IBM Passenger Rail Reservation Service

- Reduce time to value when creating a passenger rail reservation system
- Extend IT assets value with IBM Travel and Transportation Industry Framework
- Lower ownership cost with a workload optimized foundation
Executive overview

IBM® Passenger Rail Reservation Service (PRRS) is a workload optimized offering that consists of a set of industry-specific accelerators and middleware. It can be used by a passenger rail company, systems integrator (SI), or independent software vendor (ISV) to accelerate the time to value in the creation of a highly scalable and available rail reservation platform. IBM PRRS is built using a service-oriented approach and can be a critical component of an instrumented, intelligent, and interconnected railroad.

IBM PRRS provides flexible core capabilities to manage foundational components of a rail reservation system, such as inventory, availability, and reservations. Rather than using a collection of general purpose, low level system and database technologies, you can use these foundational services provided by IBM PRRS as the building blocks of your reservation system. These services allow you to focus attention and resources on providing higher level capabilities, such as yield management, multichannel sales, and customer self-service solutions, which are more tightly aligned with and responsive to the ever changing needs of your business.

IBM PRRS is also part of IBM Travel and Transportation Industry Framework, which provides capabilities in five key business domains that are specific to passenger rail. IBM PRRS is part of the Reservation System Modernization domain.

For passenger rail providers, the top industry challenges are centered on capacity and congestion, operational efficiency, reliability, structural and competition issues, and safety and security. With the introduction of IBM PRRS, railroads can focus on tackling these significant challenges, knowing that a key operational system (their reservation system) has a foundation that is workload optimized, flexible, and tailored to their industry based on decades of knowledge and experience.

This IBM Redguide™ publication explains the business value of IBM Passenger Rail Reservation System. It highlights key aspects of the architecture and how it enhances IBM Travel and Transportation Industry Framework.
Business need

Passenger rail systems have been in existence for over a century, and the focus has been on managing the use of seats on the train. This approach was adequate because most rail systems are operated as a state sponsored service with little regard for customer service.

Events have occurred in recent decades to change the focus and the business model. One such event was the advent of high speed rail. With high speed rail, rail service is much more competitive with air travel, even at distances of 500 KM or more. In many cases, the downtown-to-downtown service of high speed rail can be faster than airlines given the travel time to and from airports and long security lines.

To compete with airlines, rail operators need to match airline services, such as allowing customers to book a complete journey ahead of time, select seats, and connect through various distribution channels. Many rail operators are moving to eliminate the paper ticket in favor of electronic tickets (e-tickets) or ticketless travel.

When demand outstrips supply, having more knowledge of the passenger and their travel habits can improve capacity planning and increase security. These and other factors are often cited by governments as they continue to direct more funding into passenger rail projects.

Today, many rail operators have created and supported their own full service passenger reservation solutions. Many rail operators support simple ticketing solutions. Both groups have expressed a desire to have a more common approach to handling passenger reservations, which is a natural progression because, unlike airlines, most rail operators do not compete with each other and are more willing to share technology to lower costs and to improve service. However, recent regulatory changes in the European Union allow rail operators to compete with each other on the same routes.

For rail providers that have existing reservation solutions, many find the solutions to be too large, monolithic, and rigid, making it difficult to enhance the solutions in a timely manner when responding to changing business requirements. Instead, they are seeking a path toward modernizing this mission critical system to better meet the needs of their customers.

Although there are a couple of approaches to modernizing these systems, consensus is forming around an evolutionary approach based on service-oriented architecture (SOA) because of its associated risk reduction and incremental investment approach. In the end, the goal is a system that is more flexible and responsive to changing business requirements, which will enable rail providers to focus their dollars and resources on applications that add business value and not on maintenance of low level transaction and database components for managing inventory, availability, and reservations. For rail providers without existing reservation solutions, the challenge is to create a complete reservation system, from the lowest level foundational capabilities such as managing inventory, availability, and reservations, to implementing value added capabilities aligned with how they want to run their business, serve their customers, and interact with partners.

Introduction to IBM Passenger Rail Reservation Service

In response to the business needs for both new reservation systems and existing reservation systems that desire modernization, IBM has created the IBM Passenger Rail Reservation Service (PRRS), which is a unique offering in the marketplace. IBM PRRS is not meant to be a complete passenger rail reservation system but rather is a collection of core capabilities that can be dynamically combined and used to help create a complete reservation system. It is
also flexible enough to be able to integrate with a current reservation system in a number of ways to provide an evolutionary approach to modernization.

IBM PRRS includes the following core categories of functionality:

- Inventory management that provides a consistent view of the available inventory
- Shopping and selling that includes transactions to support the shopping for, booking, and modification of journeys
- Reservation system optimizations that provide rail specific optimizations for tasks, such as seat assignment, automatic reaccommodation, and booking cancellation due to non-payment
- Flexible selling scheme that provides the ability to dynamically change how you sell your inventory
- Rail operations support for transactions to support rail operations (for example, schedule change, suspend particular stations, and more)

IBM PRRS is designed to support the creation of modern, flexible passenger rail reservations systems by employing an SOA approach for its design. This approach means that the function provided by IBM PRRS is accessible through SOA-based messaging built on Web services and XML, providing choice and ease of integration with other platforms that make up a complete reservation system.

This architectural approach also enables you to select the right platforms for the various components that go into the creation of a complete passenger rail reservation system. For example, the existing services in IBM PRRS v1.1.1 are designed specifically for the IBM System z® platform and the IBM z/Transaction Processing Facility (z/TPF) operating system, based on the characteristics of the IBM PRRS workload. This design does not mean that your complete reservation system must be implemented on the IBM System z platform. Nor does it mean that future capabilities provided by IBM PRRS are provided only for IBM System z and IBM z/TPF. With IBM PRRS, the only requirement that must be met by complimentary platforms is that they need to support open, standards-based messaging protocols such as Web services.

Designing IBM PRRS using SOA principles also enables it to be well positioned to interoperate with emerging global passenger rail reservation system messaging standards. In particular, IBM is currently engaged with the cross-travel industry consortia and standards organization, Open Travel Alliance (OTA), working with key members of the rail industry in defining a set of rail schema messages to support seamless connectivity between passenger rail reservation systems and various distribution/partner channels.

Furthermore, IBM is chairing the effort in Open Travel Alliance to define a core rail reservation service model that will simplify the creation of value-added business functions on top of core reservation capabilities like those provided by IBM PRRS. This approach can help to protect your investment in a solution based on IBM PRRS while also expanding the market for complimentary solutions.

The next section includes a summary of the business value of IBM PRRS, its inclusion in the IBM Travel and Transportation Industry Framework, and an introduction to its capabilities.
Business value

IBM PRRS is a unique offering in the marketplace and provides unique value. With IBM PRRS, passenger rail providers can meet increased capacity demand, more rapidly support new customer interaction patterns and self-service capabilities, and transform IT systems to be more responsive and flexible. Passenger rail providers can also better compete with other transportation alternatives by taking advantage of middleware and solutions that are built around service orientation, providing greater ease of integration and higher degrees of responsive to changes in the business environment.

Because IBM PRRS provides a set of prebuilt core capabilities that are common to passenger rail reservation systems, the amount of effort that is required to create and maintain a robust, scalable solution is reduced significantly. Instead of devoting resources to maintaining low-level, core capability (such as managing inventory and reservations), as a passenger rail provider, you can choose to use resources to develop innovative and value added capabilities that can better differentiate what you provide to your customers.

Also, in prescribing a clear delineation between core services and higher level business process and flow processing, IBM PRRS introduces a modern SOA-based design for passenger rail reservation systems. IBM PRRS is flexible enough to be introduced into an existing ticketing or reservation system in a number of ways, such that you can evolve to a modern architecture versus taking a drastic, high risk, “rip-and-replace” approach to modernization.

In short, CIOs and IT executives for passenger rail providers are challenged to simultaneously reduce costs while also creating a reservation system that can meet their current and future needs in an increasing competitive market. The capabilities and design of IBM PRRS makes it well suited to help you meet these challenges.

Beyond the core challenges met by IBM PRRS, it is also important to mention that IBM PRRS is part of a broader IBM focus in supporting railways by providing the following features:

- Advanced information management
- Analytics
- Automation

It also provides integration of processes across the various business areas that constitute railways through the IBM Travel and Transportation Industry Framework.
IBM PPRS and the IBM Travel and Transportation Industry Framework

The IBM Industry Frameworks (Figure 1) combine market leading technology capabilities with prebuilt solution accelerators, best practices, and implementation patterns that can provide speed, flexibility, and choice while reducing cost and risk.

In May of 2010, IBM added a framework specific to the travel and transportation industry, to its growing list of frameworks, as a sign of its ongoing commitment to the travel and transportation industry. The IBM Travel and Transportation Industry Framework is a combination of IBM software products and assets that together with the IBM experience and subject matter expertise provide a foundation for a list of solutions for the rail industry. This framework can enable railroads to address the needs of complex sales and delivery channels, optimize passenger and freight operations, and better manage extensive assets to deliver on the promise of a more efficient, safe and secure freight and traveler experience.

The framework is open standards-based and built on common software building blocks and IBM middleware. It is designed to support advanced information management, analytics, optimization, and integration projects in the five business domains illustrated in Figure 2.
IBM PRRS is a core asset of the Reservation System Modernization domain of the IBM Travel and Transportation Industry Framework. Together with a growing list of other framework assets, it provides a foundation for the development of complete rail reservation and distribution solutions from IBM, IBM business partners, and ISVs. As part of the asset and solution development, IBM is also driving the continued enhancement of existing industry standards and the creation of new ones through its work with the Open Travel Alliance.

Service-oriented architecture and passenger rail

As discussed earlier, passenger rail providers face the following challenges:

- Meet increased capacity demand, which increases congestion and amplifies infrastructure limitations
- Support new customer interaction patterns and demands for better self service capabilities
- Transform their IT systems to be more responsive and flexible to meet the changing needs of the business
- Deal with increasing competition and structural limitations

Railroad providers need to tackle these difficult issues while providing a safe and secure form of transportation. Given this set of challenges and the existing obstacles that have existed during the 100 year history of the passenger rail industry, the best approach for transformation is one that is evolutionary or incremental in nature. The mission critical aspect of services that are provided by passenger rail providers makes any immediate and significant approaches to modernization risky. Therefore, a transformation approach built around service orientation provides an evolutionary means to modernize that can take advantage of existing assets, reducing both your costs and risks.
A new services-oriented foundation can be established that is standards-based, provides greater ease of integration internally and externally, and is responsive to the changes in the operators' business processes. This approach provides greater alignment between your business and IT and can drive down cycle times as well as development and maintenance costs through effective reuse of existing assets.

**IBM Passenger Rail Reservation Service architecture**

IBM PRRS follows a service-oriented architectural model. It provides a set of core low-level services which are the building blocks for creating a passenger rail reservation system that is reliable, scalable, and highly available.

Figure 3 on page 8 introduces a subset of a passenger rail reservation system that exploits the core functionality that is provided by IBM PRRS. At the top right of Figure 3, the box labeled composite business services (CBS) represents the higher level functionality that defines how the passenger rail provider's customers, partners, and employees will interact with the overall reservation system. The CBS layer is where a passenger rail provider implements the services that they want to provide to customers and how they want to provide them.

Figure 3 also shows a common high level process flow provided by reservation systems, including shopping, booking, buying, pre-journey, journey, and post journey. Although this flow is considered common and a best practice, a significant amount of differentiation can be achieved by different rail providers at this layer. For example, a passenger rail provider can provide for shopping and booking of complete trips which span multiple modes of transportation. The services provided at the CBS layer are ideal for deployment using modern application server and process server offerings such as the IBM WebSphere® Application Server and the IBM WebSphere Process Server. The services should be designed to be responsive to rapidly changing business needs, through the exploitation of business rules management systems offerings such as the IBM WebSphere ILOG® JRules.

Next, at the top of Figure 3, there are boxes that represent the various sales and service channels that a rail provider can support. For example, kiosks, mobile applications, web or Internet applications, call center support clients, and more. A strategy that is recommended as part of this architecture is to strive to embed as much of the competitive capabilities as possible in the CBS layer as opposed to in the various supported sales and service channels. This approach can aid in reducing costs, increasing responsiveness to changing requirements, and creating a common and seamless user experience across all service channels.
IBM Passenger Rail Reservation Service

The main interfaces used to interact with IBM PRRS are a set of IBM PRRS specific SOA-based Web service messages that are exchanged between the CBS and IBM PRRS. These interfaces do not put any special integration requirements on the platform that is used by the CBS layer.

IBM continues to work with and support various industry-specific standards bodies, and namely the Open Travel Alliance for passenger rail. Recently the International Union of Railroads (UIC), a predominantly European focused organization, and the OTA entered into an agreement to work closely on upcoming rail message and service model specifications (depicted by Open Service Messaging and Open Service Model, respectively, in Figure 3).

The work to create Open Service Messaging can help support inter-operable connectivity between passenger rail reservation systems and various distribution/partner channels. The Open Service Model is intended to define a set of core reservation services to enable the creation of complementary industry offerings and accelerate the modernization efforts of existing reservation systems. The creation and adoption of passenger rail specific messaging and service model standards will further protect investments in the CBS layer of passenger rail reservation system.

Before taking a closer look at IBM PRRS details, it is important in the context of providing core foundational services to discuss the bottom layer of Figure 3, which is the platform for which the IBM PRRS was designed and optimized. The intention of IBM PRRS is to provide passenger rail specific functional building blocks, saving the passenger rail provider the cost of developing and maintaining such core functionality. This approach enables the rail provider to focus on providing greater value and differentiation for their business.

An additional benefit of IBM PRRS is that you get this core capability optimized for a particular platform, currently the IBM System z platform which provides high levels of qualities of service. This combination provides faster time to market, scalability, high availability and
reliability, and greater price performance, because IBM has optimized the complete stack, depicted under the Open Service Model in Figure 3.

Over the years, new forms of computing have emerged, and certainly more will follow, but when looking at the architecture of an application or solution, it is easy to ascertain two primary forms emerging or a combination of these forms:

- Centralized computing deployments
- Distributed computing deployments

Loosely defined, centralized computing deployments attempt to co-locate as much of a solutions data and processing on a relatively small number of systems, which can drive up the requirements (such as performance, capacity, and scalability) of each single system. Alternatively, distributed computing attempts to partition the computing and data requirements of a solution and deploy a relatively larger number of smaller systems, each providing more discreet isolated capabilities, all working in concert to provide a complete solution.

These two primary forms of computing have differing strengths and weaknesses for supporting the different characteristics of the solution workloads. Ignoring or disregarding these strengths and weaknesses will not necessarily mean failure for your solution but it will likely mean that your solution is suboptimal. A suboptimal solution might be deemed adequate in certain situations, especially when other factors are considered, such as time to market. However, when you are building a complex mission critical solution, optimization is essential at the foundational layers of your system, otherwise the solution might be limited and fail to meet your longer term objectives.

IBM provides platforms across the computing spectrum and knows that one platform will not meet everyone’s needs. Customers require a dynamic, scalable, and optimized infrastructure that is tailored to their particular organization’s workloads. Based on decades of working closely with customers who develop and use mission critical reservation systems, IBM sees a centralized computing model as the starting point for creating an optimized solution based on the characteristics of the data model, and its usage in reservation systems.

In short, reservation system data is not easily partitioned and is undergoing a high rate of updates. In addition, the consistency of the data is critical to the business, all of these factors combine to align with what a high performance centralized solution can provide. These centralized computing concepts are explored further in IBM z/Transaction Processing Facility: Overview and Enterprise Integration using SOA, REDP-4611.
IBM PRRS interfaces and components

IBM PRRS provides a set of core foundational services. Figure 4 depicts some of the interfaces and components that it currently contains. The discussion that follows is a high-level introduction to some of the capabilities.

Starting with the interfaces to IBM PRRS, to begin using the core services that are provided, you must define the particulars of the target rail network, trains, and services that IBM PRRS will manage. On the left side of Figure 4, the purple interfaces represent the specifics of the data model and the format that is used by a particular passenger rail provider, including information about the rail network graph, train schedules, fare quotes, car types, and stations information.

This information needs to be first transformed into the data model format that IBM PRRS uses, and then it can be loaded into an instance of IBM PRRS. Depending on the particulars of each rail provider’s data model and where they maintain this information (for example, some of this data might be maintained in an asset management solution such as the IBM Maximo® offering), using an off-the-shelf extract, transform, and load (ETL) offering, such as IBM InfoSphere™ DataStage® to manage and maintain your information, will likely accelerate and reduce the ongoing costs of ensuring that the IBM PRRS installation is using the most current data.

After the details of your passenger rail services are defined to IBM PRRS, it is ready to provide low-level core capabilities, such as managing seat inventory and reservations and supporting requests for seat availability and simple fare lookups. Each of these capabilities, depicted in Figure 4 as red arrows, is exposed through a Web services interfaces (known as Rail Service Messages) that are unique to IBM PRRS.

Seat availability and inventory control is a key capability that IBM PRRS provides and is the core of all reservation systems. Flexibility in how seats are sold is a requirement if you are interested in effectively managing specific outcomes such as the capacity of your trains, revenue, and customer satisfaction. With IBM PRRS, this flexibility is provided through a
couple of different schemes that can be used together and that can be dynamically changed to control how services get sold.

For example, in IBM PRRS, you can define physical seats on a train as being dedicated for a particular use, such as for handicap or government official usage. The seats can be sold only through a limited channel or personnel type, or you can define rules based allotments of your inventory based on things such as sales or partner channel, usage, class of customer, market range (origin and destination pair), and so forth. You can also combine these methods to sell inventory and, by using the latter method, to manage the selling of the majority of inventory.

You can perform tasks, such as allotting a guaranteed minimum number of seats that can be sold through a travel agency partner or setting a limit on the number of student discount seats that are available for a particular market. In addition, you can establish these various selling approaches up front and adjust them in real time based on output from a yield management system or for some unforeseen business event. IBM PRRS provides a great deal of flexibility and control in how your inventory is sold, allowing you to continually keep your reservation system aligned with how you want to do business.

IBM PRRS allows for the creation and management of reservations using the common travel industry concept known as the Passenger Name Record (PNR), which contains the itinerary for a passenger or group of passengers traveling together. Through the Rail Services Message interface, complete trip itinerary reservations are made through booking requests which have the affect of moving available seats out of inventory and storing them in the PNR for a trip.

The PNR can contain bookings for multiple people and also bookings for journeys that consist of multiple legs. It is common practice to allow some period of time between when a customer has reserved a complete journey and when they actually have to complete the purchase. IBM PRRS enables you to set this time value to meet your needs. If a customer does not complete the purchase of the trip in the specified time, IBM PRRS automatically returns the reserved seats to the inventory to be purchased by someone else. This method allows you to provide convenience and flexibility to your customers, while allowing you to optimize your capacity.

IBM PRRS also has support for automatic reaccommodation of reservations in the event that there is a disruption or change in the service that is being provided. For example, when you change your schedule and have people who have already made reservations based on the old schedule. In situations where reservations cannot be rebooked, the PNR is set aside for manual handling.

Beyond the creation of reservations, IBM PRRS provides the ability to modify and cancel reservations. IBM PRRS provides a facility to help automate the extraction of PNRs for past journeys, providing a steady flow of valuable information that can be archived and fed into business analytics and optimization platform, helping you to understand demand and to optimize functions such as pricing and capacity. You can use IBM Cognos® to help provide insight through detailed reports and executive dashboards. IBM SPSS can provide sophisticated analytics capabilities, and you can use IBM DB2® Universal Database™, Data Warehouse Edition as the foundation to integrate multiple sources of operational business data.

Seat assignment is another important feature of IBM PRRS and part of the booking process. Similar to inventory, the seat assignment process supports a physical assignment; the dedication of a seat to a fixed use. This function is most commonly used by rail operator personnel or security people.

IBM PRRS can also assign attributes to any physical seat location, which can limit the use of the seat to a specific type of user (for example, a government official). During the seat selection process, a seat with this attribute will only be used when the matching attribute is
provided by the requestor. Seat attributes are used when the physical location of the seat matters, such as for security reasons, leaving the majority of seats available for IBM PRRS to assign based on seat selection optimizations. For example, IBM PRRS provides the ability to assign a seat “near to” another passenger. This function is an advanced function to place a passenger as close as possible to a specific seat assignment.

Seat selection optimization contained in IBM PRRS can have a direct impact on your business by providing optimization for short segments. In a train that is traveling a route of A-B-C-D, you need to keep a number of seats available for passengers traveling from, say, A-D. The longer the train line and the more numerous the stops, the bigger the challenge becomes. A suboptimal seat assignment for shorter segments can result in leaving only a few seats available for longer trips. For example, IBM PRRS keeps track of a seat sold for A-B and then prioritizes the reuse of that same seat from B onwards for subsequent seat assignment requests. All of these conditions, such as a usage attribute, the customer preference (characteristic), a “near to” request, and the reuse of a short segment seat, are taken into account on a seat assignment request with IBM PRRS. You can set the priority of these conditions based on your own business needs.

Lastly, IBM PRRS provides a set of Web services, referred to in Figure 4 on page 10 as Management Services, that are used by operations staff to perform tasks such as suspending train services, getting passenger manifests for a particular train, manually handling reaccommodations, altering quotas, and locating PNRs associated with particular seats. These Management Services provide a means to alter aspects of your operations in real time. With this approach, you can use IBM PRRS in a way that is aligned to how you want to run your passenger rail system.

IBM PRRS provides you with a core set of workload optimized capabilities, not trivial in their functionality by any means. You can use the building blocks provided in IBM PRRS to rapidly create a complete passenger rail reservation system that is flexible and tightly aligned to how you want to run your business.

Summary

High speed rail has provided the impetus for passenger rail systems to compete with air travel. This situation is forcing rail companies worldwide to reexamine how their reservation systems are positioned in response to the demands of an ever changing business environment.

IBM has responded to this challenge with the introduction of IBM PRRS, which can be used as the foundation of a completely new reservation system or a component to help accelerate the modernization of existing reservation and ticketing solutions.

IBM PRRS provides core reservation system capabilities through service orientation that can reduce time to value in providing innovative services to your customers and partners. Because it is an industry-specific and workload-optimized offering, IBM PRRS can reduce ongoing reservation system operation and maintenance costs. IBM PRRS is a core asset of the reservation system modernization domain in the IBM Travel and Transportation Industry Framework.

Through the IBM support of the creation of innovative standards for the passenger rail industry, IBM PRRS is well positioned to allow you to take advantage of IBM software, systems, and services, as well as, the services and offerings provided by IBM business partners and ISVs. These key attributes of the IBM PRRS offering make it a powerful foundational building block for creating a smarter railroad.
Other resources for more information

For additional information, refer to the following resources:

- **The smarter railroad: An opportunity for the railroad industry**, IBM Institute for Business Value, 2009:
  

- **IBM Travel and Transportation Framework for railroads**
  

- **IBM Travel and Transportation Software Solutions web site**
  
  http://www-01.ibm.com/software/industry/transportation/

- **IBM z/Transaction Processing Facility: Overview and Enterprise Integration using SOA**, REDP-4611
  
  http://www.redbooks.ibm.com/redpieces/abstracts/redp4611.html

- **Open Travel Alliance web site**
  
  http://www.opentravel.org/

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