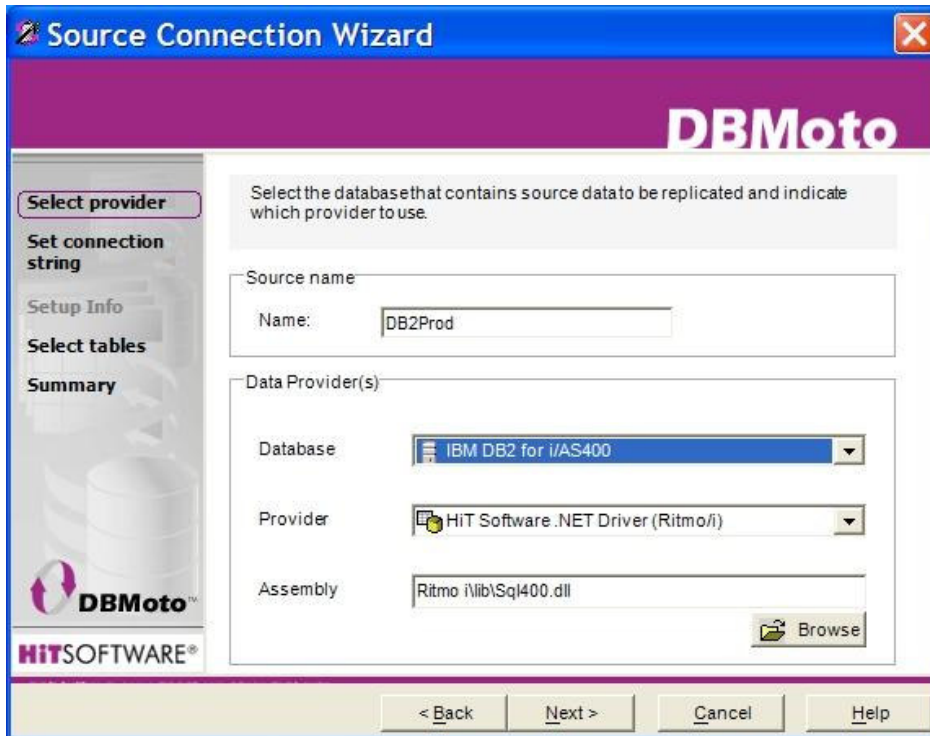
EASE OF USE

Intuitive Replication Configuration

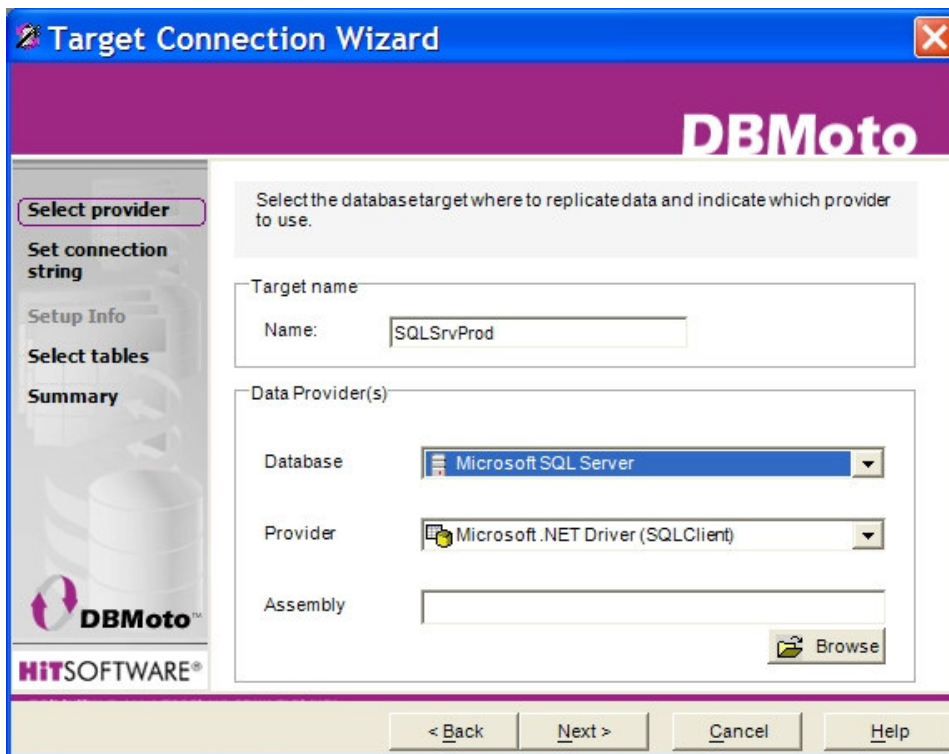
1. Configure the metadata for the replication.



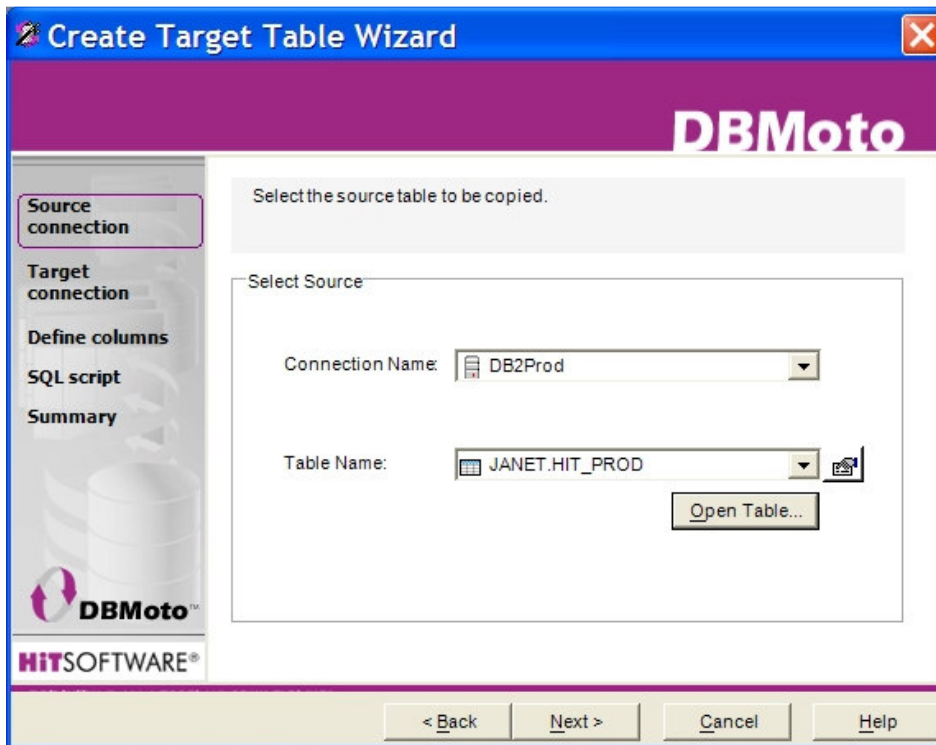
2. Configure the connection to the source database.



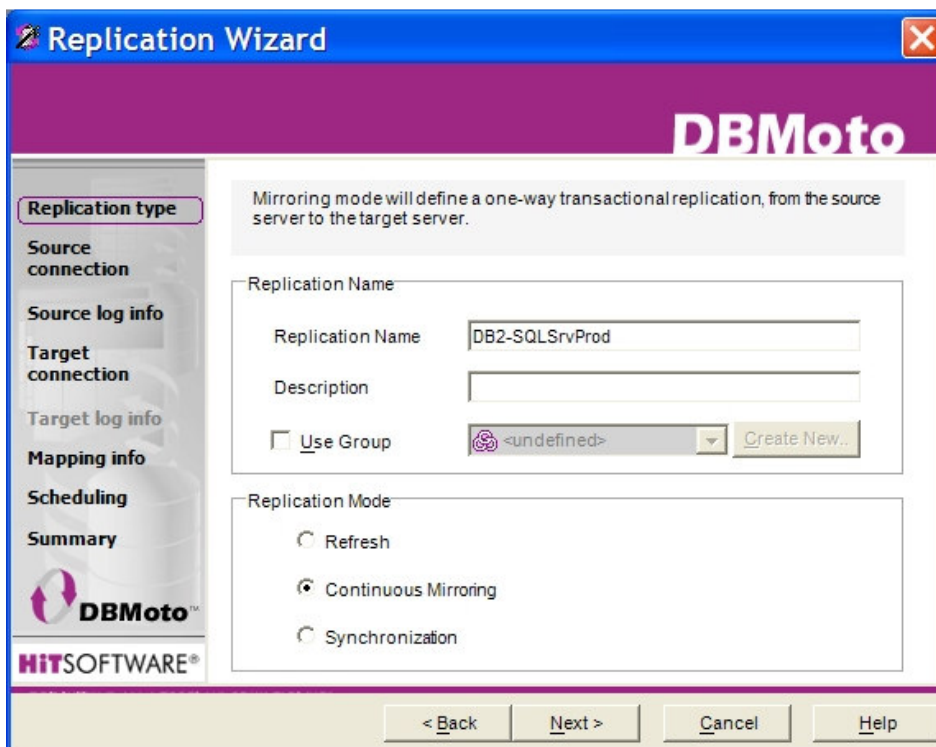
3. Configure the connection to the target database.



4. Create the target tables as needed.



5. Configure the replication
- ◇ Determine when the replication should start.
 - ◇ Set the replication details (tables, fields and transformation functions.)
 - ◇ Define scripts associated with the replication.
 - ◇ Run the replication.



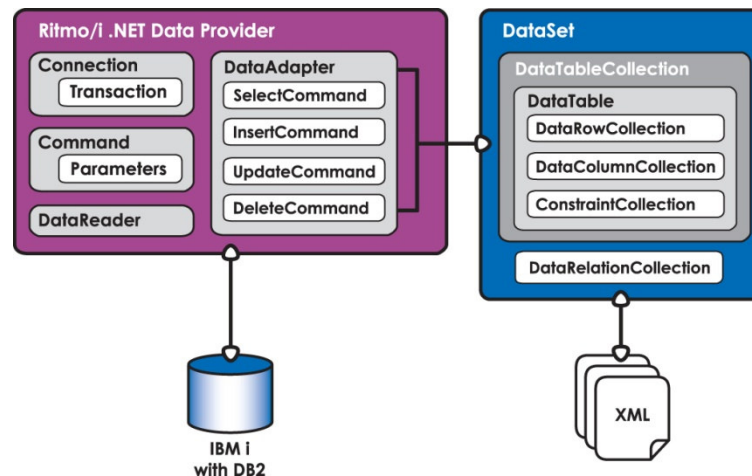
HiT Software Ritmo/i .NET Managed Provider

.NET MANAGED PROVIDER FOR ACCESSING DB2 DATA ON IBM i SYSTEMS

As demonstrated in the previous chapter, the best approach to replicating and synchronizing data on IBM i and Microsoft SQL Server 2008 is to take advantages of the power and flexibility of DBMoto. However, in some architectures it may be necessary to access DB2 data directly without waiting for the data to be replicated to a “satellite database.” If the application that needs to access data is based on the .NET framework, it is advisable to use a 100% managed .NET provider such as HiT Software’s Ritmo/i.

READ, WRITE AND MODIFY DB2 DATA FROM .NET APPLICATIONS

Ritmo/i is a 100% managed .NET data provider that uses SQL to access data on DB2 . Ritmo/i accepts SQL commands via ADO.NET or directly using methods and properties. The provider communicates with IBM i servers to read, write and modify data at maximum performance. Ritmo/i uses the native IBM Optimized Database Server to communicate with DB2 and does not require any additional software installed on the IBM i server.



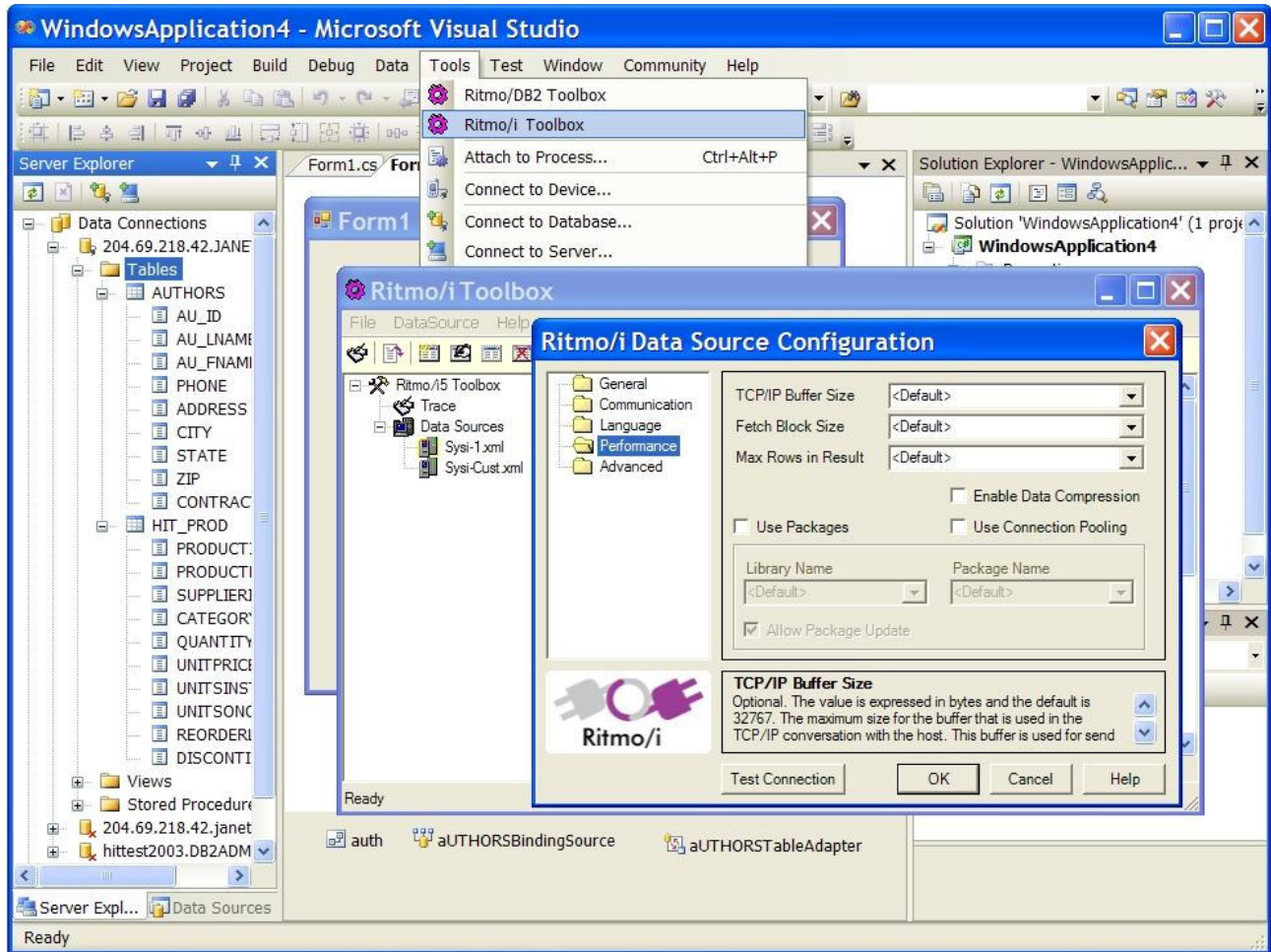
A COMPLETE RANGE OF FEATURES TO SUPPORT .NET DEVELOPERS AND USERS

For maximum performance, Ritmo/i fully supports SQL functionality (including stored procedures, multiple result sets, bulk insert and connection pooling.) Support for multi-threading ensures the scalability of applications. Ritmo/i communicates using TCP/IP connections.

Complete documentation is provided for the mapping between DB2 for i data types and .NET environment data types, as well as the use of the provider in the .NET environment. The included Ritmo Toolbox provides an easy way to create and maintain data sources as well as tools for diagnostics. Trace and debugging features help to identify problems and optimize performance. Ritmo/i is licensed per Windows server or client platform.

Ritmo/i DEVELOPER EDITION

A Developer Edition is also available, containing powerful design tools, code wizards and a command editor. In addition, the Developer Edition provides a C# Toolkit with source code examples and integration with Microsoft SQL Server Reporting Services. From the Reporting Services environment, users can choose Ritmo as a data source for connecting to DB2, and generate reports. With the Developer Edition, from Microsoft .NET Visual Studio, the user can create and manage connections, SQL commands and Data Adapters interactively.



Features	Benefits
ADO.NET compliance	Availability for the latest development tools
Support for stored procedures and multiple result sets	Speedy access to data
Support for multi-threading	Performance and scalability
Support for different IBM operating system versions	Deployment flexibility
TCP/IP connections	Standard network protocols
Double-byte support	World-wide language support
Native ODBS protocol support	Server stability
Documented support for the complete set of native data types	Translation between EBCDIC and ANSI character sets
Toolbox to configure connections and traces	Easy diagnostics
Integration with Visual Studio .NET and C# Toolkit	Reduction in development time

DEVELOPER AND RUNTIME EDITIONS

Ritmo/i is particularly useful for those who develop products or projects based in the .NET environment and need fast, direct, direct access to DB2 databases running on IBM i servers. Ritmo/i Developer Edition was designed for programmers developing .NET applications, to aid in effectively accessing DB2. Ritmo/i Runtime is suited for end users of .NET applications who need to access DB2 data in real-time with lightweight, high-performance middleware. Traditional client/server applications, ERP applications, Web applications, e-business applications, Business Intelligence tools, data warehousing, data mining and query/reporting tools can all use Ritmo/i to access IBM i servers.

HiT SOFTWARE

HiT Software is an established player in the data integration and access (DIA) market. For more than a decade, HiT Software products have been providing access to critical data, enabling data availability and offering programming-free data integration across enterprise systems. HiT Software standards-based products perform real-time, bi-directional replication between all major databases; execute real-time, bi-directional transformations between XML and all major databases; and connect applications to IBM DB2 databases via .NET, OLE DB, ODBC and JDBC standards.

Founded in 1994, HiT Software is relied upon by thousands of organizations around the globe. HiT Software products are sold and supported worldwide by the HiT Software direct sales team, international subsidiaries, and authorized channel partners. Additional information is available at www.hitsw.com, by e-mail at info@hitsw.com, or by telephone at +1(408)345-4001.

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