



NASDAQ Deploys SQL Server 2005 to Support Real-Time Trade Booking and Queries

Overview

Country or Region: United States

Industry: Financial Services

Customer Profile

As the largest electronic stock market in the United States, NASDAQ lists the securities of 3,300 of the world's leading companies. NASDAQ transmits real-time quote and trade data to more than 1.3 million users in 83 countries.

Business Situation

NASDAQ needed to replace a mission-critical, Tandem mainframe-based solution with one that was more powerful, flexible, and had a lower total cost of ownership.

Solution

NASDAQ internal developers created their Market Data Dissemination System (MDDS) using Microsoft® SQL Server™ 2005 database running on Microsoft Windows Server™ 2003 Enterprise Edition.

Benefits

- Lower total cost of ownership
- Agility to meet customer needs
- Real-time reporting
- Enterprise-ready availability and performance

“The fact that we can move mission-critical applications from Tandem to SQL Server 2005 and Intel-based servers shows how both Microsoft and Intel are creating enterprise-grade solutions.”

Ken Richmond, Vice President for Software Engineering, Market Information Systems, NASDAQ

NASDAQ, which became the world's first electronic stock market in 1971, and remains the largest U.S. electronic stock market, is constantly looking for more-efficient ways to serve its members. As the organization prepared to retire its aging Tandem mainframes, it deployed Microsoft® SQL Server™ 2005 on two 4-node Dell PowerEdge 6850 clusters to support its Market Data Dissemination System (MDDS). Every trade that is processed in the NASDAQ marketplace goes through the MDDS system, with SQL Server 2005 handling some 5,000 transactions per second at market open. SQL Server 2005 simultaneously handles about 100,000 queries a day, using SQL Server 2005 Snapshot Isolation to support real-time queries against the data without slowing the database. NASDAQ is enjoying a lower total cost of ownership compared to the Tandem Enscribe system that the SQL Server 2005 deployment has replaced.

“Ten years ago NASDAQ earned about one penny per trade. Today we make about one-tenth of a penny per trade. SQL Server 2005 is helping us meet our goals of offering our customers more while charging them less.”

Ken Richmond, Vice President for Software Engineering, Market Information Systems, NASDAQ

Situation

NASDAQ is the largest U.S. electronic stock market. With approximately 3,300 companies, it lists more companies and, on average, trades more shares per day than any other U.S. market. NASDAQ prides itself in being the home to category-defining companies that are leaders across all areas of business including technology, retail, communications, financial services, transportation, media, and biotechnology.

Since its debut in 1971 as the world's first electronic stock market, NASDAQ has been at the forefront of innovation, using technology to bring millions of investors together with the world's leading companies. Trades are executed through a computer and telecommunications network that transmits timely, critical investment information to more than 1.3 million users in 83 countries.

As part of its ongoing commitment to providing the most technically advanced infrastructure and the greatest value for traders, NASDAQ is replacing Tandem mainframes with Intel-based servers that are more powerful, easier to customize and manage, and less expensive to acquire and maintain. A key area designated for Tandem retirement was the trade reporting system that NASDAQ market participants access for trade summary, risk management, broker clearing, and related needs.

Because this information is needed in real time, NASDAQ needed a solution that would offer:

- Enterprise-ready availability and performance.
- Agility to enable NASDAQ's internal developers to swiftly react to customer need.
- Lower total cost of ownership to help NASDAQ provide the best value to its members.

Solution

NASDAQ's internal development team created its Market Data Dissemination System (MDDS) using Microsoft® SQL Server™ 2005 database running on the Microsoft Windows Server™ 2003 Enterprise Edition operating system. Both Windows Server 2003 and SQL Server 2005 are part of Microsoft Windows Server System™ integrated server software. MDDS receives direct feeds from NASDAQ's trade reporting system, and collects the data, storing it in SQL Server 2005. It is then available in real time for queries by market participants, including those using the NASDAQ Workstation, a Web-based tool that connects to NASDAQ trading systems.

MDDS is a critical system for NASDAQ, as it keeps the official daily record of all trades. It must be fast and highly available because data is constantly inserted. NASDAQ's MDDS solution receives about 8 million new rows of data per day, and gives users a view into risk management, trade summary, broker clearing, and NASDAQ market calendar information.

MDDS handles 5,000 transactions per second plus a large volume of Web queries that come from NASDAQ's WebLinkACT 2.0, a browser-based application that electronically facilitates the post-execution steps of price and volume reporting, comparison, and clearing of trades.

Some of the basic elements of the solution include use of:

- **SQL Server 2005 Stored Procedures.** Stored procedures are used to implement business rules and other functions, including identification of system users to determine what data they are allowed to see. (One trader can't examine the transactions of another trader.)

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Paul Buu, Senior Technical Specialist,
NASDAQ

- **SQL Server 2005 Snapshot Isolation.** To facilitate query responses without slowing the real-time delivery of trading information, the solution uses the Snapshot Isolation feature of SQL Server 2005, which provides data concurrency without requiring locking, through use of a temporary database that holds updated row versions for each transaction.
- **SQL Server 2005 Database Mirroring.** NASDAQ is evaluating the use of SQL Server 2005 Database Mirroring as part of its disaster recovery infrastructure. Database Mirroring increases the availability of SQL Server 2005 databases by copying transaction log information directly from one server to another, providing the option of quickly transferring operations to the standby server if the primary server becomes unavailable.

The solution is hosted on two 4-node active/active clusters using Dell PowerEdge 6850 computers running Microsoft Windows Server 2003 Clustering Services. Each computer has four 3.3 gigahertz (GHz) processors and 32 gigabytes (GB) of memory.

Benefits

The move to Microsoft SQL Server 2005 is providing NASDAQ with a number of benefits, including lower total cost of ownership, agility to meet customer needs, real-time reporting with Snapshot Isolation, and enterprise availability and performance.

Lower Total Cost of Ownership

Moving applications from mainframe to server-based environments can bring substantial savings, which is important to NASDAQ because it exists in an increasingly competitive market. “One of the most important initiatives here at NASDAQ is to get our technology costs down to provide greater value for NASDAQ members,” says Ken Richmond, Vice President for Software Engineering, Market Information Systems at

NASDAQ. “Reducing costs was a primary driver for this project. The project has been a great success when you look at the total cost of ownership compared to our old system.”

NASDAQ, like many other organizations around the world, is being asked to do more for less. “In essence we’re in a commodity business,” says Richmond. “As with other commodity businesses our prices continue to fall at the same time that the volumes we must handle are going up. Ten years ago NASDAQ earned about one penny per trade. Today we make about one-tenth of a penny per trade. SQL Server 2005 is helping us meet our goals of offering our customers more while charging them less.”

Agility to Meet Customer Needs

Moving trade booking operations from the Tandem Enscribe database to SQL Server 2005 has greatly enhanced the agility NASDAQ internal developers enjoy when customizing existing or creating new solutions.

“We have so much more flexibility with SQL Server 2005,” says Richmond. “The differences really stand out when someone asks for an application to be changed. Just a month ago we got a request from one of the business owners to make what I felt was a fairly large change involving adding new functionality to an application. The change would have been exceedingly difficult to do with our old Tandem system. Working with SQL Server 2005 our team completed the task in three or four days.”

“We have a great set of development tools with SQL Server 2005,” says Paul Buu, Senior Technical Specialist at NASDAQ.

“Management Studio provides a great working environment that simplifies testing and debugging. I can simulate a query coming in from the client, for example,

“SQL Server 2005 Snapshot Isolation gives us the ability to support real-time queries without slowing database performance.”

Ray Edwards, Director, Market Information Systems, NASDAQ

generate a report, and then test the whole process.”

NASDAQ developers like the fact that SQL Server 2005 significantly enhances the database programming model by hosting the Microsoft .NET Framework version 2.0 Common Language Runtime (CLR). It enables writing procedures, triggers, and functions in any of the CLR languages, including Microsoft Visual C#® .NET 2003 development tool, Microsoft Visual Basic® .NET 2003 development system, and Microsoft Visual C++® 2003 development system.

“So far we’ve been working with stored procedures, but we very much like the idea of the new SQL CLR feature,” says Buu. “SQL CLR gives us the ability to integrate powerful programmatic solutions without taking the time hit of leaving the database to access an external application. NASDAQ is devoted to delivering real-time solutions, so the ability to use CLR from within the SQL Server 2005 database is a much appreciated feature.”

Real-Time Reporting with Snapshot Isolation

The Snapshot Isolation feature of SQL Server 2005 was a key motivation in NASDAQ’s decision to do an early deployment of the new database. “We process about 100,000 queries per day,” says Richmond. “We saw an early demonstration of Snapshot Isolation and knew this was the solution we needed to run queries against real-time data without slowing the delivery of trading data. It has worked perfectly for us.”

Executing or clearing brokers and authorized NASDAQ supervisors can use queries to access a broad range of trading information including:

- **Trade Scans.** Provide a range of trade information including reversals, step-outs, and as-of trades.

- **Advance Trade Scans.** Users can filter transactions by entering any combination of the following filters/criteria, which can be based on either current or prior day: entry date, security symbol ID, contra firm, firm ID, ACT ready, price, start trade time, end trade time, trade status, trade venue, by/against, trade side, and special indicators.
- **Quick Scans.** Users can filter transactions by entering any combination of the following required filters/criteria for current day: ACT control number, FIX trade reference ID, firm ID, trade status, and security symbol ID.
- **Summary Scans.** Users can utilize the scan to view risk management summaries and real-time market exposure on the firm or security level.
- **Risk Management Scans.** Users can view risk management limit and real-time exposure. The risk management scans can be used by market maker, order entry, and clearing firms to view real-time market exposure for a firm (executing broker’s dollar limits, current trade dollar balance, percent buy limit, percent sell limit, balance for each type of securities, and other factors).

“All queries are performed through stored procedures,” notes Ray Edwards, Director of Market Information Systems at NASDAQ. “We’ve created about 20 stored procedures that help users vary parameters to provide different views of the data according to their query. This gives users the flexibility they need to research data. SQL Server 2005 Snapshot Isolation gives us the ability to support real-time queries without slowing database performance.”

Enterprise-Ready Availability and Performance

NASDAQ needed a solution that was enterprise ready and found it with SQL Server 2005. “Every trade that is processed in the

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NASDAQ marketplace goes through MDDS,” says Richmond. “When we started this project in May 2005 we decided that we would be better served using SQL Server 2005 even though it hadn’t yet been released. We’re now in the process of upgrading our other databases from SQL Server 2000.”

The move from Tandem to SQL Server 2005 and Intel-based servers is something of a milestone in the industry. “For years we used Tandem because of the Tandem’s reputation for reliability,” says Richmond. “The fact that we can move mission-critical applications from Tandem to SQL Server 2005 and Intel-based servers shows how both Microsoft and Intel are creating enterprise-grade solutions.”

Microsoft Windows Server System

Microsoft Windows Server System is a line of integrated and manageable server software designed to reduce the complexity and cost of IT. Windows Server System enables you to spend less time and budget on managing your systems so that you can focus your resources on other priorities for you and your business.

For more information about Windows Server System, go to:

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Microsoft SQL Server 2005

Microsoft SQL Server 2005 is comprehensive, integrated data management and analysis software that enables organizations to reliably manage mission-critical information and confidently run today’s increasingly complex business applications. By providing high availability, security enhancements, and embedded reporting and data analysis tools, SQL Server 2005 helps companies gain greater insight from their business information and achieve faster results for a competitive advantage. And, because it’s part of Windows Server System, SQL Server 2005 is designed to integrate seamlessly with your other server infrastructure investments.

For more information about SQL Server 2005, go to:

www.microsoft.com/sqlserver

Software and Services

- Microsoft Windows Server System
 - Microsoft Windows Server 2003, Enterprise Edition
 - Microsoft SQL Server 2005

Hardware

- Dell PowerEdge 6850 servers with four 3.3 GHz processors and 32 GB of RAM

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