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Microsoft® SQL Server™ 2008

CyberSavvy

Software Company Creates Automated 'Database Factory' Using SQL Server 2008

Overview

Country or Region: United States
Industry: High Tech - Professional Services

Customer Profile
CyberSavvy applies cutting edge technologies to solve business problems, creating solutions that span business, professional and developer roles, and providing tools and hosted services.

Business Situation
The company needed an effective mechanism for transferring data and schema information between an application on the client side and database on the hosted server side.

Solution
CyberSavvy created its DataPlace SaaS solution using Microsoft® SQL Server® 2008 Express on the client and SQL Server 2008 Enterprise on the server side. SQL Server 2008 replication is used extensively.

Benefits
- Integrated database development
- Reduced storage needs
- Easier automation with Service Broker
- Ability to handle files with FILESTREAM
- Improved scalability
- Easy to implement encryption

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Peter Hammond, President, CyberSavvy

CyberSavvy believes in using software automation to make life easier for its customers. Its Software as a Service solution, DataPlace, which it terms a "database factory," enables technical and business oriented customers to create and modify their own databases, hosted by CyberSavvy. The company needed a rock-solid database with a faultless data transfer mechanism to support communication between its client-side SmartClient and backend databases. CyberSavvy deploys its solutions on the Microsoft® Application Platform, using Microsoft SQL Server® 2008 Enterprise on the hosted server side, and SQL Server 2008 Express on the client side. CyberSavvy has enjoyed a number of benefits from using SQL Server 2008 including an integrated development environment, reduced storage needs with Backup Compression, easier automation using SQL Server Service Broker, and scalability.

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Fast Facts	
Number of data bases hosted on a single instance of SQL Server 2008	125 and counting
Total data	500 GB and growing quickly
Current backup size	1 terabyte
Anticipated reduction in database backup space using SQL Server 2008 Backup Compression	About 80 percent
SAN storage	8 terabytes raw storage
Application Platform Capabilities	Development, Production Data Management

Situation

Based in Redmond, Washington, CyberSavvy is a software development company with a virtual workforce of 17 developers located around the United States and Canada. A Microsoft® Registered Partner and Microsoft Preferred Vendor, CyberSavvy has created a number of applications used by Microsoft's sales, marketing, and other groups.

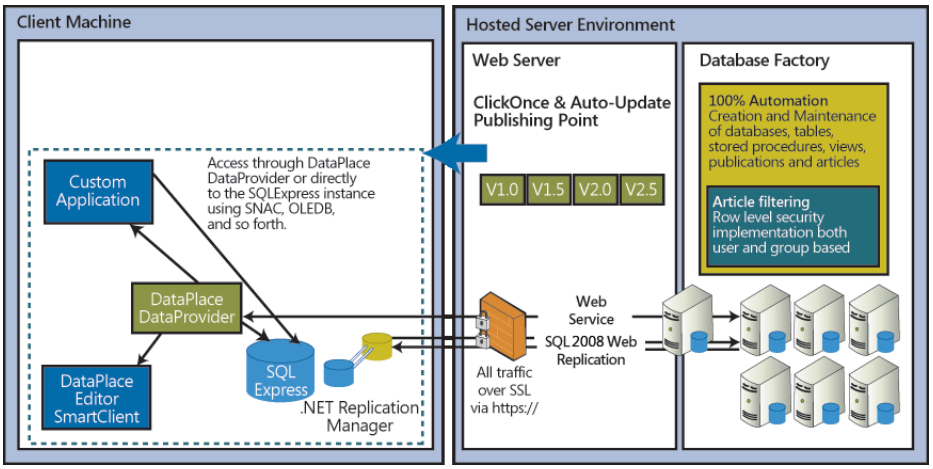
CyberSavvy, which has deep experience in creating rich business intelligence applications requiring database integration, saw an opportunity to speed development while reducing costs by providing a service based platform to automate and simplify database design, deployment, and use for occasionally connected applications, including support of mobile workers. A key challenge in creating its solution was ensuring integrity of data as it was synchronized between the server database and the client desktop or mobile application—while dealing with multi-user concurrency and offline users.

Initially the company created solutions based on Web services to handle synchronization, but found it extremely problematic and unreliable when dealing with sequential insert/update/delete actions on complex relational data. If any part of the steps failed when applied to the server, the entire synchronization process failed. Such cases might arise when a user, working offline for several days, attempted to synchronize and failed because one of their first changes was rejected due to a concurrency violation caused by, for instance, another user updating a row while they were offline—causing the subsequent actions to all fail back to the client.

Before the company could provide its customers with the kind of data-rich automated solutions its customers needed, it had to find a better way to ensure data confidence over the Web. Because it was offering its database automation services as an application service provider it needed a solution that would scale well, support numerous data types, provide robust security/encryption features, and include data compression to create a smaller backup footprint.

Solution

CyberSavvy created DataPlace, a product the company describes as a "database factory," that automates all the complex processes and design requirements for database creation and deployment with respect to offline enabled Smart Clients. Customers describe what they want the database to do, and behind the scenes, DataPlace services creates the database on the CyberSavvy server, and then replicates the enterprise ready production database across the Internet to the customer's computer, usually in under 5 minutes. In fact the DataPlace editor uses the same replication to communicate the customers design requirements in data form to the server's automation processes, enabling users to create new schema on the server database without ever connecting to it directly.



DataPlace - The DataPlace solution automates database creation, using SQL Server 2008 on both the client side and server side.

The DataPlace solution is deployed using Microsoft SQL Server® 2008 Enterprise database software running on Windows Server® 2003 Enterprise Edition operating system on the server side, and uses SQL Server 2008 Express on the client side. DataPlace uses SQL Server Merge Replication with Web synchronization over Microsoft Internet Information Services 6.0. Using replication has enabled CyberSavvy to remove a proprietary middle-tier approach to synchronization that it had created in earlier product development.

DataPlace includes a smart client application, DataPlace Editor, which is downloaded, along with the database, to the user's computer. The smart client includes a database designer that makes it easy for the user to change the schema or other attributes of the database to better match their needs. These changes are passed to the backend server through replication and translated by the sever-side DataPlace application to the server-side database. DataPlace Editor automatically checks for replication updates whenever the client database is opened. It can also be configured to automatically check for updates at user-defined intervals.

"DataPlace is possible because of the tremendous power of SQL Server 2008 and the rock-solid data integrity ensured by SQL Server Merge Replication," says Peter Hammond, President of CyberSavvy. "Merge Replication helped us to eliminate the complex problems relating to working with data over the Web in a multi-user, secure, scalable, confident and repeatable way. Building on the Microsoft Application Platform, we're able to bring the power of relational databases to people who need them, but don't know, or don't want to know, how to create or manage them."

The solution is part of CyberSavvy's vision to make it easy for organizations to benefit from the power of enterprise database driven solutions.

"With our automated system we can literally create an enterprise-ready database for the customer within 5 minutes," says Hammond. "Our customers get all the value of SQL Server 2008 without the infrastructure overhead. They really don't need much more than an occasional Internet connection."

The DataPlace solution architecture includes:

- **Client Database**. SQL Server 2008 Express is a key element of the DataPlace solution because it enables data to be stored, queried, and reported against, locally, eliminating client-server traffic for anything other than replication. SQL Server Express is a no cost and freely redistributable version of the full SQL Server database product that uses the same reliable and high-performance database engine as the other versions of SQL Server 2008.

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Peter Hammond, President, CyberSavvy

- **Server Database**. Because it is a Software as a Service (SaaS) provider, CyberSavvy maintains a copy of a customer's database on its server. The company supports more than 200 replication customers using a single instance of SQL Server 2008 Enterprise, running on the Windows Server 2003 Standard Edition operating system and hosted on a Dell™ PowerEdge™ 2850 server computer with four Intel® Dual-Core Xeon® processors and 4 gigabytes (GB) of RAM. The database is currently at 500 gigabytes and growing quickly.
- **Application Tier**. The CyberSavvy DataPlace application is co-hosted on the server and client database. The Database Editor software is integrated with SQL Server 2008 Express on the client computer which synchronizes over the Internet to the hosted server with Windows Internet Information Server 6.0 and the SQL Server 2008 Merge Replication Web Synchronization components.
- **Storage Tier**. Data is stored on a Dell PowerVault SAN array with 3.5 terabytes of raw storage. Storage efficiency is enhanced by using the backup and data compression features of SQL Server 2008.

DataPlace has proven popular with users ranging from individual developers and consultants, to large enterprises including Lowe's, Microsoft, and Spherion.

Benefits

Building upon SQL Server 2008 and the rest of the Microsoft Application Platform, including the Microsoft .NET Framework and using the latest Microsoft development tools, CyberSavvy benefited from an integrated development environment in creating its robust DataPlace database factory. The company has also enjoyed a number of other benefits working with SQL Server 2008, including reduced storage needs with backup and data compression, easier automation with Service Broker, the ability to handle large files with the FILESTREAM data type, and the scalability it needs to meet future growth.

Integrated Database Development

A rock-solid relational database was required to provide the foundation of CyberSavvy's solution, which is what the company found with SQL Server 2008.

"Our developers are skilled professionals with years of experience," says Hammond. "But our work was much easier because of how well SQL Server 2008 is integrated with Microsoft's state-of-the-art development tools and technologies."

In creating DataPlace, CyberSavvy took advantage of the efficient development environment that is integrated throughout the Microsoft Application Platform. The company used Microsoft Visual Studio® 2005 and Visual Studio 2008 Beta 2; as well as the Microsoft .NET Framework 2.0 and 3.0 to create a solution integrated with SQL Server 2008.

"DataPlace is the realization of all of the lessons that we've learned over the years about what works and what doesn't work in creating database solutions," Hammond says. "The single most important factor for any of the applications that we've built is that the database must be solid. Our customers need to have complete confidence that their data is safe. For us, this means building our solution with technology that's tried and true and proven beyond doubt. That's why we use SQL Server."

As a .NET-enabled application, the client-side DataPlace Editor can be extended by customers to more precisely meet their needs. "Our customers can create their own

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Dan Dzina, Architect, CyberSavvy

user interface using .NET-enabled solutions on top of our infrastructure and basically build their own application," says Hammond. "In fact they can create their applications using any technology that knows how to connect to SQL Server. And since SQL Server is such an important product that so many people have built upon, there are very few technologies that don't know how to connect with SQL Server."

CyberSavvy is most excited about the way their product can be customized by users who have little to no experience with SQL Server or any other database, but have experience with Microsoft Office Excel® or Microsoft Office SharePoint® Server. CyberSavvy developers have made creative use of replication and backend application logic to translate intuitive actions on the client side into the actual mechanics required on the server side.

"DataPlace provides the end user who knows nothing of SQL Server the ability to go in and add a new table, column, change a column name, and make other changes to the database," says Hammond. "The changes they make are replicated up to the server as pure data. The server then checks to make sure it's okay to do so through a set of logic that we created, and then automatically extends the table schema to accommodate the change."

DataPlace gives users the ability to evolve their database to meet their changing needs.

"Using SQL Server 2008, and the back end automation we created with Microsoft development tools, we give users a database that can evolve to their own changing specifications without ever needing to have a developer involved in the process," says Hammond. "This ability to rapidly evolve the schema is significant because in traditional database deployments there are restrictions to make sure that nothing does change, and when change is allowed it takes a lot of time and increases cost."

Reduced Storage Needs

SQL Server 2008 includes a backup and data compression features that CyberSavvy utilizes to reduce data loads on its SAN. SQL Server 2008 Data Compression reduces the storage requirements and I/O necessary to store customer data, improving the scalability of the hardware environment. With SQL Server 2008 backup compression, the cost of keeping disk-based backups is significantly reduced as less storage is required to keep regular backups. Additionally, backups run significantly faster since less disk I/O is required.

"As a software service provider, we do a lot of backups," says Hammond. "Our service level agreements call for incremental backups every 15 minutes and full database backups every night. We are already up to a terabyte of backups, so anything we can do to reduce the space required for backing data is helpful. We're anticipating an 80 percent reduction in our backup file sizes using backup compression on SQL Server 2008."

Easier Automation with Service Broker

CyberSavvy developers are impressed with enhancements to Service Broker for SQL Server 2008. Service Broker, introduced with SQL Server 2005, enables internal or external processes to send and receive guaranteed, asynchronous messages by using extensions to normal Transact-SQL data manipulation language. Messages are sent to a queue in the same database as the sender, to another database in the same instance of SQL Server, or to an

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instance of SQL Server either on the same server or on a remote server.

"Service Broker is more fleshed out in SQL Server 2008," says Dan Dzina, Architect at CyberSavvy. "There is a lot more documentation for Service Broker and it is easier to manage. This is good because Service Broker gives developers the ability to support transactional messaging using the rock-solid SQL Server relational engine."

Using Service Broker simplifies a lot of work that CyberSavvy's automation had previously accomplished using the common language runtime (CLR) feature built into SQL Server. Coupled with enhancements in the .NET Framework 3.5 (code named Orcas) and the Windows Communication Foundation and the Windows Workflow Foundation, automation is being decoupled and componentized. This allows for more flexible interaction with external services, such as the management of the Active Directory® service in Windows Server while creating or eliminating domain accounts on the fly on their backend servers.

"We use Service Broker for Active Directory integration, which enables us to work asynchronously with Microsoft Active Directory without affecting the SQL Server process," says Dzina. "We value Service Broker because we do so much automation and require so many schema changes. Service Broker exposes the SQL Management Objects to our back-end model, which greatly simplifies management of our automation processes."

Ability to Handle Files with FILESTREAM

CyberSavvy is taking advantage of SQL Server 2008 support for the FILESTREAM data type to streamline the transition between managing relational and non-relational data. The FILESTREAM data type allows binary data to be stored directly in an NTFS file system while letting the data remain an integral part of the database and maintaining transactional consistency.

The new FILESTREAM data type enables the scale-out of binary data, traditionally managed by the database, to be stored outside of the database on more cost-effective storage without comprising features for accessing and backing up such data. Prior to SQL Server 2008 and support for FILESTREAM, CyberSavvy discouraged customers from storing files in the database.

"Using FILESTREAM, we gain all the value of having non-relational material on the file system with a streaming API [application programming interface] to push it through," says Hammond. "Prior to SQL Server 2008 we allowed for storing of files in DataPlace, but it was through using varbinary(max), and we had to create supporting code to manage the file."

Improved Scalability of SQL Server 2008

In creating DataPlace as a database factory and centralized data store solution, CyberSavvy needed a highly scalable relational database that could grow to meet the needs of the company and its increasing list of small, medium and enterprise customers.

"One of our big reasons for moving to SQL Server 2008 so early was its scaling factor," says Hammond. "We are hosting hundreds of databases on a single instance with fantastic success. We are currently at about 500 gigabytes with more than 150 publications and plan to grow into a multi-terabyte provider. We can handle enterprise customers, and we don't see a limit to our ability to scale."

"We're eager to make use of the Change Data Capture feature in SQL Server 2008 … It provides a huge benefit for our customers."

Joe Snitker, Database Developer, CyberSavvy

The company's use of replication provides it with yet more room to scale, because DataPlace queries and reporting are done on the customer's own client-side database using SQL Server 2008 Express.

"Our great performance and ability to scale is possible because we utilize the client side to do all the heavy lifting, so our back end only handles replication calls," Hammond says. "Replication was rock solid even before SQL Server 2008. It is such a powerful feature that it literally changed the way we do business—from transferring data via middleware solutions, to using replication. We can't beat the level of value Microsoft has put into replication, and what we realized was by utilizing it we gained a secure method for transferring information that we could completely rely on while freeing us up to focus on customer features."

CyberSavvy has already created two new product offerings on top of its DataPlace SaaS solution. Project360°, a resource management/time tracking solution, and the Enterprise Product Roadmap, a solution for tracking products and producing dynamic Microsoft Office 2007 PowerPoint® planning presentations, were built in record time.

"We produced both of the products to exact customer specifications in a matter of weeks, rather than months and were in production well before our customers' deadlines," says Hammond. "DataPlace unleashes the power of SQL Server while reducing time to market and overall costs. The result is that finally we are able to focus our attention on the important needs of the customer without restraint."

Easy to Implement Encryption

SQL Server 2008 includes many security-related features that help protect the data in an organization, including built-in data encryption capability. This built-in encryption capability provides functions APIs to make it seamless to use encrypted data.

DataPlace hides all the complexity of this feature with a simple interface to specify the data columns to be encrypted and dynamically creates asymmetric keys for the user. Normally encryption requires the data to be exposed as binary only, but with DataPlace's automation all the encrypted data is cast back to its original type in a custom stored procedure layer for the application's presentation.

"If you encrypt a string, or picture, or even a bit value, DataPlace ensures that is the data you presented, while it's still protected as encrypted raw binary data in the table," says Hammond. "SQL Server Express manages the encryption keys with the same high level of security of the server product, providing end users with the same value usually only available on enterprise servers."

CyberSavvy customers like the granularity of encryption provided by SQL Server 2008. "We're seeing more customer interest in encryption for the database," says Hammond. "We offer our customers encryption at the column level, and the user acceptance of this feature is incredible. They love it."

Additional Benefits from Moving to SQL Server 2008

The CyberSavvy team has identified a number of additional SQL Server 2008 features that it is already using or planning to soon, including:

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- **Change Data Capture**. New for SQL Server 2008, Change Data Capture collects the complete content of changes, and places them in change tables. The feature maintains cross-table consistency and even works across schema changes. "We're eager to make use of the Change Data Capture feature in SQL Server 2008 because we had actually been handling this with our own custom code that used a mirrored table to log every creation, modification, or deletion of a record," says Joe Snitker, Database Developer at CyberSavvy. "The Change Data Capture feature uses the same philosophy, but does so on a much broader scale. It provides a huge benefit for our customers."
- **MERGE SQL Statement**. The MERGE SQL statement, new for SQL Server 2008, enables developers to more effectively handle common database administration tasks such as checking whether a row exists and then executing an insert or update. "This is very important to us because we use Merge Replication throughout our solution," says Dzina. "As new data is replicated, we often have to batch process data conditionally with updates, inserts, and deletes. So the MERGE SQL statement provides a lot of value in making it easier to handle data and process, or move it, across tables. It also makes it easier to deal with jobs requiring DataPlace's row-level security, eliminating the need to open so many cursors to look through the data on a row-by-row basis to apply rules, and determine what data needs to be updated, inserted, or deleted. The MERGE SQL statement eliminates a lot of these loops."
- **Integrated Full-Text Search**. SQL Server 2008 introduces Integrated Full-Text Search, which makes the transition between full-text search and relational data seamless while enabling users to employ the full-text indexes to perform high-speed text searches on large text columns. "Prior to the Full-Text Search feature we had to engineer our own, using stored procedures to concatenate all the fields and pass it off to a wild card WHERE clause," says Snitker. "Our old solution worked well up to about 100,000 rows, depending on field sizes, but we're delighted to be able to retire the code and make use of the integrated full-text search in SQL Server 2008."
- **Sparse Columns**. The Sparse Columns feature of SQL Server 2008 provides a highly efficient way of managing empty data in a database by enabling NULL data to consume no physical space. "Anything that reduces space is helpful to us," says Hammond. "Sparse Columns are beneficial as many designs use wide tables with many nullable columns. Currently, every optional date, quantity, etc., consumes physical space even though we have no data. Sparse Columns removes the storage hit from the empty values."

Summary

In summary, CyberSavvy has created a high-value offering for its customers by using the rock-solid relational database of SQL Server 2008 and the ease of development found with Visual Studio 2005 and the .NET Framework to create a database factory that is flexible and scalable. The solution makes good use of SQL Server Merge Replication to transfer data and schema changes between the DataPlace client solution running on SQL Server 2008 Express and the server solution running on SQL Server 2008 Enterprise.

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Software and Services

- Microsoft Servers
  - Windows Server 2003 Standard Edition
  - Microsoft SQL Server 2008 Enterprise
  - Microsoft SQL Server 2008 Express
- Microsoft Visual Studio 2005
- Microsoft Visual Studio 2008 beta 2
- Microsoft Office
  - Office PowerPoint 2007
- Technologies
  - Microsoft Active Directory
  - Microsoft Internet Information Services 6.0
  - Microsoft .NET Framework 2.0
  - Microsoft .NET Framework 3.0

Hardware

- Dell PowerEdge 2850 server computer with four Intel Dual-Core Xeon processors and 4 GB of RAM for the server database
- Dell PowerVault SAN array with 3.5 terabytes of raw storage

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Document published January 2008