Microsoft .net Enterprise Servers

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Reliability, Performance, Cost-Effectiveness on the Rise with Upgrade of Nasdaq Web Site to the Microsoft .NET Enterprise Servers

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By moving to the Microsoft .NET Enterprise Servers, the world's busiest stock market is enjoying remarkable improvements in reliability, performance, and cost-effectiveness. Even as user and content volume grows substantially on Nasdaq.com, the company has reduced planned reboots by half, cut server hardware requirements by 30 percent, run key applications 20 to 30 percent faster, and easily supported more than 5,000 concurrent users on just nine servers.

Situation

Ever since its launch in 1996, Nasdaq.com, the public Web site of the Nasdaq Stock Market, has met with one success after another: A record-setting number of page hits within days. The first site to offer bid-and-ask stock information. A reputation as *the* one-stop shopping center for investors and others seeking up-to-the-minute market information. Sophisticated and powerful applications. A growth rate from 1997 to 2000 that saw daily peak hits swell from about a million to nearly 30 times that number and a tenfold increase in page count.

To maintain their success in the face of such daunting growth, Nasdaq technical executives are running their entire Web infrastructure on the Microsoft .NET Enterprise Servers, through an upgrade that started with Microsoft® Windows® 2000 Server, including Internet Information Services 5.0, and will soon include Microsoft SQL Server™ 2000.

As Director of Web Operations Ryan Rohaley explains, when it was time to upgrade from the prior platform of Windows NT® Server 4.0 and Internet Information Server 4.0, he and his colleagues looked closely at features supporting reliability, performance, flexibility, and scalability. "We were particularly intrigued by the more robust TCP/IP stack of Windows 2000 Server and the thorough integration of Internet Information Services 5.0 with the operating system," he says. "We figured early on that this integrated approach would help us to enhance reliability, improve performance with minimal code changes, and double or triple the volume of activity supported by each Web server."

Rohaley's team also liked the scalability offered by the Microsoft .NET Enterprise Servers. "We knew that the distributed-processing capabilities of Windows 2000 Server and strong support for clustering in SQL Server 2000 would help us greatly to build highly scalable applications capable of running on low-cost hardware."

Solution Overview

Customer Profile
The Nasdaq Stock Market is the world's first electronic market and largest stock market by dollar and share volume and today lists 5,000 companies.

Business Situation
A stunning rate of growth in terms of both users and content volume revealed a need for greater reliability and performance.

Solution
An upgrade of the Web infrastructure, primarily Nasdaq.com, to the Microsoft .NET Enterprise Servers.

Benefits
Planned reboots reduced by half; server count reduced by 30 percent; application execution 20 to 30 percent faster; savings in database administration anticipated to be reduced by half.

Software and Services
Microsoft Windows 2000 Server with Internet Information Services 5.0
Microsoft SQL Server 7.0
Microsoft SQL Server 2000
Microsoft Visual Studio 6.0
Microsoft Windows NT Services

Scenario
Web-infrastructure upgrade

Line of Business
Online stock quotes and related information

Microsoft

Solution

Nasdaq.com is based on a classic three-tier architecture: a presentation layer of pure HTML and JavaScript; an application layer based on Internet Information Services 5.0, Visual C++®, Visual Basic®, and Windows NT Services; and a data layer that relies on a SQL Server database (version 7.0 as of this writing in April 2001 and slated for imminent upgrade to SQL Server 2000) and other data sources accessed through ADO/OLE DB/ODBC and external-vendor APIs.

To build the pages viewed by users, the presentation layer relies heavily on one of the ISAPI (Internet Server Application Programming Interface) extensions built into Internet Information Services 5.0. When the user issues a query, the ISAPI extension passes it the application layer and its quote engine, which is an internally developed Visual C++ component that pulls data from the SQL Server database. Much of the content of that database comes from 10 other sources on the site, provided by external vendors and delivered to the database by another internally developed script, this one based on Visual Basic. To complete the query, a Windows NT Service interfaces between the data-vendor APIs and the quote engine, which returns the requested data to the ISAPI extension that in turn formats it for the user page.

"With Windows 2000 Server we've been able to cut our planned reboots in half and reduce our unplanned reboots to less than a dozen over a period of more than a year."

Ryan Rohaley
Director of Web Operations
The Nasdaq Stock Market

Benefits

Major Improvements in Reliability and Performance

Today, with Nasdaq.com running on Windows 2000 Server, Rohaley and his colleagues are realizing a number of significant benefits. Chief among them is a marked improvement in reliability. "With Windows 2000 Server we've been able to cut our planned reboots in half and reduce our unplanned reboots to less than a dozen over a period of more than a year," he reports.

Performance is another advantage of Nasdaq's move to Windows 2000 Server. In internal load testing with Nasdaq.com running on two front-end Web servers, the site easily handled over 1,000 simultaneous connections and more than 100 ASP requests per second, and on peak market-activity days the site has supported more than 5,000 concurrent users on just nine Web servers and with less than 40 percent CPU utilization. For this, Rohaley credits Internet Information Services 5.0, two features in particular: The first, server-side-redirection, directs a user to a different page with a single HTTP request instead of the two such requests required under Internet Information Server 4.0. The second, out-of-process execution, enables any given Nasdaq.com application to run 20 to 30 percent faster than it did under Internet Information Server 4.0.

With the reliability and performance improvements provided by its move to Windows 2000 Server, Nasdaq has managed to reduce the server hardware required to run Nasdaq.com by 30 percent, even while implementing a remote disaster-recovery system and providing considerably greater overall functionality. "What this means for us is a dramatic reduction in the costs of hardware licensing, maintenance, and administration," Rohaley says.

Hardware

Web and application servers for overall Web infrastructure (Nasdaq.com plus applications): nine Dell 6350s and 50 Dell 6450s with quad Pentium II or Pentium III Xeon processors and RAM of 256 MB to 1GB.

Database servers: 20 Dell 6300/6400s with Pentium II and Pentium III Xeon processors, 1 GB of RAM, and RAID 10 data drives.

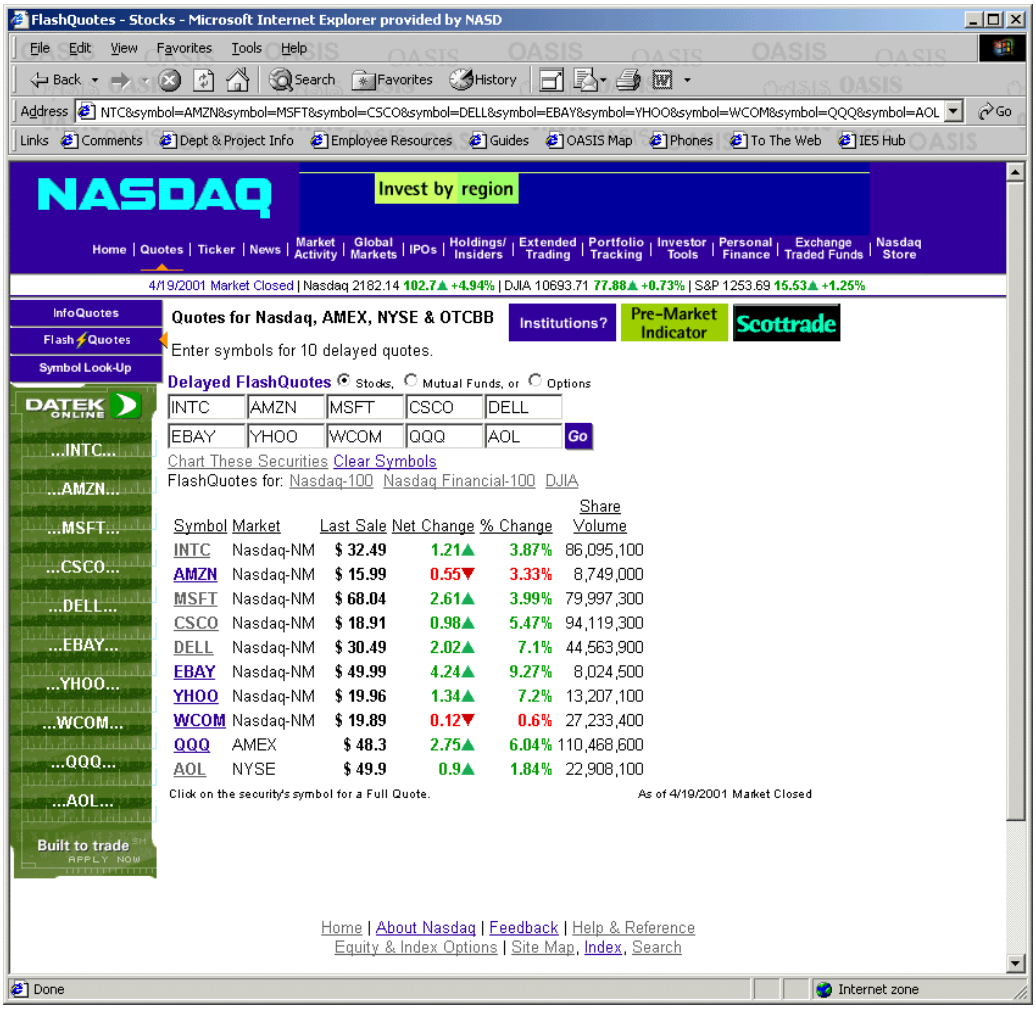

Figure 1 The Nasdaq Flash Quote page appears rapidly thanks to a quote engine that generates each quote in less than one second.

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Ryan Rohaley
Director of Web Operations
The Nasdaq Stock Market

Cutting Administrative Overhead Costs by Half

Nasdaq technical executives are looking forward to taking the next step in their upgrade to the .NET Enterprise Servers: a move from SQL Server 7.0 to SQL Server 2000. According to Rohaley, the primary motivator for this move is the site's extensive use of replication. "We perform continuous replication of more than 150 tables, so we really appreciate the fact that SQL Server 2000 supports a seamless approach to the process," he says. "Once the upgrade is complete, we anticipate reducing administrative overhead costs to just half of what they are now."

For Rohaley and his colleagues, another advantage of SQL Server 2000 is its ability to interface directly with XML. "By eliminating the need for us to use an XML parser, we figure that the move to SQL Server 2000 will help us to reduce both administrative and development costs significantly."

Big Plans in Store for the Microsoft .NET Enterprise Servers

In addition to SQL Server 2000, Nasdaq will embrace other Microsoft .NET technologies as part of its work with the Joint Developer Program for the next-generation server platform from Microsoft. For

example, Nasdaq will deploy the new platform's quote engine shortly after release, and developers are now studying the C# language with an eye toward integrating Nasdaq's own quoting mechanism into the Microsoft .NET Framework. Nasdaq also is working with Microsoft on the development of a BizTalk® 2000 Server standard for equity data called MDML, one of several emerging standardization initiatives focusing on the exchange of financial data in XML formats. And these are just of the few of the plans Nasdaq developers have in store for the Microsoft .NET Enterprise Servers.

"For us, Microsoft server and Internet technologies are almost a culture, and we plan to use them for virtually all our Web development—from architectural design to content production to publication to distribution," Rohaley says. "Given our experience, using Microsoft .NET Enterprise Servers for Internet applications is an easy and obvious choice."

The .NET Enterprise Servers are Microsoft's comprehensive family of server applications for building, deploying, and managing next-generation integrated Web experiences that move beyond today's world of standalone Web sites. Designed with mission-critical performance in mind, .NET Enterprise Servers will provide fast time-to-market as well as scalability, reliability, and manageability for the global, Web-enabled enterprise. Built from the ground up for interoperability using open Web standards such as XML, the .NET Enterprise Servers are a key part of Microsoft's broader .NET strategy, which will enable a distributed computing model for the Internet based on Internet protocols and standards in order to revolutionize the way computers talk to one another on our behalf.

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