Rational® software

TSP Provides Montefiore Medical Center with Web-Based and HIPAA-Compliant Infection Surveillance and Analysis Application Using IBM Rational Rapid Developer

Technology Solution Partners LLC (TSP) is deeply committed to rapidly delivering high-quality business solutions to its customers. When TSP's developers and consultants are engaged in combating a leading cause of death in the United States – hospital-acquired infections – that commitment is made even stronger. Headquartered in Shelton, Connecticut, USA (about 60 miles north of New York City), TSP combines technical and health care industry expertise with powerful development tools, including IBM® Rational® Rapid Developer, to provide comprehensive and cost-effective application development, management and monitoring services that solve real-world issues.

As a service provider of enterprise-level, technology-based business solutions, TSP recently tackled one such real-world issue – one with far-reaching effects in healthcare. According to the Centers for Disease Control and Prevention (CDC), hospital-acquired infections – which occur as unintended by-products of needed care – kill more than 90,000 people in the U.S. each year, making them the fourth leading cause of death in the U.S. behind heart disease, cancer and strokes. Additionally, hospital-acquired infections affect more than two million patients annually in U.S. hospitals at a cost in excess of $5.7 billion.

Industry and Institutional Challenges Spark Initial Response

In the late 1990's, seven New York-based hospital networks, including Montefiore Medical Center, formed a consortium, with limited state funding, to track the prevalence of infections. The consortium sought the help of TSP to develop and deploy a first-stage system to manage pertinent data and meet the initial requirements of the consortium. Essentially, the data was sent to TSP, who then provided customized and correlated reports to each of the consortium members.

Throughout this initial project, TSP gained a first-hand understanding of the underlying infection monitoring and analysis challenges facing health care organizations. TSP also realized that the initial project was only addressing a fraction of the much broader industry challenges. These challenges included tracking antibiotic resistance, estimating magnitude, facilitating early detection, evaluating control and prevention intervention, and many other critical elements that affected patient care and safety.

TSP's president, Girish Gupta, recalls, "We spoke with consortium specialists as well as some of the most respected thought leaders in infectious disease. Those early conversations shed light on the fact that there was a tremendous need within individual health care institutions to have a system that would enable their departments of infection control and microbiology laboratories to have hands-on access to critical data regarding infections right from their offices or workstations. And that's what we set out to create."

Over time, state budget constraints ended the consortium's project. However, a great need persisted among the consortium hospitals for a system that could provide the means to manage, monitor, analyze and correlate infection-related data. Drawing on their experiences and industry insight, TSP began developing a Web-based infection surveillance, analysis and management system to meet the needs of hospitals and other health care organizations.

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Industry Expertise and "Architected RAD" Lead to New Solutions

To quickly and cost-effectively accomplish their objective, the professionals at TSP leveraged the benefits of IBM Rational Rapid Developer — a model-driven, architected rapid application development (ARAD) environment. The powerful combination of Rational Rapid Developer and TSP's expertise enabled TSP to quickly build a complete n-tier, enterprise-class system to address the tracking, analysis and correlation of infections and infection-related data. Gupta reports that Rational Rapid Developer was critical to the project because it simplified the development process in this evolving field. "The subject matter and practices associated with infectious disease are evolving by leaps and bounds, and the Rational Rapid Developer environment enables our team to quickly keep pace with the changes. If a hospital needs a new interface, new alert triggers or needs to implement a new CDC or HIPAA (Health Insurance Portability and Accountability Act) guideline, it is just a matter of changing the object model and then automatically re-generating the application – it's that easy," concludes Gupta.

The system, which is Web-based and HIPAA-compliant, is helping hospitals fulfill an ongoing need to provide quality services while responsibly controlling costs.

Dr. Brian Currie, Vice President/Senior Medical Director at Montefiore Medical Center and principal investigator of the initial consortium notes, "There is agreement that surveillance, management and analysis of hospital-acquired infections can be used to improve the quality of care and lead us down new paths that can aid in the understanding and treatment of these infections. Without a systematic, prospective model to identify unusual patterns and emerging or re-emerging trends, it is difficult for facilities to develop intervention strategies aimed at reducing the incidence of infections."

Montefiore Medical Center became a pilot for the Electronic Antimicrobial Resistance Surveillance Data Management & Analysis Center (EARSDMAC) application and now employs it as an integral part of their infection control program. Currie reports that EARSDMAC is already having a significant positive impact on patient care. "Our mission is to continue to improve upon our tradition of providing high-quality health care services in the safest possible environment. Implementing TSP's EARSDMAC system to control infections and enhance patient care and safety reaffirms our undaunted commitment to providing our community with top resources and a state-of-the-art environment for receiving care. Now, we can readily assess and monitor the emergence and prevalence of antimicrobial resistant community- and hospital-acquired pathogens, which enables us to quickly develop the most effective evidence-based intervention strategies for controlling their prevalence," he explains.

With EARSDMAC, Montefiore's Department of Infection Control has real-time access to vital data. Currie continues, "Everything is available online. If we want to see last week's data or the Northeast's data, we can look at it, download it, slice it and analyze it – without having to wait a couple of months. In providing this functionality, the system acts as an early warning system, helping to detect outbreaks and identify unusual patterns of infections or trends in antimicrobial resistance before they escalate."

Key Objectives: Security, Accessibility and Responsiveness

According to Dr. Dhiresh Vyas, a senior TSP consultant and key contributor to the project, the EARSDMAC application addresses a wide range of important health care goals. "Hospitals, such as Montefiore, are concentrating their efforts on developing infection control initiatives that meet a number of critical and evolving objectives, including: the early detection of outbreaks or epidemics, estimating the magnitude of a health problem by analyzing trends in incidence, evaluating control and prevention intervention, monitoring changes in infectious agents, and conducting epidemiological and laboratory research."

However, over the years, there have been a variety of challenges to achieving those objectives. Currie notes, "One of the key impediments for many Infection Control departments has been the need to manually

enter data into electronic formats and then either correlate that data within the confines of spreadsheets or outsource the analysis completely. And, in addition to the rising costs, by the time the correlation and analysis is completed, it is already a couple of months after the event has occurred."

Meeting these challenges required a system that was secure, accessible, and responsive. Gupta recalls, "We needed to develop a highly secure system that accounted for the evolving requirements and would allow users to have real-time access to data via the Internet. The system also needed to provide comprehensive surveillance, management and analysis of infection patterns and antibiotic resistance."

Architected Rapid Application Development Delivers Scalable System in Four Months – with Fewer Development Resources

Rational Rapid Developer enabled TSP to save time and resources by significantly streamlining J2EE and n-tier infrastructure development efforts. As a result, the team was able to focus on the broader medical and security challenges of developing the EARSD-MAC system. In designing the EARSDMAC architecture and infrastructure, TSP needed to develop a combination of features that complied with infectious disease industry practices, and a variety of additional built-in security features as well. Gupta explains, "Rational Rapid Developer let us concentrate on creating rich application, database, and physical-level security features that are HIPAA-compliant and meet CDC NEDSS guidelines. This multi-tier security also delivers confidentiality for patients, samples, and institution identifiers. For example, the system requires password changes every 90 days, and users can only view anonymous identifiers to protect patient confidentiality."

Gupta continues, "Without Rational Rapid Developer, we would have needed at least 20 highly-specialized technologists and three managers to produce an application like this in four months. We did it with six developers," says Gupta. "With Rational Rapid Developer, we are able to readily meet changing requirements — and constantly evolve and maintain the application."

Focusing on Business Functionality

Gupta notes that because Rational Rapid Developer enabled the TSP team to focus on the business logic of the application — and not the implementation details of various layers in the n-tier system — they had time to add a variety of features that separated themselves from competitive offerings. "Some of the additional features we were able to provide included developing adaptive techniques to use standard nomenclature for the antibiotic and isolate names, as well as validation of the data to meet a variety of standards and requirements. We were also able to create customizable real-time reporting capabilities with a vast array of pertinent reports and charts, including the percentage of suscepti-ble/resistant organisms against the number of defined daily doses of antimicrobials used per 1,000 patient-days for each patient location group. That was very important, because it enables hospitals, like Montefiore, to save money based on better patient treatments and outcomes. It also provides significant savings in managing direct drug costs. This is highly significant, and provides tremendous business value to our customers," says Gupta.

Another key feature of the application is its ability to correlate data against de-identified aggregate data sources. Gupta explains, "For example, users can simply mouse click a drop-down box and choose to correlate their individual data against a variety of external sources, such as the entire Northeast. To enable this we constructed a longitudinal file for individual hospital and community acquired infected patients that links microbiological culture and sensitivity data with patient demographics."

Vyas adds, "Rational Rapid Developer's visual development environment provided us with a great mechanism to rapidly develop a very powerful application. It enabled us to create anonymity data for patient confidentiality, duplicate checking mechanisms, thresholds and alerts. We are also able to provide real-time data analysis with more than 10 dimensions, record-level drill down and even the ability to zoom-in and zoom-out of geographical affected areas. In addition, we developed an advanced pharmacy module that focuses on the key areas of electronic

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—Girish Gupta, President, Technology Solution Partners LLC

data collection, validation, processing, mapping, standardization, and the reporting and analysis of aggregate antimicrobial/antibiotic usage and consumption data by a facility. This allows the system to proactively monitor the data and intuitively identify the emergence of resistant pathogens with new resistance patterns that shorten the lifespan of antibiotic agents."

Ajay Gulati, another lead consultant on the EARDSMAC system, agrees that Rational Rapid Developer was instrumental in enabling TSP to provide all of the features required to truly address the breadth of the issue because they were able to step away from the technology details. "With Rational Rapid Developer, we are able to make evolving changes quickly — develop and deliver a customizable application, deploy it, and maintain it. We could achieve these things because, with Rational Rapid Developer, our focus was on the application and the issues surrounding infections, not on developing application frameworks. Rational Rapid Developer allowed us to focus on what we needed to accomplish; we were not bogged down with how to compile, deploy and track code changes across all of the multiple layers in an n-tier application," concludes Gulati.

Rapid, Iterative Development Eases Stakeholder Communication

The TSP team applied an iterative development approach and used Rational Rapid Developer to quickly develop easy-to-understand, browser-based user interfaces, search capabilities, record-level drill down capabilities, and a threshold and alerting system, among other key elements of the application. Through a combination of visual modeling and automated code construction and deployment, Rational Rapid Developer enabled the TSP team to rapidly prototype and deploy full use cases for review by Montefiore and other key stakeholders. Gupta recalls, "When we started, there was one set of infection detection practices. Those practices continued to evolve, so we had to go through at least six iterations of the application to address the changes. Also, at the same time, we were working with other organizations, as well as following the standards and guidelines from the CDC and HIPAA. With Rational Rapid Developer, we could incorporate all of those different concepts, standards and

practices very quickly – without having to worry about the thousands of nuances within the code that these changes affected."

Using the rich theme and style repository functionality of Rational Rapid Developer, TSP professionals are able to customize and standardize the look and feel of the entire application based on customer requirements. "We can completely customize the application and show a hospital how a user would navigate the site. Additionally, we are able to review multiple design and theme schemas as well, which gives our customers great flexibility," says Gupta.

Reduced Maintenance a Key Contributor to Value

In addition to streamlining development, Rational Rapid Developer greatly simplified TSP's testing and maintenance of the EARDSMAC application. Gulati notes, "With Rational Rapid Developer, maintenance is very easy. We only deal with the business logic – validations defined at the attribute level which are reflected automatically during code construction. Rational Rapid Developer handles all that for us, so we can focus on writing the business logic, and nothing else. That is a real advantage in the maintenance of an evolving application like this one."

Gupta agrees, "Since it is all automatically constructed code, we save a great deal of time in maintenance, debugging, testing and deployment. In the past, we would need teams of dedicated specialists, proficient in coding a particular kind of component or application. Now, we update the visual model and Rational Rapid Developer updates the code on construction automatically."

Responding to Emerging Opportunities

Rational Rapid Developer helps TSP manage the complexity of multiple technology platforms by constructing complete applications across all layers of an n-tier system, for a wide range of deployment environments. This provides TSP with technology vendor independence and insulates their development teams not only from the complexity of n-tier development, but also from rapidly changing technologies. The ability of Rational Rapid Developer to

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—Ajay Gulati,
Lead Consultant,
EARDSMAC system,
Technology Solution
Partners LLC

construct these multi-tier applications for a wide range of Web servers, application servers, relational and mainframe databases, and message transport technologies is helping TSP pursue new opportunities. "Currently, we are using Microsoft SQL Server 2000, the Windows 2000 platform, and COM/DNA technology," Gupta explains. However, we recently constructed the EARSDMAC application for both IBM WebSphere® and BEA WebLogic platforms to conduct a variety of scalability tests. Using Rational Rapid Developer, we were able to quickly generate the application for those environments. The application worked perfectly and we believe that with Rational Rapid Developer, we can quickly bring the application to any technology we need to."

Gupta notes that the TSP is proud of its achievements on the EARSDMAC project – not only because of their technological accomplishments, but also because their work benefits and reduces costs for hospitals and the patients they serve. "Rational Rapid Developer has provided exceptional benefits from a business perspective, and has enabled us to provide customers, such as Montefiore Hospital, with a technology-based solution that would typically require a dedicated, full-time staff of specialized developers and analysts– plus additional ongoing maintenance and technology costs. Through the culmination of our more than five years of working with leading authorities on infectious disease and the dynamic development environment of Rational Rapid Developer, this comprehensive application is up and running and already helping hospitals like Montefiore protect their patients from deadly infections."

According to Currie, TSP used Rational Rapid Developer to do what many thought was impossible. He explains, "Most of the people I talked to at the beginning of this project had severe reservations about whether it was doable in the first place. In fact it had been characterized as impossible by more than one person. I'm pleased to be here with a highly successful research project." He concludes, "It's a truly remarkable story."

About Rational

Rational provides a software development platform that improves the speed, quality, and predictability of software projects. This integrated, full life-cycle solution combines software engineering best practices, market-leading tools, and professional services. Ninety-six of the Fortune 100 rely on Rational tools and services to build better software, faster. This open platform is extended by partners who provide more than 500 complementary products and services.

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