



**Microsoft Windows Server System**

**Case study**

“Performance with the 64-bit versions of Windows Server 2003 and SQL Server is far better than we had imagined. We expected an average processor utilization of 30 percent, but the server is operating at only 10 percent processor utilization even though it’s handling a combined 30,000 reads and writes per hour.”

**Adam Cohen**  
*Software Development Manager  
 JetBlue Airways*



***Air Carrier Scales Up with Windows Server 2003 and SQL Server 2000 64-Bit Versions to Minimize Costs and Support Rapid Growth***

**J**etBlue Airways is scaling its database systems to accommodate the company’s rapid business growth by using the 64-bit versions of Microsoft Windows Server 2003 and SQL Server 2000 (64-bit). The company already migrated its frequent flyer application from two 32-bit servers to a single 64-bit server—a two-day effort that has eliminated performance problems and ensures the processing headroom required to accommodate a growth rate of 3,000 new frequent flyer members per day. Now that the company has validated the scalability and price-performance benefits provided by the 64-bit Windows platform, JetBlue will use it to host several enterprise applications, including a comprehensive data warehouse/OLAP solution and the company’s mission-critical reservation system.

CUSTOMER PROFILE	BUSINESS SITUATION	SOLUTION	BENEFITS
New York-based JetBlue Airlines is a rapidly growing air carrier, with 4,500 employees and U.S.\$635 million in revenues for 2002.	JetBlue needs to maximize the scalability of its database systems to accommodate its rapid growth.	The company is deploying Microsoft® SQL Server™ 2000 (64-bit) running on the 64-bit versions of Microsoft Windows Server™ 2003, Enterprise Edition, and Windows Server 2003, Datacenter Edition.	<ul style="list-style-type: none"> <li>▪ Superior scalability, which provides new business options</li> <li>▪ Better price-performance</li> <li>▪ Reduced infrastructure complexity</li> <li>▪ Lower administrative costs</li> <li>▪ Leverages existing tools and skill sets</li> <li>▪ Mission-critical reliability</li> </ul>

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## Situation

JetBlue Airways is a low-cost airline with a high level of service. The New York City-based carrier is the only airline in the world to offer passengers live satellite television at no added charge, with up to 24 channels of DIRECTV programming delivered through individual seat-back monitors. To ensure passenger comfort, every JetBlue aircraft is configured for 162 passengers and outfitted with leather seats. JetBlue customers can count on low one-way fares (a Saturday night stay is never required), assigned seats, and the convenience of ticketless travel.

JetBlue's unique customer value proposition of greater comfort and convenience, combined with low costs, is driving rapid business expansion. The carrier flew 6.8 billion revenue-generating passenger miles in 2002—an increase of 108 percent over the previous year. Today, JetBlue's route map encompasses 20 U.S. cities, which are serviced by a fleet of 37 new Airbus A320 aircraft. An additional 13 aircraft are scheduled for delivery in 2003, with JetBlue's growth rate limited only by the speed at which these new aircraft are received and put into service.

In 2000, to minimize costs and accelerate time-to-market, JetBlue built its information technology (IT) infrastructure on the Microsoft® Windows® operating system platform. Until recently, all of the carrier's business systems (other than an outsourced reservation system) were based on Windows 2000 Advanced Server and Microsoft SQL Server™ 2000 running on 32-bit Intel-based servers. Although this Windows-based infrastructure continues to serve the company well, JetBlue's rapid growth is driving the company to explore new ways to scale its database environment in support of business growth.

For example, the company's frequent flyer system contains information on 500,000

members and is expanding at the rate of 3,000 new members per day. In late 2001, to increase the capacity of the system, JetBlue moved it from a single four-processor server to a pair of four-processor servers linked together using SQL Server transactional replication.

“A single four-processor Pentium III-based database server couldn't handle both the read and write operations, so last year we spread its workload across two four-processor servers,” says Adam Cohen, Software Development Manager for JetBlue. “The first server received a flat file from our reservation system every five seconds, crunched the data, and sent the results to a second server, which supported our customer-facing Web site.”

By late 2002, JetBlue's continued rapid growth had once again led to a situation in which the system's required workload would soon surpass its capacity—even with the workload split across two servers. Processor utilization was at 40 percent on the first server and at 65 percent on the second server, which supported up to 500 concurrent users.

“Registration data for new users wasn't getting from the server that connects with the reservation system to the server supporting the Web site fast enough, causing sporadic errors on the Web site,” says Cohen. “People would register for our frequent flyer program on the reservation system and get an error when they tried to log on to our Web site immediately afterward. We considered upgrading to a pair of eight-processor servers, but this option would have carried significant costs and could have left us in a similar situation down the road, with no way to continue scaling up.”

## Solution

To address the immediate scalability issues with its frequent flyer system, JetBlue migrated the system from the two 32-bit servers to an Itanium II–based 64-bit server running the 64-bit version of Microsoft Windows Server™ 2003, Enterprise Edition, and SQL Server 2000 (64-bit). As a result, new customers registering for JetBlue’s trueBlue frequent flyer program no longer experience problems, and the new server has plenty of additional capacity.

“The 64-bit versions of Windows Server 2003, Enterprise Edition, and SQL Server 2000 have improved our business by ensuring that customers experience a seamless registration and booking process,” says Cohen. “With the improved scalability provided by the 64-bit versions of Windows Server 2003 and SQL Server, our frequent flyer system now has plenty of headroom to accommodate future growth.”

According to Cohen, maximum performance on one of the 32-bit servers was 190 transactions per second. The new server—a Hewlett-Packard rx5670 with four 64-bit Itanium II processors and 12 gigabytes (GB) of RAM—delivers almost twice the performance: 370 transactions per second at 100 percent processor utilization.<sup>1</sup> “Performance with the 64-bit versions of Windows Server 2003 and SQL Server is far better than we had imagined,” he says. “We expected an average processor utilization of 30 percent, but the server is operating at only 10 percent processor utilization even though it’s handling a combined 30,000 reads and writes per hour.”

<sup>1</sup>32-bit server: Compaq ML570 with four Pentium III Xeon processors (700 MHz, 1-MB L2 cache) and 4 GB of RAM; 64-bit server: Hewlett-Packard rx5670 with four Itanium II processors (1 GHz, 256-KB L2 cache, 3-MB L3 cache) and 12 GB of RAM

The migration process was fast and painless. Two database administrators moved the system from the two 32-bit, four-processor servers to the 64-bit server in a single weekend—a process that involved little more than backing up the databases on the 32-bit servers and restoring them onto the 64-bit server. “The migration process was truly seamless,” says Cohen. “It only took a few hours, and went off without a hitch.”

In addition to restricting the potential for a negative customer experience, the company’s new 64-bit solution is simpler and easier to manage than the previous solution. “Administrative costs for the solution are lower because we now have one less server to back up and administer,” says Cohen. “In addition, we no longer need to maintain replication, leading to a less complex solution and a reduced administrative workload.”

### Moving Forward with the 64-Bit Versions of Windows Server 2003 and SQL Server 2000

JetBlue’s success with its frequent flyer system validates the company’s long-term plans for scaling up its database infrastructure with the 64-bit versions of Windows Server 2003 (Enterprise Edition and Datacenter Edition) and SQL Server 2000 (64-bit). The company recently ordered two Unisys ES7000 Orion 130 servers, each configured with 16 Itanium II processors and 32 GB of RAM (each server can support up to 32 processors and 128 GB of RAM).

The frequent flyer application will be moved onto one of the ES7000 64-bit servers, which JetBlue plans to divide into multiple hardware partitions using the Cellular MultiProcessing capabilities of the ES7000. Like all mission-critical applications at JetBlue, the frequent flyer system will be clustered across two partitions configured into an active-passive cluster. JetBlue is using the clustering capability built into Windows Server 2003

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and SQL Server 2000—a feature that works the same in the 64-bit environment as it does in the 32-bit environment.

“A nice thing about the 64-bit Windows Server 2003 and SQL Server environment is that it comes with all the familiar tools of the 32-bit environment,” says Cohen. “Had we chosen a scale-up approach based on UNIX, we would have been forced to learn a completely new set of tools.”

### Deploying a 64-Bit Data Warehouse

JetBlue’s plans for SQL Server 2000 (64-bit) encompass more than just the frequent flyer application. The company is building a comprehensive data warehouse using SQL Server 2000 (64-bit) and the 64-bit version of SQL Server 2000 Analysis Services—a solution that also will run on the Itanium II–based Unisys ES7000 servers. Development of the data warehouse is already well underway, with deployment scheduled for the second quarter of 2003.

“SQL Server 2000 Analysis Services enjoys a huge performance boost when running on a 64-bit platform,” says Cohen. “Our new data warehouse will integrate with every other business system that we have. By building the solution on the 64-bit versions of Windows Server 2003 and SQL Server 2000, we’ll ensure the scalability to handle all aspects of our business—and we’ll be able to get at all the data related to any piece of information. With this level of visibility into our business, we’ll be able to make smarter decisions and build stronger customer relationships.”

### Bringing the Reservation System In-House

The company’s plans for the 64-bit versions of Windows Server 2003 and SQL Server extend past deployment of the company’s new data warehouse. Within two years, the company will deploy an internally developed reservation system running on the 64-bit Windows platform and the Itanium II–based ES7000

servers—as a more cost-effective alternative to the outsourced reservation service that JetBlue uses today.

“Building our new reservation system on the 64-bit Windows platform is a huge priority,” says Cohen. “The system will handle everything from scheduling flights to ticket purchases and check-in. It will need to support an extremely high load, and all of the benchmark tests that we’ve run show that an Itanium II–based Unisys server running the 64-bit versions of Windows Server 2003 and SQL Server is up to the task.”

### Scaling Up with the 64-Bit Version of Windows Server 2003, Datacenter Edition, and SQL Server 2000 (64-bit)

JetBlue’s new 64-bit ES7000 servers will run SQL Server 2000 Enterprise Edition (64-bit) and the 64-bit version of Windows Server 2003, Datacenter Edition, Microsoft’s high-end operating system for mission-critical applications. The 64-bit version of Windows Server 2003, Datacenter Edition, takes advantage of the Itanium II processor’s 64-bit address space to provide native support for up to 512 GB of RAM.<sup>2</sup> This high level of support will help ensure adequate memory headroom for any application that JetBlue chooses to run on the 64-bit platform, especially the memory-intensive online analytical processing (OLAP) applications that will run on top of the data warehouse.

### Benefiting from the Windows Datacenter Program

JetBlue will participate in the Windows Datacenter Program, which provides an integrated hardware, software, and service offering delivered by Microsoft and Unisys. The program provides several

<sup>2</sup>The 64-bit version of Windows Server 2003, Datacenter Edition, supports up to 512 GB of RAM, although this number may be limited by the server’s hardware configuration. The 64-bit version of Windows Server 2003, Enterprise Edition, supports up to 64 GB of RAM, with similar potential hardware limitations.

mission-critical services that help customers keep their mission-critical applications up and running:

- A joint support queue that provides JetBlue with a single point of contact for all hardware and operating system issues
- Certification and stress testing of driver and operating system updates on JetBlue's specific server configurations prior to the delivery of these updates
- Mainframe-style system certification and change control processes that help eliminate unnecessary downtime and maximize system availability

### Consolidating Servers on the 32-Bit Windows Platform

For systems that don't require the scalability of the 64-bit Windows platform, JetBlue plans to consolidate its existing 32-bit applications—today running on several dozen two-, four-, and eight-processor servers—onto two recently ordered Unisys ES7000 Orion 230 servers that will run Windows Server 2003, Datacenter Edition, and SQL Server 2000. These new servers will join the three 32-bit Unisys ES7000 servers upon which the company currently runs its most mission-critical applications. Each new server will have 16 32-bit Intel Xeon MP processors and 16 GB of RAM (each server can support up to 32 processors and 64 GB of RAM), which will give JetBlue plenty of spare processing power—and room for additional processors—as the workloads of the servers grow.

### Benefits

For JetBlue, scaling up its mission-critical systems with the 64-bit versions of Windows Server 2003 (Enterprise Edition and Datacenter Edition) and SQL Server (64-bit) running on Itanium II-based

servers delivers several strong benefits. Most notably, the new environment offers new levels of scalability, superior price-performance, and reduced infrastructure complexity—on the same Windows platform with which the company is already familiar. Migrating the frequent flyer application to the 64-bit environment required no new skills and was completed in less than a weekend. Plus, JetBlue IT staff can maintain the new environment by using the same tools and skill sets that they already possess.

“The 64-bit Windows Server 2003 and SQL Server environment makes Microsoft a true enterprise-class contender in the database arena,” says Jeff Cohen, Chief Information Officer at JetBlue. “The platform enables us to run mission-critical applications with the confidence that we'll get the scalability and uptime that we need. The majority of our databases will be moved to the 64-bit environment.”

### Doing More with Less

The 64-bit versions of Windows Server 2003, Datacenter Edition, and SQL Server 2000—as well as the 32-bit version of Windows Server 2003, Datacenter Edition—will enable JetBlue to do more with less. “In the past, each new application required deploying one or more new servers,” says Jeff Cohen. “With the level of scalability and reliability provided by Microsoft and Unisys, we'll be able to support a workload that would have required 66 two- and four-processor servers with only four ES7000 servers. In addition to reducing our administrative workload, simplifying our infrastructure by scaling up on fewer servers will eliminate complexity, leading to better server management and higher levels of availability.”

### Superior Scalability Provides New Options

The superior scalability provided by 64-bit versions of Windows Server 2003 and SQL

## Software and Services

Microsoft® Windows Server™  
2003, Enterprise Edition (64-bit  
version)

Microsoft Windows Server 2003,  
Datacenter Edition (64-bit  
version)

Microsoft SQL Server™ 2000  
Enterprise Edition (64-bit  
version)

### Hardware

Hewlett-Packard rx5670 server  
configured with 4 64-bit Itanium  
II processors and 12 GB of RAM

2 Unisys ES7000 Orion 130  
servers, each configured with 16  
64-bit Itanium II processors and  
32 GB of RAM

2 Unisys ES7000 Orion 230  
servers, each configured with 16  
32-bit Xeon MP processors and  
16 GB of RAM)

Server enables JetBlue to rapidly and cost-effectively address its business challenges, such as increasing the capacity of a frequent flyer system that was rapidly reaching its limits. In addition, the improved scalability provided by the 64-bit environment opens up new business options for JetBlue, such as lowering the total cost of ownership for the reservation system by bringing it in-house. JetBlue expects this project to deliver a full return on investment in less than two years.

### Better Price-Performance

In many cases, the 64-bit Windows environment will provide JetBlue a price-performance superior to that of the 32-bit Windows platform, and an even greater price-performance advantage over UNIX-based solutions. For example, had the company chosen to move its frequent flyer solution onto two eight-processor 32-bit servers to alleviate performance problems, new hardware costs would have been approximately \$150,000. In contrast, the cost of a single four-processor 64-bit server was approximately \$80,000—close to 50 percent less than the 32-bit option. Moreover, the company now needs one Windows license and one SQL Server license for the application instead of two.

### Reduced Infrastructure Complexity and Lower Administrative Costs

The 64-bit Windows Server 2003 and SQL Server environment enables JetBlue to run the same applications on fewer servers and manage these solutions with less effort. JetBlue's new frequent flyer solution now runs on one server instead of two, resulting in one less piece of hardware for system administrators to support. In addition,

JetBlue's 64-bit frequent flyer system no longer requires replication between two servers, which further simplifies the solution and reduces the amount of effort required to maintain it.

### Familiar Software Development and System Management Tools

JetBlue developers and system administrators do not need to learn any new tools or skills for the company to realize the benefits of the 64-bit Windows Server 2003 and SQL Server environment. The frequent flyer system was migrated to the 64-bit environment using the same SQL Server management tools with which database administrators were already familiar. And the new reservation system and data warehouse are being developed using the same Microsoft Visual Studio® .NET development system that the company's developers use to create 32-bit solutions.

### Mission-Critical Reliability

The reliability improvements in the 64-bit version of Windows Server 2003, Datacenter Edition, will help JetBlue achieve the mission-critical availability required for its in-house reservation system, as well as any other solutions that the company chooses to run in this environment. The Windows Datacenter Program will augment the stability of the new operating system—and the hardware reliability provided by Unisys ES7000 servers—with the mainframe-style support processes that are necessary for proper management of mission-critical solutions.

Microsoft Windows Server System™ is the comprehensive, integrated, and interoperable server infrastructure that helps reduce the complexity and costs of building, deploying, connecting, and operating agile business solutions. Windows Server System helps customers create new value for their business through the strategic use of their IT assets. With the Windows Server platform as the foundation, Windows Server System delivers dependable infrastructure for data management and analysis; enterprise integration; customer, partner, and employee portals; business process automation; communications and collaboration; and core IT operations including security, deployment, and systems management.

For more information about Windows Server System, go to:  
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## Software for the Agile Business

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