IBM

e-business case studies

The University of North Carolina at Chapel Hill:

Learning the value of Java
and e-business

e-business

Putting e-business to Work

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Overview

e-business Case Study: The University of North Carolina at Chapel Hill

Established in 1789, the University of North Carolina at Chapel Hill (UNC) is the oldest state university in the United States. UNC's student body totals nearly 25,000 students, of which approximately 62 percent are undergraduates. This case study examines UNC's successful development of a Web-based registration system using IBM's WebSphere Application Server Advanced Edition (WAS). UNC's Web-based registration system has emerged as an unambiguous hit with both students and university administration. What's more, the outstanding performance of WAS in developing the Web-registration application has cemented its future role within UNC as it moves closer to a Web-centric model.

UNC's Web-based Student Registration Solution

☐ Transform business processes

■ Build new applications

■ Run a scalable, available, secure environment

☐ Leverage knowledge and information

■ Primary e-business solution attribute
☐ Secondary e-business solution attribute

UNC

The University

- First state university established in the United States (1789)

- Total enrollment: 25,000

The Web Site

- *www.unc.edu*

The Application

- Web-based student registration system

The Benefits

- 88% decrease in time required to process student registrations, resulting in increased student satisfaction

- $75,000 in total cost savings resulting from elimination of outsourcing fees for telephone-based registration and associated administrative costs

- 80% reduction in long-distance charges associated with telephone-based registration

- 800% increase in online registration capacity

- Reduced application development cycle time

The Technology

- IBM WebSphere™ Application Server Advanced Edition

- IBM CICS®

- IBM RS/6000®

- IBM S/390® Parallel Enterprise Server™

e-business Solution Profile

UNC's Web-based student registration application was developed using IBM's WebSphere Application Server, a Java-based application environment for building, deploying, and managing Internet and intranet Web applications. Prior to deploying the Web-based system, UNC had relied primarily on a telephone-based registration system linked to an IBM S/390 server containing various administrative databases. Some operations of the telephone-based registration system were outsourced to a third party, who would feed the registration data into the system.

Under UNC's new Web-based application, the S/390 remained an integral part of the e-business solution. Other key components of the platform include an IBM RS/6000 server, running Netscape enterprise server software. Developed components of the UNC system include Java servlets designed to interface with the CICS front-end of the mainframe system, as well as a Java servlet that communicates with a security interface in the system.

According to George Bowie, Application Development Project Specialist who worked on the project, UNC needed to build a more efficient system that preserved as much of its legacy investment as possible. "We specifically wanted to re-engineer our telephone-based registration system running on a mainframe by putting a Web technology 'wrapper' around it," says Bowie. "Preserving the mainframe portion of the system was crucial since we have already invested in thousands and thousands of lines of code."
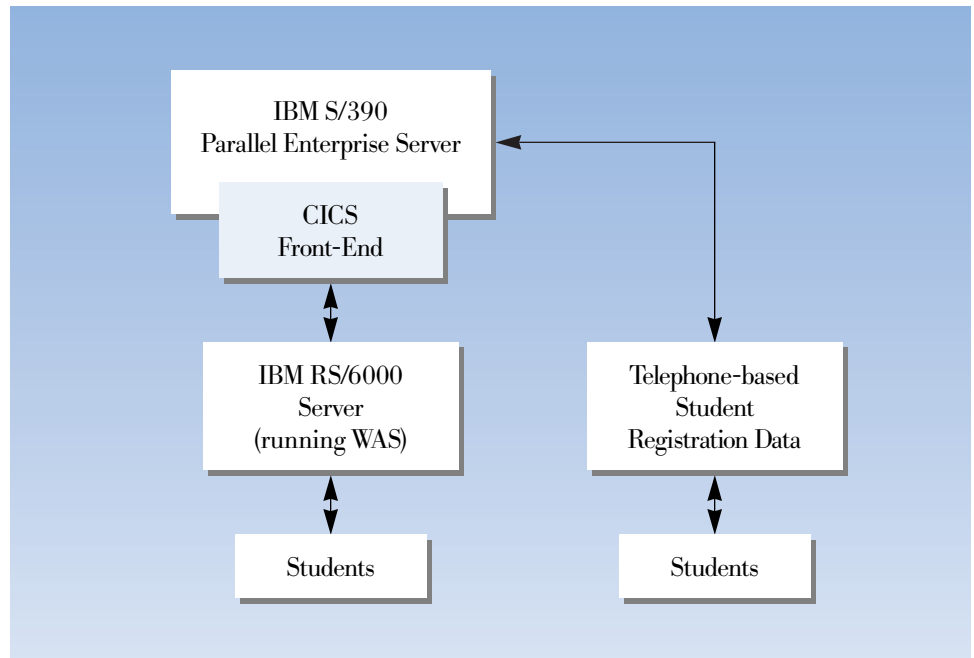
Source: University of North Carolina

Figure 1. Basic System Architecture of the UNC Web-based Registration Solution

Planning and Decision Environment

The initial impetus for UNC's Web-based registration application came from within the Student Information Services (SIS) team. Bowie notes that while the merits of the proposed Web registration proposal were very clear and powerful, SIS was nonetheless required to sell both students and university administration on the idea. For Bowie and the other members of the SIS staff, the successful deployment of Web-based registration represented an important chance to raise the profile of the department, thus opening the door to even more ambitious IT initiatives down the road. "Registration represents the preeminent student application," says Bowie. "So to get it on the Web would go a long way toward positioning us to construct the next generation of online student services."

Approval for IT projects such as the Web-based registration application is granted by the SIS Coordinating Committee (SISCC), a group composed of students and UNC administrative personnel. To Bowie and his team, the immediate challenge was to establish the value proposition of the project to two separate constituencies: students and the administration (principally the UNC Registrar's Office). In addition to obtaining approval, the Web registration initiative also faced the potential of significant delays caused by a backlog of other IT-oriented projects. According to Bowie, the SIS team typically has approximately 200 projects in the wings, with 30 to 40 under way at any one time.

The SIS team sought first to convince the student constituency of the benefits of the project, since it was, by all accounts, a fairly easy sell. "For students, the biggest problem with the telephone-based registration system was that they always got a busy signal," says Bowie. "In 1989, when telephone registration was first implemented, it was seen as an innovative thing. But with the opportunities presented by the Web, it made a lot of sense to move up to that next level."

After constructing a workable prototype of the registration application, SIS demonstrated it to students, who immediately expressed their overwhelming approval of the application. The only remaining issue was the project's priority relative to other projects important to students' hearts. "Before we proposed the registration application, students wanted us to implement Degree Audit over the Web," says Bowie. "In order to clear the way for Web-based registration, we worked extremely hard to quickly implement and deliver the solution. After that, we jumped from No. 100 to No. 1 on the list."

Selling UNC's administration on fast-track approval for Web-based registration proved some-what more challenging. According to Bowie, the main value proposition put forth by SIS was the ability to discontinue its outsourcing of telephone-based registration to a third party, which had proved costly in both administrative time and money. "In order to do registration outsourcing, the university was required to organize and deliver lots of information to the outsourcing vendor," says Bowie. "But for all the time and resources that we were spending, we were not getting much benefit out of it. So the idea that the Web could take the place of the telephone and reduce dependence on outside sources proved to be a persuasive argument, especially to the Registrar's Office."

Implementation Timetable and Strategy

The initial planning effort for the Web-based registration solution began in January 1998, with approval from the SISCC granted in March 1998. Work on the infrastructure portion of the solution began immediately, while development of the code for the front-end of the solution (principally HTML and CICS) began in June 1998. After building the CICS front end, the SIS developers then needed to interface with the SIS Web server, on an RS/6000. According to Bowie, the initial approach was to employ Perl scripts and, under Perl, to go through sockets to get to CICS. But this approach, according to Bowie, proved to be a dead end.

Bowies recalls, "After initial testing — and we did a lot of that — we became sure that a Perl implementation would not work: it used far too much memory. And since scalability was crucial — we were anticipating having to handle thousands of simultaneous transactions — it immediately became obvious that we could not do it in Perl." After concluding that Perl was not the answer, SIS decided to pursue a solution based on Java over C. "One factor underlying our evaluation process is the fact that Java is the department's language of choice," says Bowie. "Given this, we looked at a range of application servers and found that WebSphere came closest to meeting our requirements." After shifting to WAS, notes Bowie, major improvements in performance became apparent. "We were immediately surprised by how little memory the WebSphere solution used, and how generally responsive it was."

As the 1998 Fall registration approached, Bowie and the SIS team conducted a significant amount of preliminary testing, the majority of which was done in conjunction with the UNC Registrar's Office, in advance of the full launch tentatively scheduled for late October. The scope of testing was extended further in early October, when seniors were permitted to register early using the WebSphere-developed system. "This was basically a beta test," says Bowie of the senior class pilot. The result: "The students were ecstatic. We received so many positive comments on the system that we felt comfortable initiating the full launch in late October."

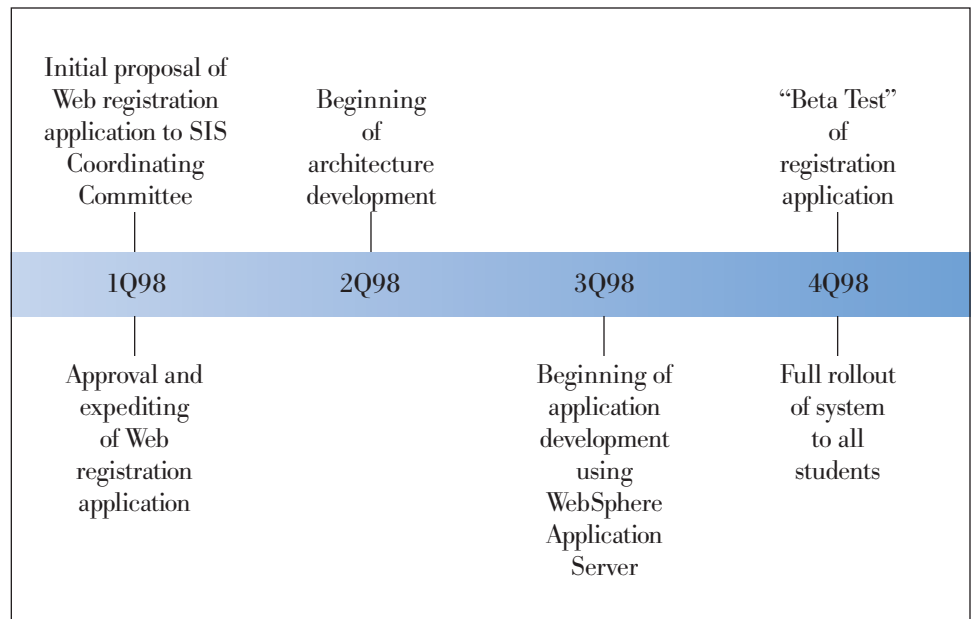Weeks later, the system was made available to the general student population. Despite some minor performance glitches (easily corrected through quick tuning of Java servlets), the system exceeded even the most optimistic expectations. "Our target was to achieve about 50 transactions per second on the back-end," says Bowie. "For the freshman class, the transaction volume was about 90 transactions per second. This was a truly amazing performance." Bowie attributes a great deal of the team's implementation success to the choice of WAS as its application server and the Java application development environment.

When speaking of WAS, Bowie saves most of his praise for its advanced application development features. "WebSphere's most outstanding feature is its built-in test environment in VisualAge®," he says. "It's a huge help in writing applications because you're writing directly into your target environment. We used it to the hilt." In one key example, Bowie and his team needed to know how changes to the application's servlet structure would affect the performance of the system as utilization increased. "If you make a change, you have to know how it will impact performance as the system scales up. The benefit of WebSphere is that you can get a feel for scalability right on the spot, and that's a tremendous help. Also, the fact that I can see the results of what I do immediately has led me to write better code."

Initial proposal of Web registration application to SIS Coordinating Committee	Beginning of architecture development		"Beta Test" of registration application
1Q98	**2Q98**	**3Q98**	**4Q98**
Approval and expediting of Web registration application		Beginning of application development using WebSphere Application Server	Full rollout of system to all students

Source: University of North Carolina

Figure 2. Implementation Timetable for the UNC Web-based Registration Solution

Return on Investment

George Bowie believes the most immediate benefit from the Web registration e-business solution was the sheer speed with which student registrations were processed. "There is a major bottleneck in the telephone-based registration system because it can only process 140 students at a time," says Bowie. "This meant that registration required four complete weekends, running 12 hours per day. When we implemented our Web registration solution, we immediately noticed that we could complete all registrations within one eight-hour span. This represents an 88% decrease in our student registration cycle time." Bowie is quick to point out that the benefits of removing the registration bottleneck extend beyond the UNC student body. "Getting the process done more quickly also means the administrative staff doesn't have to be on-site for the entire weekend, and they're naturally happy about that," he says. "In many ways, this was an unanticipated benefit, because we never thought we'd be able to push this many students through Web-based registration. This turns out to be an extremely efficient process on the Web."

The registration application proved to be even more of a boon to UNC's administrative budget. One of the major goals from the perspective of the UNC administration was to obviate the need to outsource its telephone-based registration system, thus reducing the drag on the financial and administrative resources.

According to Bowie, the rapid adoption of Web-based student registration has led to a significant decline in direct telecommunications costs for the university. Prior to the deployment of the Web registration application, 50 percent of registrations were done over long-distance telephone lines. After implementing its Web-based e-business solution, only 10 percent of registrations were handled by long distance. "Because we've been able to shift a large portion of student registrations from the telephone to the Web, direct long distance charges from our toll-free line have fallen close to 80 percent," says Bowie. "Combined with our savings from the elimination of our outsourcing contract, this solution has really delivered serious hard dollar savings in telecom costs."

In addition to the tangible benefits of the solution, Bowie points out a range of benefits that defy measurement, but are nonetheless important in assessing the solution's value to the university. "We realize profit by delivering more services with the same amount of resources. In essence, that's what we've been able to do with the Web registration application. Within the same budget, we're able to deliver more services to the university's key constituencies."

Overall Benefits	
Function	**Benefit**
Improved Student Services	Reduced the total time required for student registration by 88%, from eight 12-hour days to less than one day
Cost Savings	Reduced long-distance charges associated with telephone-based registration by 80%
	$75,000 in cost savings associated with elimination of outsourcing agreement for telephone-based registration. Rapid adoption of Web-based registration led to lower utilization of telephone-based registration, which fundamentally enabled UNC to bring the system in-house.
Administrative Overhead	Elimination of the telephone outsourcing relationship relieved the UNC registrar's staff of a major administrative burden.
Application Development	The use of WAS to develop the registration application reduced development cycle time.
	The use of Java servlets in the application substantially increased the systems efficiency and scalability, providing an 800% increase in transactions per second over a Perl-based solution.
Future Initiatives	The success of the registration application, largely made possible through the use of WAS, has raised the profile of Student Information Services, thus opening the door for future Web initiatives.

Source: University of North Carolina

Figure 3. Benefits of the UNC Web-based Registration Solution

Implementation Issues/Lessons Learned

UNC's current Web application strategy reflects key lessons learned from some of its early Web initiatives, which began as far back as 1995. One of the most important lessons, reports Bowie, is the importance of selecting products that can be moved from one platform to the next in the most efficient manner. "We followed this approach when we were looking for application servers," says Bowie. "We wanted one that would make it very manageable to move from one platform to the next. It was also critical for us to use an application server that didn't have an immense amount of third-party code, and that the core code be extremely efficient."

UNC's first Web initiative, the posting of class rolls, was considered a successful deployment. UNC followed this up with the posting of grades over the Web, which, unlike the posting of class rolls, became a very high-volume application. "This was one of our first lessons about performance, and this really triggered our looking at application servers that can handle volume efficiently," says Bowie. "It also taught us that we needed an application server that made efficient use of memory — without the cost of having to write it ourselves — and one that also made efficient use of connections between hardware components. These demands were ultimately met with WebSphere."

Future Plans

In the long run, UNC plans to move nearly all of its applications to a Web-based environment, says Bowie, who declares "The green screen is dead." The next application to be Web-enabled will be grade entry, enabling professors to log grades directly onto the UNC system via a Web browser. But an even bigger story relates to the strategic technology choices that will bring the university into the next century. "Our next big strategic push will be to move toward Enterprise JavaBeans' technology, which WebSphere supports. We have already begun to deploy enterprise beans applications, and based on what we've seen they're extremely efficient. Our initial testing in terms of performance looks very good. We expect to start using enterprise beans extensively in our applications."

According to Bowie, UNC's adoption of Enterprise JavaBeans was driven by its inherent efficiency and versatility. "There's a major benefit from being able to write one piece of code that can be accessed in a number of ways from different environments, such as client/server, Web, and mainframe," says Bowie. "We were looking for a solution that would allow us to write one portion of code that performs all of our business rules, and is accessible from every environment. Prior to using WebSphere, we looked at a number of alternatives, but each one we tried required us to provide a great deal of our own support software. What we saw in enterprise beans was the ability to easily write business code that satisfies our need to perform business logic. Putting in enterprise beans then allows us to access this code from various environments. In short, it made remote objects easy to write, and that's the most important point."
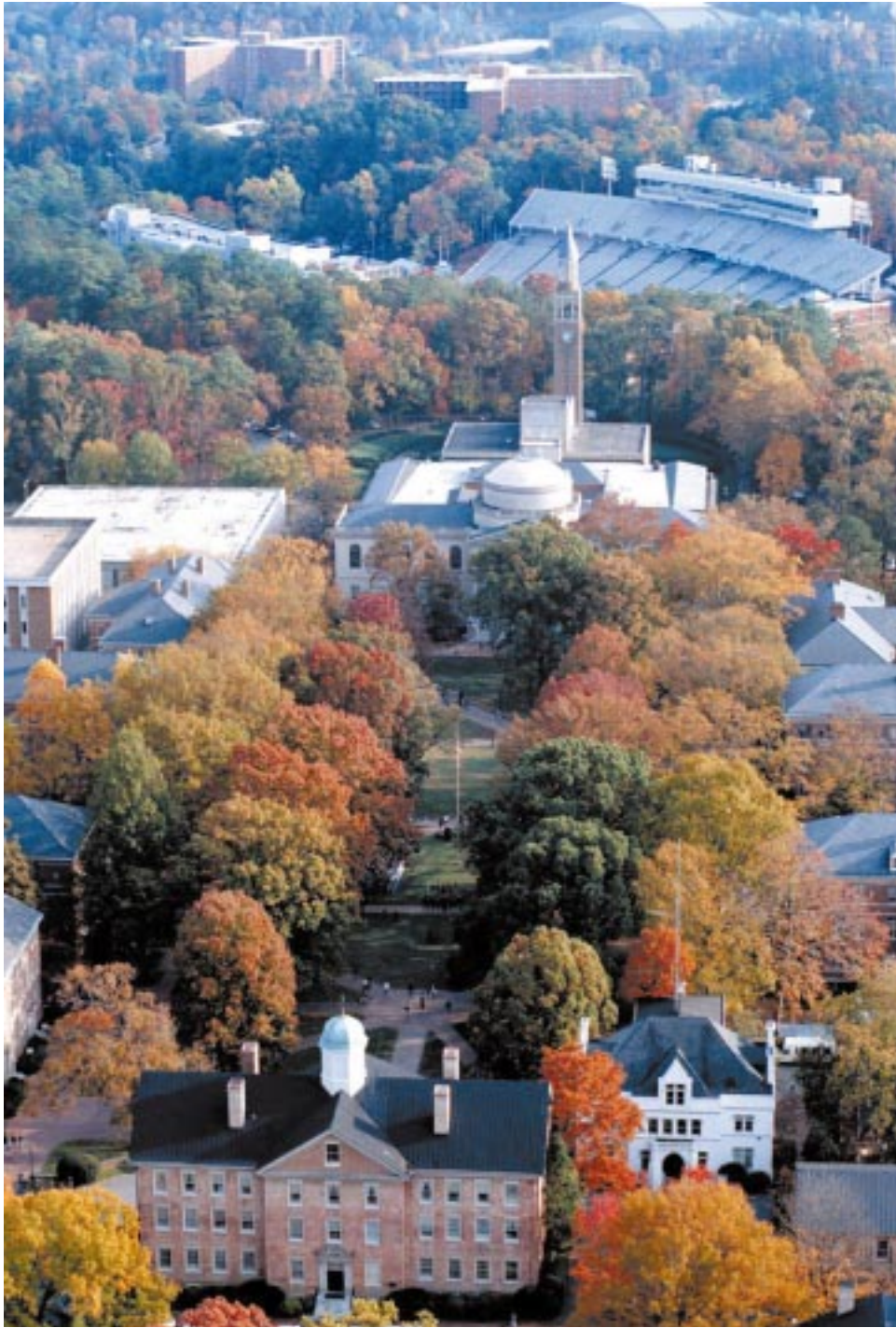
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