CASE STUDY

**Travel**
**Powerful E-Commerce**
**& Middleware Solutions**

# American Airlines

## ADVANCED MIDDLE TIER APPLICATIONS DELIVER HIGH PERFORMANCE E-COMMERCE SOLUTION, LEGACY CONNECTIVITY AND PERSONALIZED SERVICE ON THE WEB

### Highlights

#### Company

**American Airlines**

#### Business Challenge

**Improve existing travel planning application by speeding up the booking process, and giving personalized service to 32 million AAdvantage members.**

#### Solution

**Re-architect site for faster navigation, and intuitive operation. Capture customer "profiles" and deliver custom built web pages**

#### Hardware/Software

- **3 Sun Enterprise™ 4000 servers**
- **O/S: Solaris 2.6 Operating Environment™ software**
- **BroadVision One-To-One**
- **Sight & Sound's BookSmart**
- **CORBA architecture using IONA Orbix**

#### Key Business Results

**The new site generated 25% more revenue in the months immediately after its implementation than the previous site ever earned in the same time frame.**

**Customers can now book a flight in as few as five page views and average less than 5 minutes per booking - a reduction of 60%**

## OVERVIEW

American Airlines tapped an array of advanced enterprise technologies – including IONA Technologies' Orbix ORB, the BroadVision One-To-One personalization Internet application, Sight & Sound's BookSmart CORBA-based booking engine, and Sun's Ultra Enterprise™ 4000 servers in the middle tier – to create and deploy the second generation American Airlines Reservation Website. The full-featured, E-Commerce travel planning and booking destination combines ease of use and high-performance with a direct connection to the legendary SABRE reservation system and includes a unique personalization facility that creates a customized experience for every AAdvantage member.

## INTRODUCTION

As the world's second largest airline, American Airlines (AA) and American Eagle provide scheduled jet service to more than 250 destinations throughout North America, the Caribbean, Latin America, Europe and Japan and employ over 90,000 professionals. AA has long been committed to leveraging leading-edge technologies to enhance the travel planning experience for its customers. Early evidence of its commitment dates back to the late 1960's when AA introduced the legendary SABRE reservation system. For over 30 years the name SABRE has been instantly recognized as one of the largest and most sophisticated computing systems on the planet. In fact, The SABRE Group, now spun off as a separate business entity, has become so vital and central to travel industry that even its own engineers must pass retina identification scans before entering the massive concrete underground bunker that houses its nine mainframes in Oklahoma.

Today, AA is again positioned at the forefront of innovation with the rollout of its visionary second generation travel planning and booking website. The robust and easy-to-use website offers a vast new palette of options for customers who prefer to self-manage their travel arrangements while enjoying a dynamic Web experience.

At the core of AA's heavily traveled website are Sun Enterprise™ 4000 servers. "Since we had to handle millions of hits per day, we established a set of prerequisites for our system hardware, including high availability and scalability," said John Samuel, managing director of Interactive Marketing Group at AA. "After weighing all our options, we selected Sun Microsystems. Not only did Sun meet

our hardware requirements, but they offered a high level of compatibility with our tools and overall development strategy."

## BACKGROUND

In 1995, Sight & Sound Software, of Portland, Oregon, developed and integrated a dedicated communications application for American Airlines, called "Personal AAccess." It allowed AAdvantage members direct modem access to SABRE. Thousands of customers embraced the new technology, which gave them freedom to manage travel booking at their leisure. Riding on the success of its booking application, the following year AA introduced its first Web-based offering. In early 1997, AA management concurred that their site (then comprising over 3,000 pages) should continue to provide its customers the very best that the leading edge technologies had to offer. By evolving its Web presence American Airlines would offer its 32 million AAdvantage members the best travel booking system anywhere.

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*–John Samuel managing director of Interactive Marketing Group at American Airlines*

## CHALLENGES

After a careful research and modeling phase, system designers envisioned a new system that would be easy to use, fast, scalable and offer a uniquely tailored experience for every customer. The most daunting challenge faced by AA was developing an E-Commerce application that could identify each individual visitor and, based on customer history, respond by quickly generating custom built Web pages specifically targeted to the customer's interests. The BroadVision One-To-One application system, with advanced personalization capabilities was tapped to handle the job. For speed and scalability, AA leveraged CORBA technology running on Sun servers to provide the backbone for the crucial middle tier.

### IONA's Orbix and CORBA

Based on open-standards, CORBA had certain inherent features that made it ideal for the AA website. By implementing the distributed object model with IONA's Orbix, CORBA objects could scale and seamlessly communicate between networked servers, regardless of platform or application language. Sight & Sound, acting in a dual role as ISV and consulting system integrator used its CORBA compliant BookSmart engine to interface with SABRE, translate the maze of SABRE codes into plain English, and implement business logic. "We chose IONA's Orbix ORB because it scales nicely, offers platform-independence, and has proven very reliable when running on Sun servers," noted Mark Tilden, Chief Technology Officer at Sight & Sound.

### One-To-One Marketing

To take the customer experience to the next level, AA selected BroadVision One-To-One for its powerful personalization functionality in a single E-Commerce application. When a customer logs onto the AA website, the user's profile is read from an Oracle database. Then, the BroadVision matching engine creates web pages customized for each user, based on that profile. For example, if a customer's profile included visits to tropical islands, then the customer might see banner promotions for trips to Hawaii along with the frequent flyer mileage that could be used or accumulated in flying there. The custom page could also leverage AA preferred supplier agreements by posting car rental promotions and hotel specials in Hawaii.

In addition to the core One-To-One engine, BroadVision supplies tools for creating and managing content on the site. AA marketing managers utilize the One-To-One Command Center to manipulate the site in real time by defining customer segments, business rules and promotional material. Within the One-To-One Command Center, AA can set up the criteria that links customers having specific profile traits with current promotions. The One-To-One Publishing Center allows the creation, classification and updating of content in a distributed environment. These tools update the core databases that drive the Broadvision engine. The ability to customize profiles and promotions in real-time gives AA a distinct marketing edge when it comes to rolling out and fine tuning new promotions.

## ARCHITECTURE - A CLOSER LOOK

The American Airlines Web site can be best described as a three tiered, E-Commerce architecture with CORBA providing the distribution mechanism:

***"We researched several vendors and chose Sun because almost all our software was already available on the Solaris platform."***

*–John Samuel managing director of Interactive Marketing Group at American Airlines*

The top tier features an HTTP server (Netscape's Enterprise server) and BroadVision's Interaction Manager, used to implement personalization throughout the site. The Interaction Manager talks to the Netscape server using Netscape's proprietary interface, NSAPI. The interaction manager is responsible for building dynamic pages, sending HTML output to the web server, and receiving response data when a user clicks a button or link on the page.

Also in the top layer is a set of C++ Orbix objects, which act as the interface between the CORBA server (second) layer and the BroadVision interaction manager. These objects implement the user interface for the travel planning pages, handle input from the user, and call the CORBA servers to get data and initiate reservations. They also extend BroadVision's functionality by displaying flight lists, showing details for a specific flight, and picking flights for pricing "The middle tier architecture is open and makes it easy to plug in new functionality with IONA objects and CORBA servers," said Tilden."

Because the Web is a connectionless environment, managing the user's state and session is a challenge. Since standard HTTP protocol does not offer any built-in way of keeping track of a user's session, BroadVision creates a unique "session ID" string that is embedded in each page sent to the browser, and is returned with the response from each page. This allows BroadVision to identify input coming from a browser and associate it with a particular user.

To keep track of the complex state information, Sight & Sound engineers developed a special "store manager" that keeps a state structure for each user. The store manager associates a BroadVision session ID string with a particular user's state structure called a "data store" using a hash table. The data store and store manager are also part of the C++ objects in the top layer.

The second (or middle) tier is the CORBA server layer and performs a variety of important functions. Orbix objects handle the business logic that drives the site such as ticketing rules or restrictions on a particular itinerary. Orbix objects also manage over 600 simultaneous connections with the SABRE mainframes to process reservations. For load balancing purposes the SABRE Interface objects are divided equally between four multithreaded server processes. Finally, CORBA servers handle connections to an Oracle database, perform code conversions and store information about the user's transactions.

In the third layer reside the site's two data sources: the SABRE reservation system, and an Oracle database that maintains user profiles, code conversion tables and other data. The "profile" database is also indirectly connected to a "frequent flyer" database that contains the "mileage" status of American's AAdvantage members.

## DEVELOPMENT ENVIRONMENT

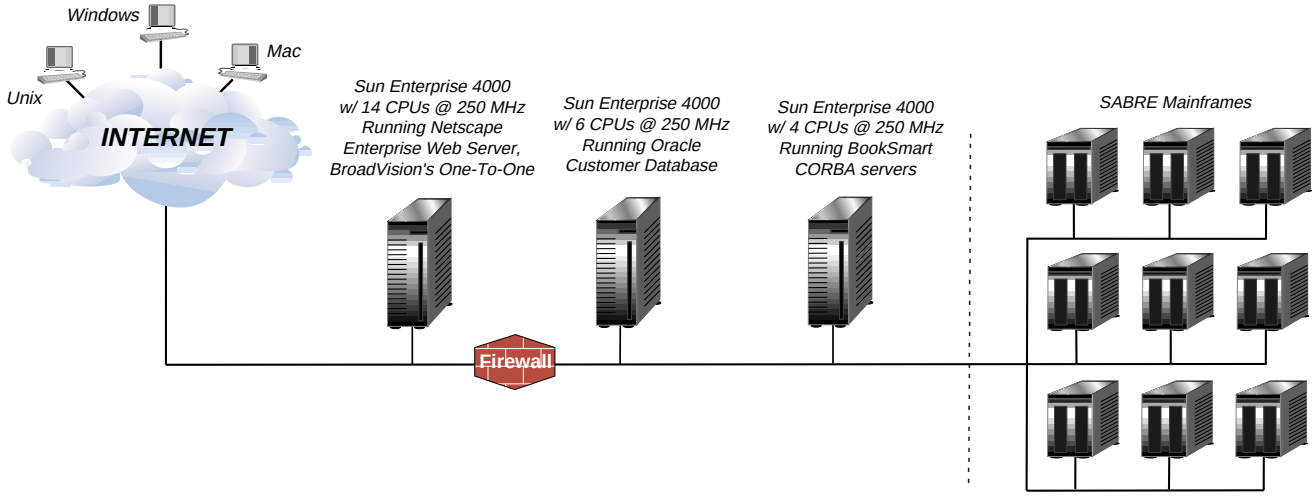
In June 1998, AA unveiled its redesigned website, which two dozen engineers spent 10 months developing. The primary development environment was Sun's Ultra™ technology-series machines running the SunSoft C++ compiler. Sight & Sound, with its track record of delivering complex systems on aggressive schedules, designed the booking engine architecture and implemented the interface to BroadVision and middle tier CORBA system. Quantum Leap of Chicago designed the site's information layout, flow and graphics for the user interface. Through the strategic refinements contributed by Quantum Leap site navigation was greatly simplified while customers' awareness of their options was dramatically expanded. Both firms integrated their efforts with the Broadvision One-To-One application to deliver a precision-tuned E-Commerce experience for AAdvantage customers. SABRE group provided hosting and connectivity to SABRE as well as modifications to some existing AAdvantage applications.

***"Sun technologies give us the flexibility and scalability we need to stay ahead of the curve in the highly competitive Web-based travel business."***

*–John Samuel managing director of Interactive Marketing Group at American Airlines*

## DEPLOYMENT ENVIRONMENT

When AA customers visit the website they first hit a Netscape Enterprise Web server running on a Sun Enterprise 4000 with 14 CPUs and 4 Gb of memory and two 9 Gb drives. BroadVision's One-To-One system also runs on the same machine with the web server. The customer database server runs on another Sun Enterprise 4000, which has six CPUs and a 45 Gb storage and 5 Gb of RAM. A third Sun Enterprise E4000 runs the CORBA servers. It has four CPUs, two 9 Gb drives and 1 Gb of memory. All CPUs run at 250 MHz. Samuel cited the impressive reserve capacity of the Ultra Enterprise server line to handle the anticipated increases in traffic on the website well in to the future. "We




***American Airlines Reservation Website***

*Running IONA's Orbix and*
*BroadVision's One-To-One on Sun E4000's*

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researched several vendors and chose Sun for its excellent scalability and the fact that almost all our chosen software was already available on the Sun platform," said Samuel.

## RESULTS

As soon as the website became available to customers, online bookings peaked to new levels. The site generated an unexpected 25% more revenues in the months immediately following the redesign than in the previous most lucrative comparable period.

AA points to real-time access to discount fares, called NetsAAver fares, intuitive self-booking features, and quick service - a direct result of running on scalable Sun servers - as reasons for the recent boost in its online business. Customers can navigate through the booking tool in just five pages - a vast improvement over other systems.

Personalized attention is another aspect of the website that attracts customers. In addition to tracking a customer's background ticket information, the website logs the visitor's home airport, frequent destinations and favorite activities. So when AAdvantage has a travel promotion, customers who are likely to have an interest are notified. "Personalized content based on customer history elevates the AA Web application to a whole new level of service," said Samuel.

## FUTURE

American Airlines is now working to make the website even more powerful by giving its customers extended travel options, enhanced personalization and faster turnaround times. With these and other slated improvements AA is backing up its commitment to customers by providing a Web-based travel planning and booking service without peer. Noted Samuel, "Sun technologies give us the flexibility and scalability we need to stay ahead of the curve in the highly competitive Web-based travel business."

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