Sapient Uses Microsoft .NET Framework and Visual Studio .NET to Simplify Development, Enhance Security of Medical-Information Solution

With the help of the Microsoft® .NET Framework and Microsoft Visual Studio®.NET development environment, Sapient Corporation built a medical/health-information and management solution for corporations with onsite clinics. The fully integrated components of the Microsoft .NET Framework and the comprehensive development environment of Visual Studio .NET proved instrumental in enabling Sapient to provide its client, Whole Health Management, a powerful, secure, and versatile solution.

Company Overview

Founded in 1991 and with offices in 16 cities worldwide, Sapient Corporation provides business and technology consulting to Global 2000 businesses in the form of rapid application and support of advanced information technology on a fixed-price basis. One of those businesses, Whole Health Management, recently enlisted Sapient to develop an integrated medical-records and health-information solution to work in concert with the onsite clinics that Whole Health manages in its role as an employee health-care provider. In response, a collaborative Whole Health and Sapient team created YourWholeHealth, an aptly named solution providing comprehensive functionality to employers, employees, and health-plan administrators at such companies. The solution joins an off-the-shelf system that handles electronic medical record and scheduling information with a third-party Web-portal provider through which individuals can view their medical records and access a variety of health-related information. Sapient developers built the solution on an exclusively Microsoft platform, using an array of Microsoft .NET Framework components, and with the help of the Microsoft Visual Studio .NET development environment. And everyone involved, says Sapient Senior Manager of Technology Dean McRobie, is delighted by the results of their handiwork.

As McRobie goes on to explain, Whole Health executives came to Sapient with the idea of enhancing the onsite health clinics they manage with an integrated medical-records management system. Such a system would reduce operating costs by giving employees direct access to

Solution Overview

Profile
Based in Cambridge, Mass., technology consultant Sapient Corporation employs 1,900 and in the year 2001 generated business sales of $330 million.

Business Need
Sapient needed a way to simplify development of an integrated medical-records and health-information solution while providing the performance, security, and total cost of ownership required by the customer.

Benefits
Simplified development due to the fully integrated development environment of Visual Studio® .NET, ASP.NET, and the component-based foundation of the .NET Framework; a highly secure solution thanks to the integrated security of the .NET Framework; and the performance advantages of compiled, rather than interpreted, Active Server Pages (ASP).

Microsoft Technologies Used
Microsoft® Windows® 2000 Server with Internet Information Services 5.0 and Message Queuing 3.0
Microsoft BizTalk Server® 2000
Microsoft .NET Framework
Microsoft Visual Studio .NET
SQL Server 2000

medical information and giving employers greater reporting capabilities regarding clinic operations. The requirements were limited but stringent, and they focused on integration. Because the solution would be communicating highly confidential health and medical information, security needed to be integrated seamlessly, comprehensively, and from the very beginning. Whole Health executives wanted a solution that could be developed, deployed, and maintained cost-effectively, and they knew this would require tools and components that were integrated easily if not transparently.

For McRobie and his colleagues, these requirements led ultimately to the Microsoft .NET Framework and Visual Studio .NET. "At first, we considered using Netscape Directory Services and Oracle Database Server," he says. "But in the end we knew the integration challenges of working with the Netscape and Oracle products might limit the critical level of security we needed and introduce more complexity in development and support. In contrast, the highly integrated nature of the .NET Framework and Visual Studio .NET would provide the end-to-end security we were seeking and a simplified approach to development and support."

Solution

To create the YourWholeHealth solution, twelve Sapient developers spent six weeks on design and ten weeks on implementation and testing. Of all the .NET Framework components, they made perhaps the most use of ASP.NET. With it, they created the business logic behind three user portals: one providing employees direct access to their private medical records and other health information; one providing employers information on how their onsite clinics are being used, along with secure real-time reporting; and one enabling administrators to create and manage user accounts as well as the content to be displayed on the other portals.

Another .NET Framework tool that Sapient developers used extensively for the YourWholeHealth solution is COM Interop, which they used to make the .NET Framework components interact with a BizTalk® Server 2000-based system for exchanging data between the front end (with user authentication provided by the Active Directory® service) and a central data repository based on Microsoft SQL Server™ 2000. A separate part of the BizTalk Server 2000 component relies on parsing with the help of System.XML v.4, which Senior Associate of Technology Robert Gaines says was easier to use and provided twice the performance of its predecessor.

YourWholeHealth runs on two Web servers with an additional server used for the BizTalk Server 2000 components. The solution interacts with three external systems: an electronic medical-records (EMR) application; an electronic practice-management (EPM) application; and the third-party Web portal that is integrated into the front end. The data repository acts as central clearinghouse for the data and generates reports, with BizTalk Server 2000 handling the data flow among these systems: intercepting messages, interpreting them, writing data to the database, and then forwarding it to the appropriate system.

Benefits

Rock-Solid Security, Simplified Development

Reviewing the components that constitute the versatile and multifunctional YourWholeHealth solution, Gaines is happy to discuss the advantages that his team realized from having used the Microsoft .NET Framework and Visual Studio .NET. First among them is security, because of the

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highly sensitive nature of the data processed by the solution. Take user authentication, for example. "When a user logs into the solution, the built-in impersonation features of .NET Framework and Windows® 2000 Server provide automatic authentication from the presentation layer all the way down to the database," he explains. "This is not only a thorough approach to solution security but also a practical one, because it uses the fully integrated security model of the .NET Framework, minimizing the need for specialized security coding and reducing the need for ongoing security audits."

According to Gaines, simplified development was another major advantage of working with the .NET Framework and with Visual Studio .NET, due largely to that product's integrated development environment (IDE). "It was invaluable to have a single user interface for integrating components ranging from the Web portal to the database, for integrated debugging support, for access to consistent menu items and tools, and for a uniform approach to working with Visual SourceSafe," he says. "This kind of productivity advantage translates directly into simplified development."
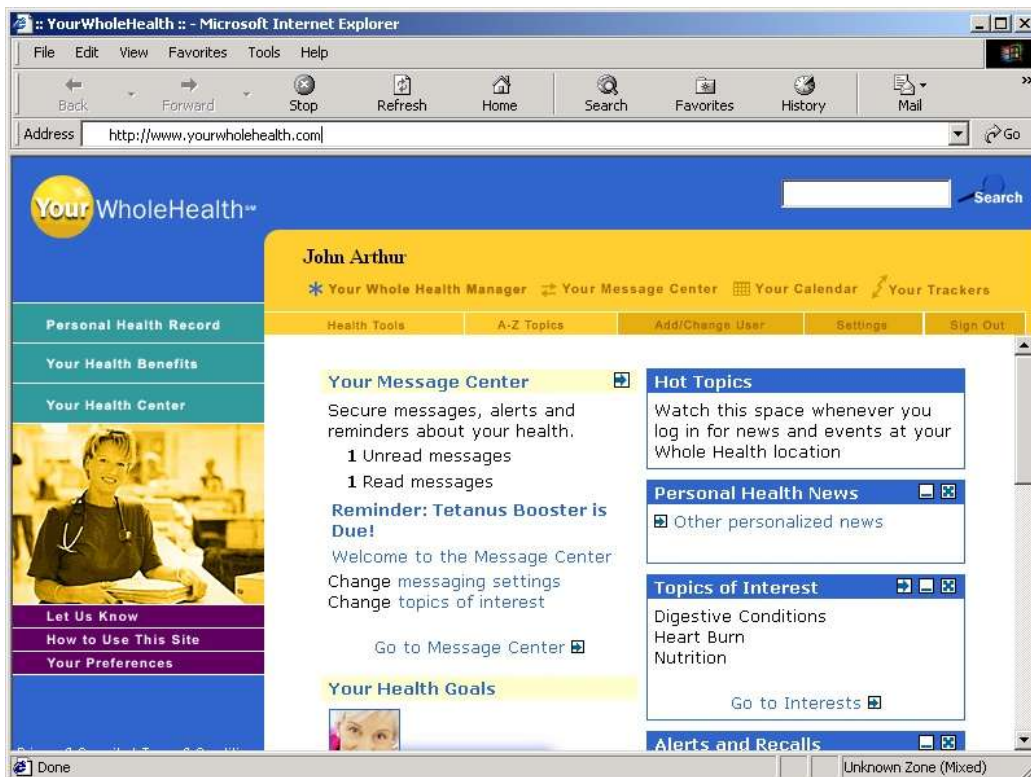
Figure 1: YourWholeHealth users can easily access medical records and related information.

Multitier Approach and Versioning Prove Highly Practical

Yet another contributor to simplified development, according to Gaines, was ASP.NET, largely because of the way it reinforces the separation of the presentation tier and the business-logic tier. "This enabled the team to work readily with a third-party design firm that developed the front-end pages while focusing on implementing the business logic," he reports. The team extended this idea further by developing custom content tags that could be placed in the ASP.NET pages to display content that would be unique to a given employer or clinic. "Because of this, the

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developers of the front-end pages didn't need to concern themselves with presentation logic and could focus instead on the visual design and user-experience aspects of the pages," he adds.

Productivity applies beyond development of the initial solution, Gaines is quick to add, and because of this he and his colleagues are grateful for the enhanced support for versioning provided by the .NET Framework. "It used to be a complex operation to deploy a solution built by multiple developers at various different times," he says. "But with the enhanced versioning support of the .NET Framework, complexity is reduced and testing is vastly simplified."

"Staggering" Performance Results

McRobie and the team laud the functionality and performance benefits provided by the .NET Framework and Visual Studio .NET. "Functionality is enhanced by transparent COM interoperability, ease of data manipulation, and native XML support, and performance, by the fact that ASP.NET is compiled rather than interpreted," McRobie points out. "Initial testing indicates that our compiled ASP.NET code appears at least three times faster than interpreted ASP." Stress testing also has yielded some pretty impressive results, he adds. "The solution is easily supporting 1,250 fully authenticated concurrent users, a number that is far more than we originally anticipated and staggering in its implications."

One such implication is that YourWholeHealth will easily scale, when necessary, to accommodate more users and powerful enhancements, helping it to play an increasingly important role as a competitive differentiator for Whole Health. One of those enhancements will involve an upgrade from BizTalk Server 2000 to BizTalk Server 2002. As Sapient Director of Technology Graeme Douglas explains, this upgrade will enable the team to easily orchestrate Web services, simplifying the custom development that is required to make YourWholeHealth suitable for its diverse corporate customer base.

"With BizTalk Server now, business processes can be captured in a tool with a very accessible user interface, and BizTalk Server 2002 will do this while giving us even stronger integration with third-party packages, standards-based Web services, and a more standards-based approach to messaging," Douglas says. "This means much of the new ideas for customizing a solution can be initially applied by the customers themselves, ideas that we'll implement in a way that's timely, that enhances performance, and that contributes to a lower total cost of ownership. That's what we are getting with the .NET Framework and Visual Studio .NET, which makes these technologies so essential to our success."

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