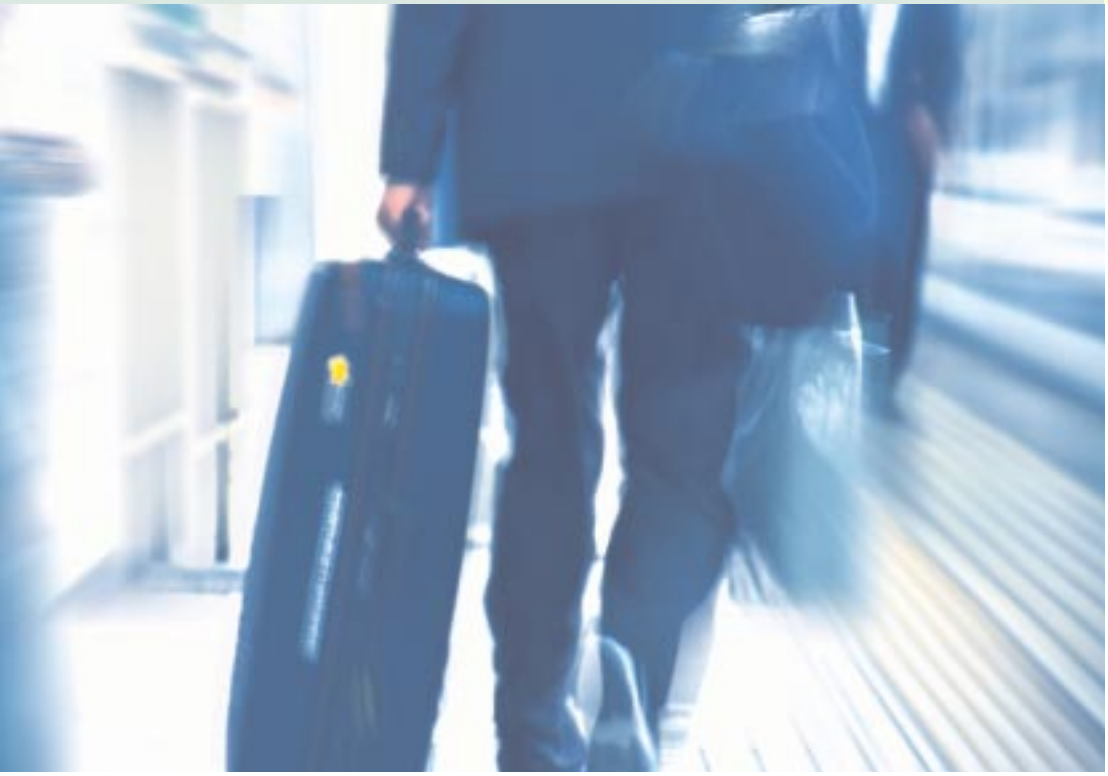


Web-enabled Portal Solution for Travel and Itinerary Management

Industry
Travel Services

Business Challenge
Broadening travel services in the face of fragmented delivery channels

Technology Solution
Dimension Data Travel Portal

Enterprise Hardware Platform
Scaleable Intel® architecture servers

SOLUTION ARCHITECTS

DIMENSION DATA

intel®

Solution Blueprint:
Web-enabled Portal Solution for Travel and Itinerary Management

Solution Provider:
Dimension Data

MEETING NEW MARKET DEMANDS

The Web-enabled Travel Portal is a powerful portal technology that interfaces directly with reservation systems for travel suppliers, such as hotels, airlines, car rental agencies, and entertainment venues, and creates a consolidated record for storing all aspects of a traveler's itinerary. Using new Web Services baseline technologies, this solution overcomes limitations imposed by today's proprietary, closed information systems operated by individual travel suppliers. The Travel Portal offers travel suppliers unprecedented potential to enhance the convenience of traveling and expand service opportunities.

THE BUSINESS CHALLENGE

Travel suppliers, faced with competition from online booking and ticket sales, are increasingly frustrated by legacy infrastructure limitations that impede efficient travel experience management and restrict new service offerings.

Currently, travel-planning services are fragmented, resulting in travelers being burdened unnecessarily with the coordination of many details, particularly once a trip has commenced. This fragmentation also dampens efforts of travel organizations to broaden the services they offer to travelers.

The current interfaces between the travel suppliers (airlines, car rental agencies, hotels, etc.) rely on Global Distribution Systems (GDS), which are proprietary information systems originally developed for airlines. Interfaces to the legacy GDS are inflexible and expensive, primarily due to the lack of competition among professional services firms to enhance and maintain these interfaces. The result is a technical barrier that discourages existing and new travel suppliers from designing and offering more services and inventory via the GDS.

The system's most significant shortcoming is its lack of flexibility in managing the travel experience after an itinerary has been purchased—so support for the traveler generally ends before the trip even begins. Although hotel and car rental segments of the itinerary depend on the flight segments, changes to the flight segments during the travel experience do not seamlessly propagate through the itinerary. The cumbersome task of calling the downstream hotel, car rental companies, and other individual travel suppliers to accommodate changes falls to the travel agency or individual traveler. While in the past travel agencies commonly managed the travel experience on behalf of the traveler, with the advent of online booking and ticket sales, many travelers no longer choose an agency that provides this service. The bottom line is that travelers still require, at some level, human interaction to complete their travel experience. Today's systems cannot make adjustments to itineraries when one or more aspects of their travel changes.

THE SOLUTION OVERVIEW

Using new Web Services baseline specifications, the Dimension Data Travel Portal overcomes the problems of proprietary and fragmented information by providing the consolidated, expanded information and flexibility today's travel suppliers need. To deliver an integrated, end-to-end travel management solution that overcome the constraints of the GDS, the Travel Portal has three core components:

- **Travel Services Portal (TSP.com)**—A portal that allows a customer to search and select reservations from multiple suppliers and create a complete travel itinerary, resulting in cost savings and quicker, one-stop trip planning.
- **Travel Supplier Central Reservation Systems (CRS)**—The Travel Supplier Central Reservation System contains information for airlines, car rental agencies, hotels, golf courses, and other possible destinations. These systems are accessed through a Web services description language (WSDL) interfaces. This standards-based interface eliminates development time and data access costs, while increasing the convenience of access and the real-time data quality.
- **SPNR Storage Services**—This link binds everything together, serving as the repository of all a customer's travel information. The data repository stores and manages each comprehensive travel itinerary that is created, enabling convenient and cost-effective door-to-door travel experience management.

The solution in this blueprint shows how records are stored and accessed[1]. Ongoing development will show how this service will become essential to any successful trip by capturing events that occur throughout the trip, managing this information, and sending notices to the affected suppliers.

TECHNOLOGY

The TSP design is based on the Intel® Itanium™ processor and uses eXtensible Markup Language (XML), Web services description language (WSDL), simple object access protocol (SOAP), and universal description, discovery, and integration (UDDI) technologies. Running within a Java* environment based on the Linux* operating system, the Travel Portal solution uses SOAP calls to send and receive data from participating Central Reservation Systems (CRSs). Each system employs .NET Servers and Framework to deliver Web services. These services provide real-time data concerning flight information, hotel reservations, car rental availability, and entertainment options to the requesting Java models. The information from these models is repurposed and delivered to browser-based clients as Java Server Pages (JSPs). As requests are made to the CRS, a trip itinerary is built. The consolidation of trip information is designated as a Super Personal Name Record (SPNR).

The SPNR is stored and managed by the GDS. The GDS is hosted on a Microsoft* Windows* 2000-based Microsoft SQL Server* and provides a means by which participating CRSs can request, validate, and modify SPNR information when needed.

This solution uses vendor-specific best practices to ensure its longevity and scaleability. As the solution grows, it scales by the addition of tiers, such as an Enterprise Java Beans (EJB) layer, or can be adapted to legacy system requirements. Using SOAP to communicate within distributed object architecture systems, the TSP can be modified to accept requests from other Web Services clients. In addition, the CRS layers can include solutions other than .NET Server.

[1] The initial prototype of this solution will not include event notification.

WHO THE SOLUTION WILL BENEFIT

Top decision-makers in the travel industry will benefit from this solution. They include:

Travel suppliers, such as key airlines, car rental agencies, and hotels. Provides better service to customers by making up-to-date information directly available in real-time. This solution also reduces costs by eliminating batch data uploads to GDSs and translation costs. Additionally, it improves business processes and supports addition of new travel-related services.

Online and offline travel agencies. Improves service by accessing reservation information from suppliers in real-time. The solution also reduces the transaction costs for access and distribution of GDS information, accesses a broader supplier network, and reduces costs.

GDSs. Allows the possibility for a GDS—by owning and maintaining the SPNR repository—to add value as a full-service provider, rather than as a consolidator and distributor of information.

Other companies that fulfill interrelated customer needs. While this solution targets the travel industry, a Web services model can be adapted for most industries where a number of suppliers work together to fulfill customer needs or in large enterprises to assist in the reduction of code duplication and help bolster application management.

SOLUTION BENEFITS

The Travel Portal can transform the current processes and traditional methods, benefiting travel suppliers, online and offline agents, GDSs, and travelers.

REAL-TIME DATA ACCESS AND MAINTENANCE

Using Web Services technology allows continuous real-time access to the various travel suppliers' data sources. A single storage repository for a customer's SPNR data supports a seamless travel experience and offers the opportunity for effective data mining.

- Decrease in standard system costs to store and maintain data within the GDS
- Decrease in costs to routinely synchronize and withdraw data from various sources to GDS data stores

ATTRACT NEW CUSTOMERS

Through the new technology, the owner of the SPNR can provide services not only to travel agencies, but also directly to businesses and individual consumers. The variety of suppliers, the unique online services, and the stored travel profile that the portal offers will lead to new customers.

- Increase in transaction percentages from enhanced customer base
- Decrease in transaction fees paid to travel agencies

ADD NEW SUPPLIERS AND SERVICES

Using flexible WSDL technology, suppliers have the opportunity to build interfaces and partake in travel portals. The wide end-consumer base and the ease with which a supplier can contribute information will encourage suppliers to align with the portals and the SPNR Storage Services.

- Increased supplier fees to join portal

EARN CUSTOMER LOYALTY

By storing travel profiles and tracking traveler preferences, the owner of the SPNR gains a unique perspective on each customer, thereby understanding and serving customers better. This information can be invaluable to travel suppliers in tracking industry trends, targeting preferred consumers, producing valuable marketing campaigns and packages, and forming logical alliances with other travel suppliers. SPNR Storage Services can collect, collate, and distribute this information to their partnered suppliers for additional service revenue.

FUNCTIONAL BUSINESS CONCEPT

The current interface technology between travel suppliers and the GDS database is proprietary, usually inflexible, and expensive to maintain. Existing and new travel suppliers have been discouraged from offering more services, application enhancements, and inventory to the industry GDS.

ARCHITECTURE MAINTENANCE

The current GDS architecture requires inventory and pricing data from the travel suppliers to be maintained within the system's infrastructure domain. As a result, the GDS today is faced with an ever-increasing cost for managing inventory and pricing information for travel suppliers. Travel suppliers also incur costs for managing information at the GDS, as they must periodically synchronize the GDS information with their internal information systems.

LIMITED FLEXIBILITY

In distributing airline segments, hotel rooms, and car rentals, systems typically require a block of inventory to be reserved, resulting in inconsistencies between the inventory systems of the travel suppliers and the GDS. The external interfaces to these systems are based on Electronic Data Interchange For Administration Commerce And Transport protocol (EDIFACT). These interfaces do not allow real-time messaging or support transactions. Travel suppliers must upload pricing data periodically using these interfaces, which prevents them from quickly reacting to market conditions. These limitations have resulted in travel suppliers looking for alternatives to the GDS.

INFORMATION CONSOLIDATION

One example of the difficulty in consolidation of disparate information relates to hotel reservations. The GDS has difficulty consolidating information from the various technologies used by hotel reservations system feeds. Switch companies emerged to convert the hotel reservation data into batch files accepted by the GDS. The GDS subsequently licenses this converted information to offline travel agencies, and, as online booking has become prominent, to online travel sites.

TRAVEL EXPERIENCE LIMITATIONS

The GDS limits the number of travel-related services that can be added to the travel experience. Since the interfaces were originally developed for airlines, most travel suppliers have to adapt their information to this legacy interface. This has resulted in inefficient business processes that make it difficult to reach new market segments by adding new services.

These systems are also inflexible in managing the travel experience. To improve the travel experience and circumvent the travel agencies, online travel portals provide a Web-based user interface to the travel services available through the GDS. These travel portals are built upon existing GDS systems, and therefore have inherited all the GDS limitations discussed. Although growth has been explosive in this arena, these online systems have not fully replaced the travel agencies, due to the human interaction needed to manage itineraries.

TRAVELER'S PROFILE MANAGEMENT

Although GDS systems try to manage the travel experience and the traveler's profile, they are quite limited in their capabilities to gather information. The Passenger Name Records (PNRs) that are used in today's GDS database are limited and contain only the flight information of a traveler on a specific date, time and carrier. It is quite difficult to add information specific to other travel suppliers to the profile.

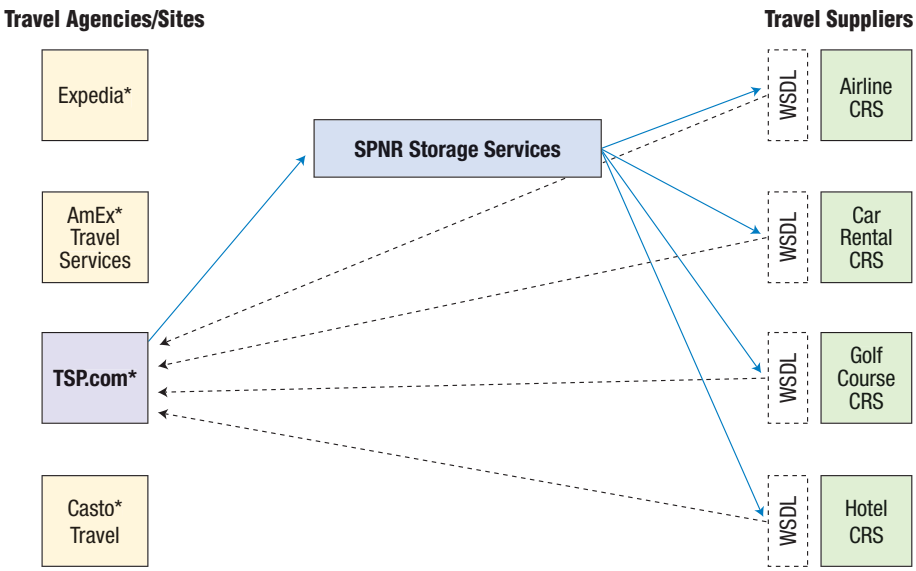
The travel industry considers a centralized SPNR for the traveler that stores profile information for all aspects of a traveler's itinerary to be the solution to this problem, provided that it can deliver real-time traveler events bi-directionally, and handle all update aspects of the traveler's itinerary seamlessly.

These limitations are overcome by using Web Services to address the inflexibility of older GDS interfaces and provide more information to all potential suppliers, resulting in an overall improvement of the travel experience for the customer.

The SPNR Travel Portal solution is based on the Microsoft .NET Server and Java J2EE on Linux architectures. It introduces advanced technology (specifically, Web Services and event management[2]) to better manage travelers' profiles and the links between suppliers, the travelers and the overall travel experience.

This design and resulting technology is architected to replace traditional methods and processes currently used in the travel industry. The following diagram shows the solution described in this blueprint with focus on the areas highlighted in yellow.

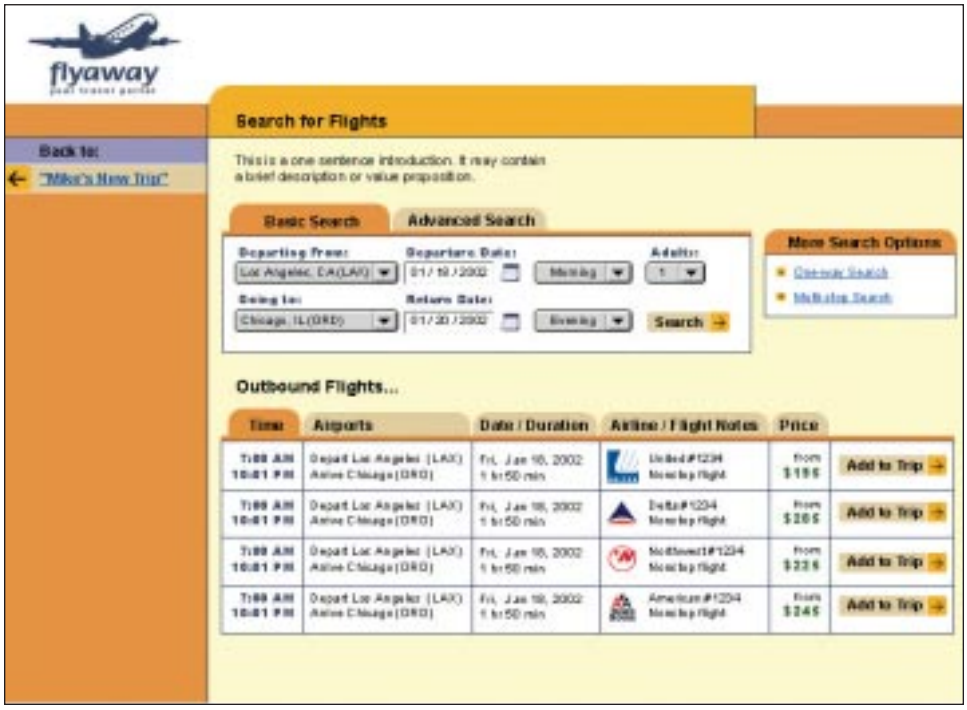
[2] Initial phase does not include event notification (e.g., if the flight is delayed the other systems will be notified and the itinerary modified).



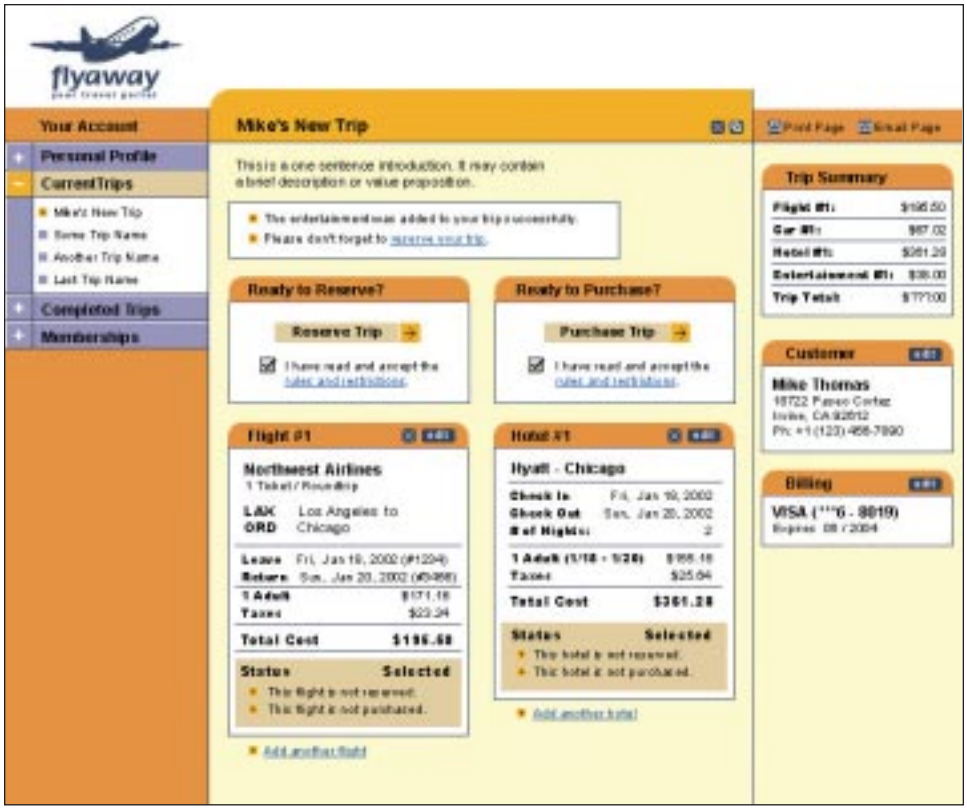
In the architecture shown above, TSP.com only manages the traveler's profile, also known as the PNR. To provide services, such as availability and reservation of flights, hotel rooms, and car rentals, the portal would interface in real-time with the appropriate back-end supplier's systems to complete those tasks using WSDL interfaces.

Due to the flexibility of the Web Services interface, the travel suppliers are able to interact with the portal by providing push events related to the traveler's experience. The portal in turn manages the traveler's experience by informing the other travel suppliers associated with a traveler's itinerary about these events and updating that itinerary accordingly in the PNR database.

USER EXPERIENCE



Here, a user is connected directly to the GDS via DiData's tps.com interface and their WSDL web services implementation. Users can search for carriers, flight schedules, pricing and seating assignments directly through tps.com. They can also purchase tickets, plan itineraries, book car rental and hotel rooms from one common interface. Each itinerary is then related back to the common SuperPNR record for that traveler. The SuperPNR database allows DiData's system to manage traveler itinerary history and track each instance against a common passenger record.



All new flights are tracked within the tps.com system based on the users SuperPNR–record. By using this record and tracking mechanism, DiData is also able to manage user itineraries from previous trips, airline, car rental and hotel memberships and tie all of this back to a common passenger name record for better business and individual user management.

SOFTWARE ARCHITECTURE

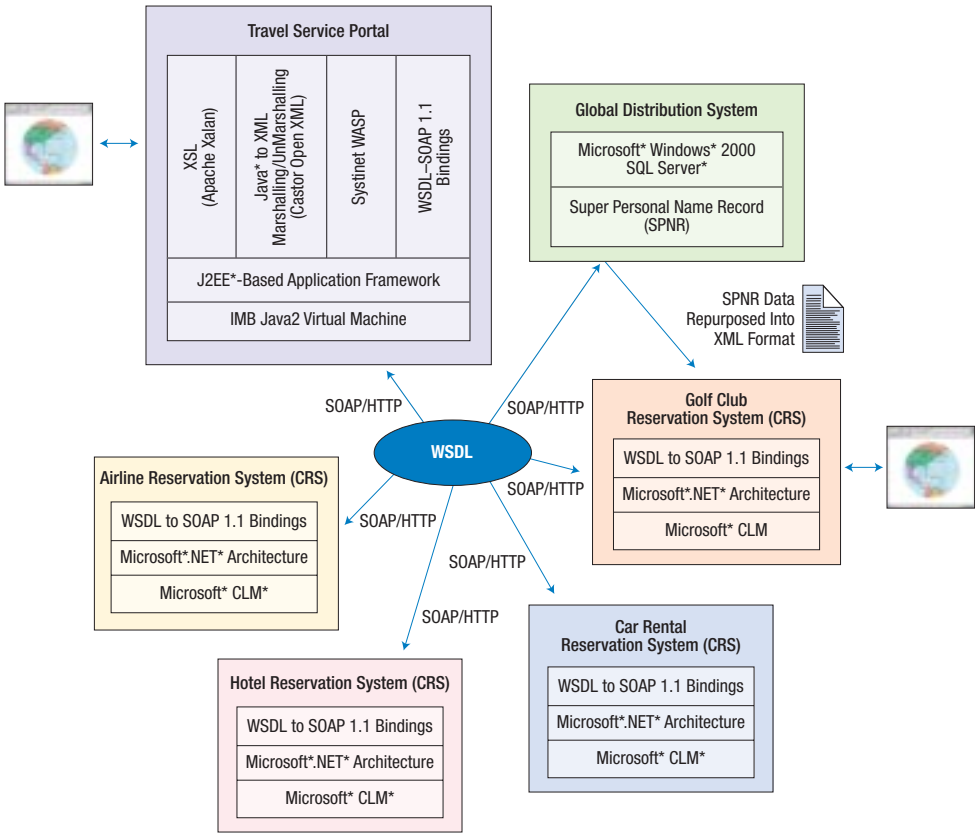
The SPNR travel services portal uses a Microsoft .NET and Java 2 Enterprise Edition (J2EE) based Portal Framework on Intel® Architecture. For Web Services, a number of mapping tools were used to translate Java Objects to XML structures and vice versa. The figure below illustrates the solution stack for the Travel Services Portal Solution.

The goal of the SPNR architecture is to provide a framework for exposing and consuming of Web Services via SOAP for the various suppliers to the portal, the GDS, and the Travel Portal Interface itself. The overall solution is divided into three logical system components to achieve this:

- **TSP**—consumer of Web Services
- **GDS**—manager of the SPNR data
- **A collection of CRSs**—exposure of Web Services.

The system also supplies two separate channels and three different views of data. The browser-based channel provides for the management of travel options and the view/modification of SPNR data. The Travel Services Portal provides a consolidated view of all CRS data and the ability to allow CRS consumers to view and modify SPNR data. The GDS will also be responsible for the creation of an XML version of the SPNR data.

Each system in the solution uses the baseline specifications (XML, WSDL, SOAP and UDDI) of Web services to communicate over HTTP. Although the system does not use UDDI as a tool for the discovery of service, it uses WSDL to specify services and SOAP to bind them to their respective systems.



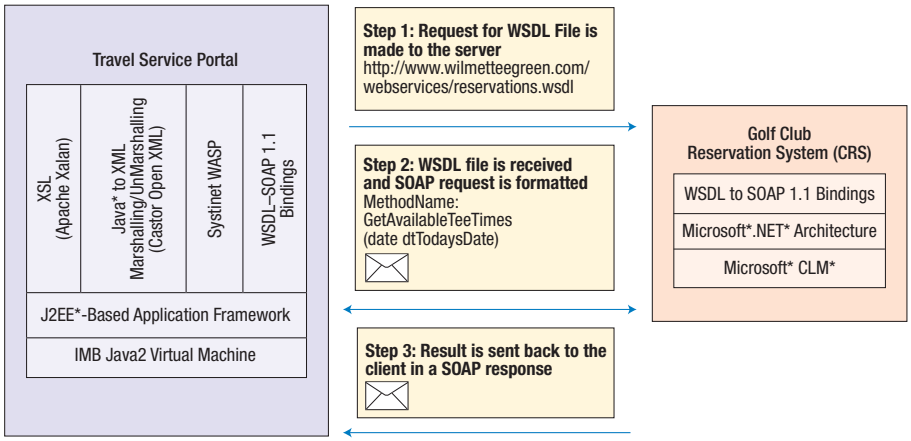
The main components of a WSDL message used are:

- The name of the service, including its Uniform Resource Name (URN)
- The location the service can be accessed at (usually an HTTP URL address)
- The methods available for invocation
- The input and output parameter types for each method

The Travel Services Portal is an HTML version 3.2-compliant solution, which runs on most available HTML 3.2-compliant browsers (such as Internet Explorer 5.5 or Netscape* Navigator 4.7).

WEB SERVICES MODEL

Within the Web services model, the portal's various servers use WSDL to describe the network services offered. WSDL identifies the services provided by the server and the set of operations within each service that the server supports. For each operation, WSDL also describes the format that a client must follow to request an operation.

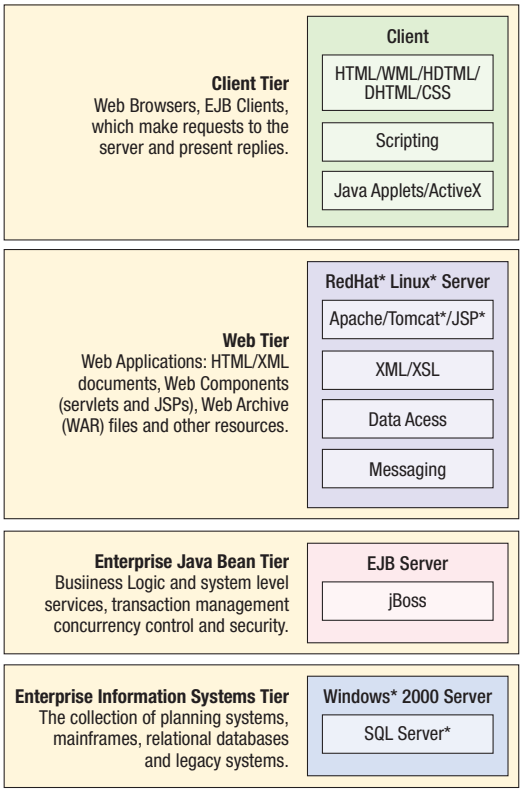


TRAVEL SERVICES PORTAL (TSP): JAVA/LINUX

The TSP is built on J2EE* and the Linux platform and uses the Systinet* WASP Toolkit for consuming Web services. The architecture is logically divided into three layers, or tiers: client, Web. and Enterprise Information Systems (EIS).

Each tier represents a collection of functionality and services within the architecture. For instance, the presentation layer (such as the Web browser) is managed by the Client Tier.

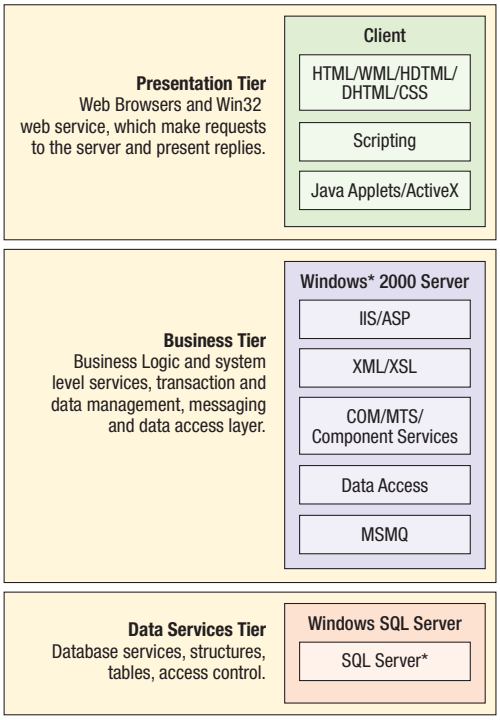
The Enterprise Java Beans (EJB) Tier was not implemented in the initial phase of the solution; however the architecture is scaleable and can respond to the needs of a four-tier EJB centric architectures if required.



CENTRAL RESERVATION SYSTEM (CRS): MICROSOFT .NET ARCHITECTURE

The CRS applications are built on the Microsoft .NET Framework and use Microsoft's SOAP Toolkit to manage the creation of Web Services. In addition, CRS objects are designed to authenticate and modify PNR information from the GDS. The CRS is built on a three-tiered environment.

All CRS systems place the core of the application within the Business Tier, Microsoft's Information Server (IIS). As the system matures, however, the business logic can be separated from the ASP pages and placed into components. Moving logic outside of ASP pages promotes reuse and supports the need for flexible and scaleable architectures.



GLOBAL DISTRIBUTION SYSTEMS (GDS)

PNR data management occurs within the framework of the GDS. As itineraries are created, TPS can create and modify PNR data. CRS objects are able to query, view, and modify PNR data. The GDS is built on Microsoft's SQL Server 2000 database because of its flexibility and its ability to render data into XML natively.

An alternate approach to the GDS database uses Microsoft's Limited Edition, Enterprise Windows .NET 64-bit server architecture with Microsoft's SQL 64-bit database server on a 4-way Intel® Itanium™ processor-based server platform. When the size of the GDS database, the complexity of table and system design or the density of the GDS records requires the additional cache and RAM available on the Itanium™ architecture, select the 64-bit platform over 32-bit SQL architecture. While the solution shown in the diagram was built on the 32-bit version of Microsoft's SQL 2000 Server, it could have been built on the SQL 64 and Windows .NET 64-server architectures.

SYSTEM ARCHITECTURE

External CRS systems, which are Web service consumers within the Travel Portal, connect to it via the Internet. Each CRS system shown here was initially built on the same Microsoft .NET server architecture. For purposes of this initial design, they all carry the same hardware footprint. The underlying CRS engine could just as easily have been a Linux*-based Web service consumer as well. The most vital technical consideration is that each consumer (CRS) within the portal must be SOAP version 1.1-compatible.

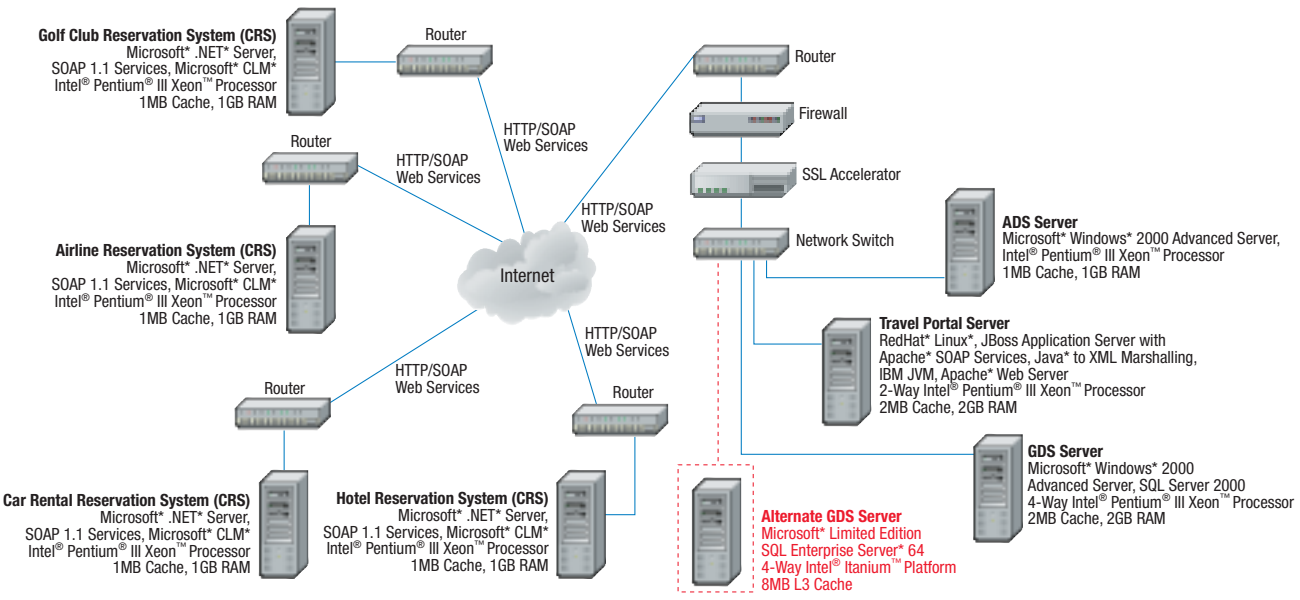
Individual CRS system components shown in the diagram also represent a single "feed" or consumer of data to the SPNR Travel Portal. Whether that consumer is an individual agency/user, supplier, or other travel portal service, they will be authenticated to the SPNR subnet via the Microsoft ADS server when they initially connect to the Portal service. Once authenticated, they are handed off to the RedHat Linux which handles all XML and SOAP requests or events from the consumer.

In designing the hardware, two architectures were considered:

The design was built using the 4-way Intel® Pentium® III Xeon™ processor-based server, running Microsoft Windows Advanced Server 2000 and the Server 2000. Cache and RAM on this server are standard size, but depending on the number of consumer connections, XML's I/O requirements and server usage, may have to be increased to provide acceptable system performance.

Another possible design would be built on Microsoft's Limited Edition Enterprise Windows .NET 64-bit server architecture with Microsoft's SQL 64 database server on an Intel® Itanium™ 4-way server platform (shown in the following diagram in red). The advantage of this approach is the larger cache and system RAM available on the Intel® Itanium™ processor platform, which could run certain portions of the SQL database in RAM and minimize XML or connection latencies. If the XML data needs to be secure socket layer (SSL) encrypted, the Itanium platform handles this via the SSL service (natively) and certificate running locally on that platform. This consumes additional SQL Server overhead to assemble the XML data for consumer packaging locally, but it saves network bandwidth and XML or SSL traffic outbound through the Red Hat Linux JBoss Portal Application Server.

Dimension Data Corporation Super PNR Travel Portal Prototype Solution



SUMMARY

To serve travelers better, reduce costs, and increase revenue and market share, travel suppliers must overcome legacy infrastructure limitations that hobble them. Using powerful new Web Services standards-based technology, the Travel Portal solution interfaces directly with reservation systems for travel suppliers, such as hotels, airlines, car rental agencies, and entertainment venues, and creates a consolidated record for storing all aspects of a traveler's itinerary. By overcoming limitations imposed by proprietary, closed information systems, the Travel Portal provides the consolidated and expanded information and flexibility today's travel suppliers need.

LEARN MORE ABOUT THIS INNOVATIVE SOLUTION

For general information about the products described in this solution blueprint, visit:

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If you have a specific question about implementing this solution within your organization, contact your Intel representative or e-mail us at: **solutionblueprints@intel.com**

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