AVANADE® CASE STUDY

Avanade Helps World-Renowned Cancer Center Improve Patient Care

M. D. Anderson's Electronic Medical Record System, Built with Service-Oriented Architecture, Improves Physicians' Productivity and Patient Care

M. D. Anderson, a world-renowned cancer center, needed to get complete, up-to-date patient data to medical professionals in a useful and timely manner. Commercial electronic medical record (EMR) systems could not accommodate the complex workflows at M. D. Anderson, where research and clinical care are closely intertwined. Using Service-Oriented Architecture (SOA), Avanade Inc. helped M. D. Anderson build an EMR system that aggregates both clinical and research data from more than 40 disparate applications, providing physicians and nurses a complete and current view of the data associated with each patient. With the new system's flexibility, the center can continue to allow departments to pursue whatever software applications best suit their needs, presenting the data from those applications in a single comprehensive tool. With its security, the center's physicians can collaborate worldwide. With its scalability, the center can continue to grow in its ability to serve more patients and incorporate new types of data into each patient's record. Most important, however, providing physicians with comprehensive EMRs has improved productivity and greatly enhanced patient care.

THE UNIVERSITY OF TEXAS MD ANDERSON CANCER CENTER

OVERVIEW

Industry
Healthcare

Geography
United States

Solution Summary
Avanade helped M. D. Anderson develop a breakthrough Electronic Medical Record system by taking advantage of Service-Oriented Architecture.

Technology
ACA®.NET, ACA Lifecycle, Microsoft® .NET, Microsoft SQL Server™ 2005, Microsoft Office SharePoint® Portal Server 2003; Microsoft Operations Manager 2005; Internet Information Services version 6.0; Windows Server® 2003; Windows Vista®; Microsoft Visual Studio® Team System development system

Benefits

- For the first time, physicians have a complete and current electronic view of data associated with each patient.
- Complete electronic medical records are available to medical staff when and where they need the data, which improves patient care.
- Complete electronic records also improve the facility's workflow, improving efficiency to reduce costs.
- M. D. Anderson has implemented a system that can accommodate growth in numbers of patients and amount of patient data—as well as evolve in functionality.

Customer Background

M. D. Anderson

The vision of the University of Texas M. D. Anderson Cancer Center is to be the premier cancer center in the world, based on the excellence of its people, research-driven patient care, and science. M.D. Anderson seeks to eliminate cancer through programs that integrate patient care, research, prevention, and education. The center provides cancer care in the form of surgery, chemotherapy, radiation therapy, immunotherapy, and combinations of these and other treatments.

Located in Houston, Texas, M. D. Anderson has treated more than 700,000 people since it was founded in 1944. With more than 16,000 employees, M. D. Anderson serves about 79,000 patients annually. In 2007 it was named the nation's top cancer center by *U.S. News & World Report* magazine.

Business Challenge

Doctors need comprehensive electronic medical records

"In cancer, the world of research and the world of clinical care are intertwined very closely," says Lynn Vogel, Vice President and Chief Information Officer at M. D. Anderson. "Developments can move from the research side to clinical practice even on a weekly basis."

Managing that flow of information can be a real challenge, especially because, Vogel says, "Cancer patients have a lot of data." The data can include routine care, lab tests, radiology images, and data derived from their participation in clinical and research protocols.

Because of this mountain of data, medical professionals' productivity has long been hampered by the effort required to find both physical records and particular pieces of data within a record. "A nurse might have had to go to a radiology department film library to pull the film—and sometimes it would be off with someone else," says Vogel. "Or the nurse or doctor would take half an hour paging through a physical medical record to find a particular lab result."

So, early on, M. D. Anderson saw the need to move to electronic medical records (EMRs), which would both ease the burden of paperwork and improve the availability of data. In 1999 the center's IT department created an application called ClinicStation to integrate the presentation of radiology images with clinical data stored in a variety of IT systems. Structurally, ClinicStation was an impressive early move toward a service-oriented architecture (SOA), which treats services as components that work together to accomplish business goals. By reusing software features and simplifying their integration as "services" in new composite business systems, SOA leverages investments in existing technologies and provides the agility to adapt to an organization's changing needs.

ClinicStation was written using the Microsoft® Visual Basic® version 6.0 development system and the Component Object Model (COM). Over the next six years, the center continued to enhance ClinicStation with new features, and it evolved into a complex workflow system. But as M. D. Anderson sought a more advanced EMR strategy to include data other than radiology images, it found that commercial software packages couldn't accommodate its needs. Most such packages were focused only on acute care and couldn't integrate research data. Additionally, many had been originally designed solely for outpatients or for

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inpatients and didn't make a successful transition to cover both.

In 2005, M. D. Anderson decided to expand the success of ClinicStation and SOA by developing its own EMR environment in-house. The solution needed to be able to adapt to the center's complex organization and workflow processes in providing medical professionals with comprehensive, up-to-date patient data from disparate software systems. Only SOA could link the data from more than 40 back-end systems into single comprehensive tool.

Thus the center's IT department had two technical goals, says Chuck Suitor, Director of EMR Development and Support. "First, we wanted to make sure the architecture would support us for a good long time to come. We needed an infrastructure that could guarantee performance, scalability, and reliability." The system needed to support not only growth in numbers of patients served and the amount of data on each patient, but also potential new technologies and functionality.

"Second," Suitor continues, "we had to ensure that our IT organization could grow. Historically we'd had an exceptionally small development team, three people or fewer, and now we needed a methodology and organization that could support a large team."

Microsoft .NET Is the Right Choice

M. D. Anderson decided to rewrite ClinicStation using a full SOA and the Microsoft .NET Framework. The center selected Microsoft software because it wanted a set of technologies to provide a foundation that would support numerous existing heterogeneous systems and into which its different departments could integrate commercial software applications. "Such an ambitious project was only feasible with these kinds of tools now available that literally weren't available even three or four years ago," says Vogel.

Avanade aids in development and knowledge transfer

The revised ClinicStation would serve as the foundation for the M. D. Anderson EMR strategy. ClinicStation would be the application to present all types of patient data—from both existing systems and those to come in the future—to medical staff at the appropriate time. The center thus required an architecture, methodology, and organization that could build a flexible system customized to its workflow—and could guide IT staff through continual upgrades to handle more patients, more data, and more functions. Vogel and Suitor realized that they needed to create a disciplined software development organization with common standards, tools, libraries, processes, and methodology.

In October 2005, M. D. Anderson chose Avanade as its partner in the development effort. "Avanade had experience in building large-scale development teams, which was something we were very interested in," says Suitor. "We had to learn the techniques of implementing and managing a large team, and ensuring the consistency of our implementation of a solid architecture." Avanade had unparalleled expertise in mission-critical .NET/SOA development. However, Suitor was especially impressed that Avanade had experience partnering with customer development teams to support knowledge transfer and long-term system maintainability.

The project began with Avanade re-architecting ClinicStation through a full use-case definition effort to develop functionality requirements and provide

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documentation necessary for future system maintainability. Over 15 months, M. D. Anderson and Avanade worked closely together on iterative feature development with rigorous quality assurance. M. D. Anderson was particularly concerned that critical HIPAA and other secure information was protected and auditable at every step in the process.

Avanade also helped retool the M. D. Anderson software development staff from Visual Basic to C#. Avanade developed a detailed curriculum and affiliated training on the Avanade Connected Architecture® for .NET (ACA®.NET) SOA framework, which is built on C#. Avanade then developed an EMR "training sandbox" that demonstrated how to develop new EMR functionality with coding standards, best practice guidelines, and support in both a hands-on and video training format.

The Solution

Innovative service-oriented architecture provides access to data in different formats

In the new system, still called ClinicStation, physicians and other medical staff gain access to patient data from more than 40 back-end systems operating on a variety of disparate platforms through the SOA framework. SOA means that M. D. Anderson can take a "best of breed" approach that allows different departments to choose commercial software applications that address their specific needs. "The new system wraps each of those applications with Web services to expose them in a standards-based way to support a true service-oriented architecture," says Kevin Kelley, Regional Chief Technology Officer for Avanade.

"We have created what we call a virtual repository here," says Vogel, "and it makes the flexibility of adding new systems and new data sources extremely easy. That flexibility is facilitated by the SOA framework, because we don't have to move data around. Every time you move a piece of data from point A to point B, you have a risk. The risks are that you'll lose the data, or that point B will become out of date from point A. The SOA framework, where services expose or present data, eliminates those problems. When a physician looks at image data or clinical data in ClinicStation, he or she is really looking at that data as it exists in the host system."

ClinicStation serves about 10,000 unique users a month, up to 4,500 simultaneously. The users include staff, referring physicians, consulting physicians, and even patients, who have their own portals to relevant data.

ClinicStation offers 75 services, reflecting various types of data. Its use is intensive: 125 million service calls a month, with peak utilization topping 3,000 service calls a second. Its security infrastructure involves a shared token server to authenticate a user and client application. The security takes advantage of Web Service Enhancements 3.0 for Microsoft .NET, a Microsoft technology that offers developers the latest advanced Web services capabilities to keep pace with the evolving Web services protocol specifications.

The new architecture has dramatically increased performance. "It's really quite phenomenal," says Suitor. "A single server on the new architecture can easily handle the load of our entire 11-server Web farm in the old architecture."

The new architecture also has significant new safeguards in protecting availability. "In medicine," says Vogel, "you must have systems that do not fail. Because if they do fail, there are consequences, which ultimately end up on the shoulders of the patient. We take that extraordinarily seriously, and the new architecture has given

ACA.NET

Built by the industry's leading technologists, ACA.NET is a tool set that trims hundreds of hours from standard project timelines. ACA.NET and the Avanade Connected Methodologies also reduce risk, create faster time-to-market, and provide greater functionality.

us a data development environment that is truly state of the art." The production environment is architected for high availability with no single point of failure throughout the design.

The M. D. Anderson team continues to expand the system, and is currently working to formalize its governance process around SOA issues. "As people discover these services, and want to use them, we will need a process to determine that they are the right people getting access to the right services at the right time for the right reason," says Vogel.

Avanade Value

Experience and tools deliver fast, effective development

Avanade consultants used their experience and knowledge to help M. D. Anderson create a solution architecture that takes full advantage of the flexibility, scalability, and performance of SOA. Avanade also helped M. D. Anderson speed development by using ACA.NET for security, logging, instrumentation, and governance. "The Microsoft and Avanade tools around .NET, and the ACA.NET toolkits, enabled us to easily support the latest standards in SOA," says Suitor.

The foundational elements of the new M. D. Anderson software factory are the Avanade Connected Methods (ACM) project management methodology for large .NET application development initiatives and ACA Lifecycle, which integrates ACM with the Microsoft Visual Studio® Team System development system and Visual Studio 2005 Team Foundation Server. "Avanade shared their experience and assets to quickly enable us to establish a methodology for a large team to work productively," Suitor says.

Results

When the medical staff can do more, the benefits accrue to the patients

With its new EMR system development, M. D. Anderson has improved the accuracy of data used in medical professionals' decision making, provided a scalable foundation for continued high-performance growth in numbers of patients served, increased the productivity of its medical staff, and lowered costs so as to provide better patient care. "At the end of the day, all of these benefits really accrue to the patient," says Vogel.

Richer data is available more quickly

The original ClinicStation had a very rich set of features, and the newly written version had to ensure that every feature was as good or better than the original.

"Our care pattern involves intense two- or three-day encounters with patients, who see various specialists and get all the diagnostic tests they need," says Suitor. "But physicians want to have access to information on a patient when they are seeing the patient. So if newly created data was not instantly available, it would slow down the decision-making process in this series of appointments. This system makes everything instantly available to everyone."

The result is that the medical staff—the institution's most expensive resource—can be more productive. "Historically," Suitor says, "if one physician wanted to consult another, they'd have to go to the same physical location so they could look at the same images and data. Now they can talk on the phone and be looking at separate computers, but be looking at exactly the same thing."

Because the system can also provide links for appropriate resources outside the

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facility, it's not just M. D. Anderson medical staff who gain. Vogel recalls one situation where an M. D. Anderson patient was hospitalized in London, and the physicians were able to share electronic images as part of a joint consultation. "In this example, it turned out there was no serious complication," Vogel says, "so the patient was able to be discharged, rather than having to be operated on due to a lack of information."

"We knew the institution would be counting on the features of ClinicStation, so performance and functionality were key areas of emphasis," says Suitor. "The new version has exceeded our expectations."

Methodology allows continued growth

The EMR has become the foundation for growth at M. D. Anderson. "The institution continues to expand dramatically," says Suitor. "In every measure—number of patients seen, clinic visits, surgeries, revenue, margin, etc.—it grows every year. Although I don't think we can claim ClinicStation is the only cause of that growth, it's certainly a significant contributor."

The reason is not just the system's flexibility and scalability, but the IT organization that Avanade helped M. D. Anderson develop to support it. "Our department underwent significant growth," says Suitor, "with the development organization increasing from 3 people to more than 40, and we did so with real success."

Thanks to the technologies and methodology Avanade helped put in place, M. D. Anderson has large-scale development capabilities with a highly disciplined approach to software development and an overall process that enables the center to deploy new critical features faster. "With our release management, version control, code libraries, and other capabilities, we have built a software development factory that, frankly, I would stack up against any commercial software company, bar none," says Vogel.

Flexibility improves workflow and reduces costs

One way that M. D. Anderson has increased productivity is by using the system's flexibility to improve workflow. "For instance," Suitor says, "if a drug utilization needs to be reviewed by a pharmacist before a patient can continue with care in the clinic, we don't need to have a pharmacist standing right there to do it. The pharmacist can take care of it from wherever he or she needs to be operationally. This means we can keep the hospital and all the clinics flowing much faster."

The improved workflow—as well as the reduction in time wasted by medical staff looking for data—has dramatically reduced costs. However, Vogel is reluctant to attach specific numbers to the reductions. "We've had faculty here point out that if every physician who uses ClinicStation saves a half-hour a day (which is certainly reasonable), that has saved the center—depending on assumptions and calculations—$8 to $10 million a year. But the problem is, that $10 million doesn't accrue to the organization's bottom line."

It's a problem, however, only from an accounting standpoint, in terms of quantifying benefits. The benefits do exist—for patients. "What's it worth to a patient to have his or her physician at the other end of the phone with instantaneous access to the CT scan that was completed this morning?" Vogel asks rhetorically.

"We have extraordinary statements from physicians saying they could not do what they do today in the absence of ClinicStation. It's like those television commercials: the technology costs a few bucks and the staff time costs a few bucks, but when a

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physician stands up and says he couldn't practice without this—that's priceless."

A model for hospitals and service-oriented enterprises

"Because we are a cancer center, things that happen here are likely to be harbingers of things that will happen across the field of medicine generally in the next couple of years," says Vogel. "As you get into genomic medicine and personalized medicine, what used to be research will be part of the clinical process. So the ways we are seeking to link research and clinical data will also become appropriate in other fields. Similarly, the inpatient and outpatient worlds are becoming part and parcel of the same process and package of care. These developments mean that the IT implications of what we are doing are far broader than just cancer centers."

Indeed, the potential implications extend beyond hospitals to many other types of businesses. Though many enterprises talk about SOA, most are in initial stages: planning, prototyping, or perhaps setting up a single application. At M. D. Anderson, however, ClinicStation is not just an application with SOA. It's the foundation of a service-oriented enterprise. In cancer care, things change: new knowledge, new treatments, new types of data. The changes come perhaps more dramatically than in other fields, but not necessarily more significantly. At M. D. Anderson—as perhaps at many service-oriented enterprises in the future—the flexibility and interoperability of its IT environment allow the institution to change with the times.

About Avanade

Avanade is a global IT consultancy dedicated to using the Microsoft platform to help enterprises achieve profitable growth. Through proven solutions that extend Microsoft technologies, Avanade helps enterprises increase revenue, reduce costs, and reinvest in innovation to gain competitive advantage. Avanade consultants deliver value according to each customer's requirements, timeline and budget by combining insight, innovation, and the talent of our global work force. Founded in 2000 by Accenture and Microsoft, Avanade has more than 6,500 professionals serving customers in 22 countries worldwide. Additional information can be found at www.avanade.com.