WebHealthCentre.com
Free Health Care on the Web

Telemedicine Portal Extends Quality Healthcare to India's Rural Poor

Overview

Country: India
Industry: Healthcare and Healthcare Insurance

Customer Profile
WebHealthCentre.com is a health portal offering information and online consulting services. Its mission is to make quality healthcare accessible to patients wherever they are.

Business Situation
Quality healthcare is inaccessible to most people in the developing world because of economic and logistical barriers. Although there are many healthcare Web portals, few are actually conduits for care.

Solution
Tata Consultancy Services used Microsoft technologies to create WebHealthCentre.com, a telemedicine portal offering health information as well as online consultation, appointments, and lab reports.

Benefits
- Improved access to healthcare
- Better use of doctors' time
- Rapid development, usability
- Scalable to millions of patients
- Extensible to new technologies

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>
> Dr. Sumanth Raman, Director, WebHealth Systems

The number of patients is increasing exponentially each year, putting enormous pressure on healthcare delivery systems worldwide. Hospitals and specialists are concentrated in cities and are inaccessible to the rural poor. Tata Consultancy Services (TCS)—a Microsoft® Certified Partner and India's largest information technology (IT) enterprise consulting firm—collaborated with several Indian physicians to create WebHealthCentre.com, a comprehensive healthcare portal like no other. In addition to offering abundant health-related reference materials, WebHealthCentre.com offers online medical consultation, online appointment scheduling, and online lab results for physicians. By using the Microsoft .NET Framework, Microsoft Windows® 2000 Advanced Server, Web services, and Microsoft SQL Server™ 2000, TCS quickly created a flexible and scalable set of online healthcare services that are extensible to a range of platforms.

TATA CONSULTANCY SERVICES

Microsoft®
Windows Server System™

Situation

In 1998, Indian internist Dr. Sumanth Raman had an idea for a new kind of online healthcare portal. He envisioned a Web site that not only offered abundant healthcare content for reference, but also delivered healthcare services by using telemedicine technologies.

In Raman's native country, the doctor-patient ratio is low: 1:2,000, compared to 1:467 in the United States. Further, most physicians are concentrated in urban areas, which are difficult and expensive to reach for millions of rural poor. A low-cost telemedicine solution could bring much-needed healthcare services to remote areas of India, where a standard telephone connection and a simple PC are more readily available than a medical clinic or superspecialist consultant.

Raman was encouraged by the fact that the Indian government and volunteer organizations have provided hundreds of villages with kiosks equipped with a computer, a telephone, and an educated operator. The government is also equipping health clinics in many rural areas with basic communication devices such as telephones and PCs with Internet access. Lastly, mobile phone usage and mobile network coverage have penetrated rural India in a big way; rural cellular phone usage grew by 77 percent in 2002.

"Our objective was to build a Web site that would enable medical professionals to offer telemedicine and online consultation to people across geographic barriers through the Internet," says Dr. Raman, Director of WebHealth Systems. "This would be useful to doctors and institutions in giving follow-up advice and preventive care to their own patients and to others seeking medical advice."

Even at the conceptual level, Raman and associates were keen on making the site a medical and health services channel, rather than merely a content portal. They envisioned online consultation, online lab reports, Web-based electronic health records, health trackers and calculators, a virtual clinic and student center, online appointment scheduling, and the ability to access the system by using mobile devices.

Technologically, Raman wanted a flexible, economical development environment that would enable rapid delivery of the solution and accommodate multiple delivery mechanisms, including mobile devices. The solution also had to provide ease of use and cost-effective scalability. "We were looking for a technology for the people," Raman says. "We needed a common interface through which we could easily deliver a range of healthcare services to the literate and semiliterate."

Solution

Raman and his colleagues laid out their basic requirements for the new portal:

- Ease of use by a wide cross section of people
- Cutting-edge yet cost-effective technologies
- Simple logon by many different users and easy assignment of user rights
- Tight security to protect confidential medical records
- Structured data capture for future data mining
- Scalable to handle millions of users
- Extensible to accommodate audio and video interfaces

The team of physicians turned to Tata Consultancy Services (TCS) for assistance in bringing its ideas to life. TCS is India's largest information technology (IT) enterprise as well as Asia's largest independent software and

services organization. A Microsoft® Gold Certified Partner, TCS also has a large consulting practice in the healthcare industry, a global presence and outlook, and a willingness to support community initiatives with cost-effective services.

Ideal Platform for Web and Mobile Services

Vikram Rajkondawar is a TCS engineer and technical lead responsible for Microsoft .NET feature implementation on the WebHealthCentre.com project. "The Microsoft .NET Framework is ideal for the kind of site that Raman and his colleagues wanted to build," says Rajkondawar. "It is the best platform for cost-effectively developing Web- and mobile-enabled services. Microsoft Windows Server System products such as Microsoft Windows 2000 Advanced Server and Microsoft SQL Server 2000 provide the security, scalability, and extensibility they required."

The breadth of Microsoft technologies provided TCS with the building blocks to satisfy all WebHealthCentre.com requirements. TCS used the following Microsoft products to create WebHealthCentre.com:

- **Microsoft Windows® 2000 Advanced Server** provides a highly reliable platform with easy system management features and contributes to the rapid development of Web services.
- **The Microsoft .NET Framework** provides platform-independent communication between applications; a high degree of robustness, scalability, and interoperability; rapid development; broad language support; a large set of programmable controls; event-driven programming; Extensible Markup Language (XML)–based components; easy user authentication; increased performance through the use of compiled code; and automatic recovery

from memory leaks and errors to maintain application availability to users.
- **Microsoft Visual Studio® .NET 2002** provides development tools for quickly and easily developing Web services–based applications and data exchange capabilities.
- **Microsoft SQL Server™ 2000** accommodates large volumes of data and provides rapid data searches and flexible reporting. TCS has found that data management is easier with SQL Server than with other databases such as Oracle. It's also far more cost-effective and easier to work with, reducing development time and costs.
- **Microsoft Internet Explorer** proved to be fast and easy to use. The auto-complete feature saves time and prevents errors, especially in rural clinics with limited literacy.
- **Microsoft Windows NetMeeting** offers WebHealthCentre.com a suite of audio, video, chat, text, and whiteboard solutions at no extra cost, helping patients and healthcare workers in rural areas connect with physicians in real time. NetMeeting integrates with data templates created by TCS to provide a single-window interface through which doctors simultaneously view the patient, his or her medical history, and attached diagnostic images and reports.
- **Microsoft Passport authentication services** provide tight security for confidential patient data.

"Microsoft also has a large and significant presence everywhere our users are located, and their familiarity with the Microsoft suite of products made training much easier," Raman says.

Developers Quickly Become Productive

At the time TCS launched development of WebHealthCentre.com, Microsoft .NET was brand new. "The technology was new, but our developers soon felt really comfortable using

.NET," Rajkondawar says. "In a week's time we were up to speed and very excited by its flexible and diverse features."

Adds Paulraj Chellappa, a project leader at TCS: "The .NET Framework helps us develop compact applications that can be sent on mobile devices; this is invaluable for us, since diagnostic centers are in remote areas of the country with often no more sophisticated technology than a mobile phone. With .NET technologies, we can exchange a broad range of data using Web services, integrate wireless access into existing healthcare applications, and implement very tight security."

The TCS development team also used the Visual Studio .NET 2002 development system to create application code. The IntelliSense® technology in Visual Studio accelerated development by automatically generating code in the Code Editor. The team used Microsoft ASP.NET to build Web pages and Microsoft ADO.NET to provide consistent access to data sources such as SQL Server and data sources exposed through XML.

"Visual Studio .NET is the only development environment built from the ground up for Web services," Chellappa says. "By allowing applications to share data over the Internet, Web services enable us to assemble applications from new and existing code, regardless of hardware device, programming language, or object model. Visual Studio .NET helped us easily build data-driven applications with XML."

For the broadest possible reach to Internet-enabled devices, Visual Studio .NET 2002 provides mobile Internet features that enabled TCS to build a single mobile Web interface that supports a broad range of devices. These included Wireless Markup Language (WML) 1.1 for Wireless Application Protocol (WAP) cell phones; compact HTML for i-mode phones with continuous Internet

access; and HTML for Pocket PCs, handheld devices, and pagers. Server-side mobile controls intelligently generate the appropriate rendering and pagination for the target Web device, providing a rich and consistent user experience while preserving developer flexibility.

Robust, High-Performance Database

SQL Server 2000 provides WebHealthCentre.com with a high-performance, highly scalable, cost-effective database. "SQL Server holds the top TPC [Transaction Processing Council] performance and price/performance ratings and is generally accepted to be easier to install, use, and manage than other enterprise databases," says Ramesh Manian, a project leader at TCS. "SQL Server includes online analytical processing [OLAP] and data mining as standard features, which saved us a great deal of development time and costs for our client. SQL Server is, of course, compatible with the .NET Framework, which also accelerated development."

SQL Server statistics for the WebHealthCentre.com database are as follows:

- Workload: 60-plus queries per minute
- Average data load rate: 75,000 rows per day
- Peak data load rate: 24,000 rows per second

Leading Telemedicine Portal

In just five years, WebHealthCentre.com has become the world's most-used telemedicine portal. It provides one of the largest online health databases in the world, has 37,000 registered users, stores more than 40,000 medical records, and has facilitated more than 18,000 online consultations—through its affiliated network of hospitals and physicians alone—to date. WebHealthCentre.com receives approximately 400,000 page views

each month from doctors, patients, and medical students around the world and has been among the top 10 Web sites rated by the Google PageRank order under the "Online Health Consulting" category. Interestingly, although designed to serve the rural poor, WebHealthCentre.com receives more hits from the United States than from any other country.

Key features of WebHealthCentre.com include:

- Online, real-time medical consultation with remote healthcare professionals.
- PC or mobile-phone access to regional directories for hospitals, specialists, blood banks, medical appliance suppliers, and welfare agencies.
- An online appointment scheduler that enables patients to make appointments with participating physicians.
- An online lab report tool that helps diagnostic centers automate the process of uploading lab reports to the Web.
- Access to test results through mobile devices.
- Online access to electronic health records.
- Medical image upload services.
- Online sonogram viewing.
- A medical student resource center.
- Healthcare job listings.
- Online shopping for healthcare supplies.

Online Lab Tool and Appointment Scheduler

Over a 90-day period, seven TCS developers added two popular interactive applications on WebHealthCentre.com: an online lab reporting tool and an online appointment scheduler.

The online lab tool is an application created with Visual Basic .NET that runs in participating labs across India. The tool is used to retrieve lab report data from various lab databases and upload the reports to the

WebHealthCentre.com server by using Web services and the Framework. The uploaded lab results are then available for a physician to view on the Web or by mobile phone.

"All these labs use different databases and different platforms, but our application doesn't care," Manian says. "Using Web services, we can bridge these different environments and translate a diversity of data into a common format."

The online appointment scheduler enables patients to request appointments with any doctor who uses it. The module was developed by using ASP.NET, with SQL Server as the database. This tool offers a far more convenient and cost-effective method of appointment scheduling than making expensive long-distance calls.

Benefits

WebHealthCentre.com is providing improved access to healthcare information and services for citizens around the world, particularly in India's low-income rural areas. The Web portal makes better use of physicians' time by giving them instant access to patient data through PCs and mobile devices. The use of .NET, Visual Studio, and Windows Server System products helped TCS get the Web site up and running in a matter of months. WebHealthCentre.com has a foundation that is scalable and extensible to accommodate new technologies and features.

Improved Access to Healthcare Services

Millions of users around the world access WebHealthCentre.com every day, but the site plays a particularly critical role in improving access to quality healthcare in India. WebHealthCentre.com is currently in use in eight Indian states and has provided online medical consultation—through its affiliated network hospitals alone—to 18,000 people to

date. In addition, countless more telemedicine consultations have taken place with participating institutions. Through a combination of government and private funding, WebHealthCentre.com currently reaches 98 villages with a total population of nearly 1 million.

Because WebHealthCentre.com allows patient history details and diagnostic images to be stored for later access, patients can receive top-level medical advice from remote specialists in their home towns, avoiding travel expenses for patients and their families. Even in the case of surgery, initial screening advice and date-setting can be done remotely.

At 14 local medical clinics in the Madurai and Theni Districts in Tamil Nadu, India, a Real-Time Online Teleconsultation Clinic is open every day from 9:00 A.M. until 1:00 P.M., when physicians and area clinics can access specialists at Government Rajaji Hospital for opinions on specific cases. Local physicians can send medical images, medical reports, electrocardiograms, and other documentation for the expert to view.

As part of the Sustainable Access in Rural India Project, an active nongovernmental health organization has helped set up Internet kiosks in villages throughout several Indian states. Health services through WebHealthCentre.com using audio and video support enable patients to see and speak to physicians and physicians to speak to patients. "These kiosks link to regional specialist centers and allow patients to hold online consultations with doctors they would likely never be able to see in person—at least not without expensive travel and weeks of waiting," Raman says.

Better Use of Doctors' Time

The extensive online resources of WebHealthCentre.com help busy physicians make more efficient use of their time. "Doctors tend not to be very technology-savvy," Raman says. "All they use is e-mail. But response in India has been very good. Nearly 1,000 doctors are using our applications."

Online tools such as lab reporting are particularly appreciated, because they significantly reduce report availability time. Normally, physicians wait from two to six hours to receive lab reports. The online lab reporting tool delivers reports within two to three minutes after they are available from the lab. "The online lab reporting tool provides not only significant time savings, but also, in some cases, life-saving benefits," Raman says. "For critical cases, speed of treatment is often a matter of life or death."

Rapid Time-to-Market with Comprehensive Solution

By using .NET technologies and Visual Studio .NET, TCS was able to roll out the first implementation of WebHealthCentre.com in just 36 weeks. Adding the online lab results tool and appointment scheduler took seven developers just 90 days. "We were able to get up and running on Microsoft .NET very quickly without a huge investment," Manian says. "That allowed us to get to work on the site right away and have a production-ready product ready in record time."

Scalable to Millions of Patients

The Microsoft foundation also gives WebHealthCentre.com a great deal of cost-effective scalability to handle expected growth. Already the site is being used by nearly 1,000 doctors, receives 400,000 page views each month from 70,000 to 100,000 unique visitors, stores more than 40,000 medical records, and has 37,000 registered users.

The company's next big project is to extend telemedicine services to the remote island

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For More Information

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For more information about Tata Consultancy Services products and services, call (425) 462-4861 or visit the Web site at:
www.tcs.com

For more information about WebHealthCentre.com, visit:
www.webhealthcentre.com

territories of Andaman and Nicobar Island in the Bay of Bengal, where 31 rural healthcare centers are being connected with two large regional hospitals. Implementers will incorporate live, multiparticipant videoconferencing to personalize health delivery and help doctors make more accurate diagnoses.

Extensible to New Technologies

WebHealthCentre.com is looking to extend mobile access to other types of devices. For example, the site's creators would like to integrate monitoring devices such as heart- and pulse-rate monitors as well as oxygen-saturation indicators into the system, so physicians can collect data on a patient's key health indices over specific periods of time. The data will be sent back to WebHealthCentre.com databases, where it can be analyzed by physicians.

"Healthcare can be considerably enhanced by gathering more patient data," Raman says. "Small patient-monitoring devices can send a continuous stream of real-time data to databases that store the data and allow both automated responses to certain events and detailed analysis of the data by using data mining tools. Microsoft technologies give us an extremely powerful platform to extend WebHealthCentre.com in any direction."

Microsoft Windows Server System

Windows Server System integrated server infrastructure software is designed to support end-to-end solutions built on the Microsoft Windows Server™ 2003 operating system. It creates an infrastructure based on integrated innovation, Microsoft's holistic approach to building products and solutions that are intrinsically designed to work together and interact seamlessly with other data and applications across your IT environment. This allows you to reduce the costs of ongoing operations, deliver a more secure and reliable IT infrastructure, and drive valuable new capabilities for the future growth of your business.

For more information about Windows Server System, go to:
www.microsoft.com/windowsserversystem

Software and Services

- Microsoft Windows Server System
  - Microsoft Windows 2000 Advanced Server
  - Microsoft SQL Server 2000 Enterprise Edition
- Microsoft Visual Basic .NET 2002
- Microsoft Visual Studio .NET 2002
- Services
  - Web services

Technologies

- Microsoft ADO.NET
- Microsoft ASP.NET

Hardware

- One HP DL360 application server
- One HP DL360 database server
- One HP DL360 Web server

Partners

- Tata Consultancy Services

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Software and Services
- Microsoft Windows Server System
  - Microsoft Windows 2000 Advanced Server
  - Microsoft SQL Server 2000 Enterprise Edition
- Microsoft Visual Basic .NET 2002
- Microsoft Visual Studio .NET 2002
- Services
  - Web services

Technologies
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Hardware
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