

db4o | The Open Source Object Database | Java and .NET

# INDRA: Mission Critical High Speed Train Control System

By Dave Rosenberg

Spain's AVE rail system represents the modernization of the country's railroad infrastructure. The goal of the new high-speed bullet train line network is to provide new links so that all provincial cities would be less than four hours traveling time from Madrid, and six and a half hours from Barcelona.

The enormous undertaking of a new high-speed line represented great technological challenges due to the traveling speed of the trains, the materials in the infrastructure and the signaling and communications systems available at the time.

Indra Sistemas, the leading Spanish Information Technologies and Defense Systems company won the contract to build the control centers for Spain's AVE high speed bullet train system. INDRA pioneered the use of db4o as a mission-critical, fail-proof, real-time object database. db4o provides the database behind the brains of this integrated high-speed train control system (IRC). Built entirely in Java, IRC is at the forefront of transportation management systems. Indra relies on the small footprint, speed, and simplicity of db4o in the design of the control systems' complex and demanding architecture.

The IRC Control System was designed from a global perspective, integrating information and control from each of the elements that make up a high-speed rail line; from the off-line generation of operating plans to the real-time control of the trains, including scheduling to allow for the prediction of conflicts in resources usage.

Indra's specialty in real-time applications led them to conclude that the IRC system would benefit from an object database. The architecture used by Indra includes three areas of management allowing for different degrees of accessibility and control of the line:

- Real-Time Network
- Near Real-Time Network and
- Corporate/Intranet/Internet Network.

Indra chose the db4o object database to manage and control in all three layers of the system connecting to a relational database in the corporate network.



**Indra**

Indra Sistemas (MCE:IDR.MC, [www.indra.es](http://www.indra.es)) is the leading Spanish Information Technologies and Defense Systems company, with revenues exceeding \$1 billion. A solid technology base, permanent innovation, quality in processes and results, demanding management and the high degree of qualification of the almost 6,500 professionals that work for the company are the pillars sustaining Indra's success.

Indra is organized around three areas of activity: Information Technologies, Simulation and Automatic Testing Systems and Defense Electronic Equipment. Indra offers a complete range of advanced solutions and services covering the entire value chain, from consulting, through project performance and the integration and implementation of solutions to the outsourcing of information systems and business processes.





## db4o: the real-time object database

*"When we designed our real-time high speed railways control system for Spain's AVE train, we choose db4o as the core of the Real-time Data Base."*

José Miguel Rubio Sánchez, IRC Technical Manager, Indra Sistemas

The IRC system leverages db4o as a key data management element. db4o provides a single data model systemwide, allowing centralized monitoring, tracking and problem resolution. This element becomes increasingly important as Spain rolls out additional routes on the AVE system. Initially running between Madrid and Seville, AVE trains now service Zaragoza and Llieda as well. Multiple new routes are planned over the next 3 years.

Indra was able to see immediate benefits by integrating db4o into the complex Real Time System Control Framework, using db4o to store the large number of objects necessary to represent the railways real-time state.



## Thirty Thousand Objects in Memory

The Real-time System Control Framework consists of over 30,000 objects in memory and 30 classes, with 80 TB of information eventually flowing into Oracle's relational database on the corporate level. db4o's speed allows the system to process over 200,000 objects per second.

The benefits of db4o go beyond just speed; db4o is optimized to run in a minimal footprint and requires zero administration. Additionally, db4o is native to both Java and .NET programming frameworks, allowing developers to store objects directly.

*«db4o's speed allows the system to process over 200,000 objects per second»*

## Object Database for Object Oriented Design

Indra's use of db4o enabled them to focus their efforts on the design and development of the complex information smart model without having to worry about the technological issues of storing objects. db4o's object oriented database enabled truly object oriented software design.

*"Possibly the most important benefit is the ability to query with objects, enabling us to have a very complex Java OOD without requiring data transformation. Another key benefit is the zero maintenance environment, a must when designing real-time systems."*

José Miguel Rubio Sánchez, IRC Technical Manager, Indra Sistemas

## About db4objects

db4objects develops, commercially licenses and supports db4o, the leading open source object database. With more than 100,000 deployments, db4o offers Java and .NET developers one of the easiest and fastest ways to store objects natively. Development managers rely on db4o to cut development costs and deliver new products to market faster.

db4o is used by some of the world's largest companies, including BMW, Hertz, and Bosch. db4objects is a privately-held company based in San Mateo, California and backed by noted Silicon Valley investors including Mark Leslie, founding CEO of Veritas, who also acts as the chairman of the company.