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# Europe's rail gets a fresh ST4RT

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**At a conference in the European Parliament hosted by interoperability experts of Hit Rail ([www.hitrail.com](http://www.hitrail.com)), Brian Simpson, then Chairman of the European Parliament Transport and Tourism Committee, voiced his frustration at not being able to buy a single train ticket from Birmingham to Milan. The railways in Europe, he said, should look at the airlines as an example of how to organize worldwide ticketing.**

**H**it Rail B.V. is a private Dutch non-profit company created in 1990 and owned by 12 leading European railway companies. Its purpose is to help European railway companies to carry out international projects in related fields of data communications and information technology. Hit Rail is responsible for managing an international private data communications infrastructure and message brokering services currently used by 50 railway companies from 21 countries. For more information, please visit <http://www.hitrail.com/> or send an email to [info@hitrail.com](mailto:info@hitrail.com).

**T**he main challenge for the rail ticketing interoperability has been the difficulty of getting different systems, developed in different countries and by different companies, to communicate with each other in a coordinated way. There are two main areas of difficulty here. The first one is to get disparate IT systems to understand the “form” of the information exchanged, in other words, to let them use the same messages with different syntaxes. This problem has been resolved by Hit Rail’s HEROS service, described later in this article. The second one is how to enable IT systems to understand the “substance” of the information exchanged between each other, i.e. when not only the syntax but also the logic of the message is different.

These problems can only be solved by taking a semantic approach through a common ontology. An ontology is defined by Wikipedia as “a formal naming and definition of the types, properties, and interrelationships of the entities that really exist in a particular domain of discourse,” i.e. a standardised description of what the terms used in a particular context mean. This

issue is addressed in the new ST4RT project ([www.st4rt.eu](http://www.st4rt.eu), see below).

Submitted by an eight-member consortium in the framework of Shift2Rail ([www.shift2rail.org](http://www.shift2rail.org), a joint undertaking of industry and European institutions established under the Horizon 2020 program of the European Commission), ST4RT (Semantic Transformations for Rail Transportation) will develop the platforms and systems needed to enable interoperability between rail ticketing systems and potentially also between different transport modes.

## **Making sense of “918”**

Historically the interconnection of rail reservation and ticketing systems was standardised by the International Union of Railways (UIC, [www.uic.org](http://www.uic.org)) by defining a set of messages and procedures described in the so-called “918” protocol.

Since at that time transmission lines had limited capacity, the “918” messages were designed in such a way as to minimize their length. They are bit-oriented, i.e. each bit has a specific meaning, and only relevant bits are included in the message. Therefore, each message



The ST4RT project (Semantic Transformations for Rail Transportation), was submitted by an eight-member consortium, coordinated by UNIFE. ST4RT will make use of components from the Shift2Rail Interoperability Framework (IF) developed in the IT2Rail “lighthouse” project, extending it for use in related Shift2Rail projects. Its implementation started on the 1st November 2016 and is set to last for 24 months. The general approach adopted by the ST4RT project is shown in Figure 1: two different standards A and B are semantically annotated in order to create mappings from their data models to the global reference ontology. The resulting mappings are the basis for the semantic transformations of ST4RT, so that data expressed in the two standards can be converted into their respective ontological version. Whenever two systems that adopt the different standards A and B need to exchange information, the semantic transformation takes place.

A cornerstone of the project will be the work package in which a real demonstrator will be developed to prove the validity and effectiveness of the semantic analysis. The demonstrator will run on the HEROS platform provided by Hit Rail.



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must include a so-called “topographic label,” indicating which elements are present. This obviously makes these “918” messages complex information items whose processing must be done in low-level assembler-like languages, requiring skilled experts.

To overcome this limitation, the relevant UIC working group developed a new version of the “918” messages in an XML syntax (the modern way of exchanging information) some years ago. However, for many years no railways were able to implement it. Reservation messages have to be exchanged between a railway requesting a reservation and a railway answering

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with an allocation. It didn’t prove to be viable for a single railway to spend the time and money required to develop the XML interface, as partner railways were not ready to use the same format.

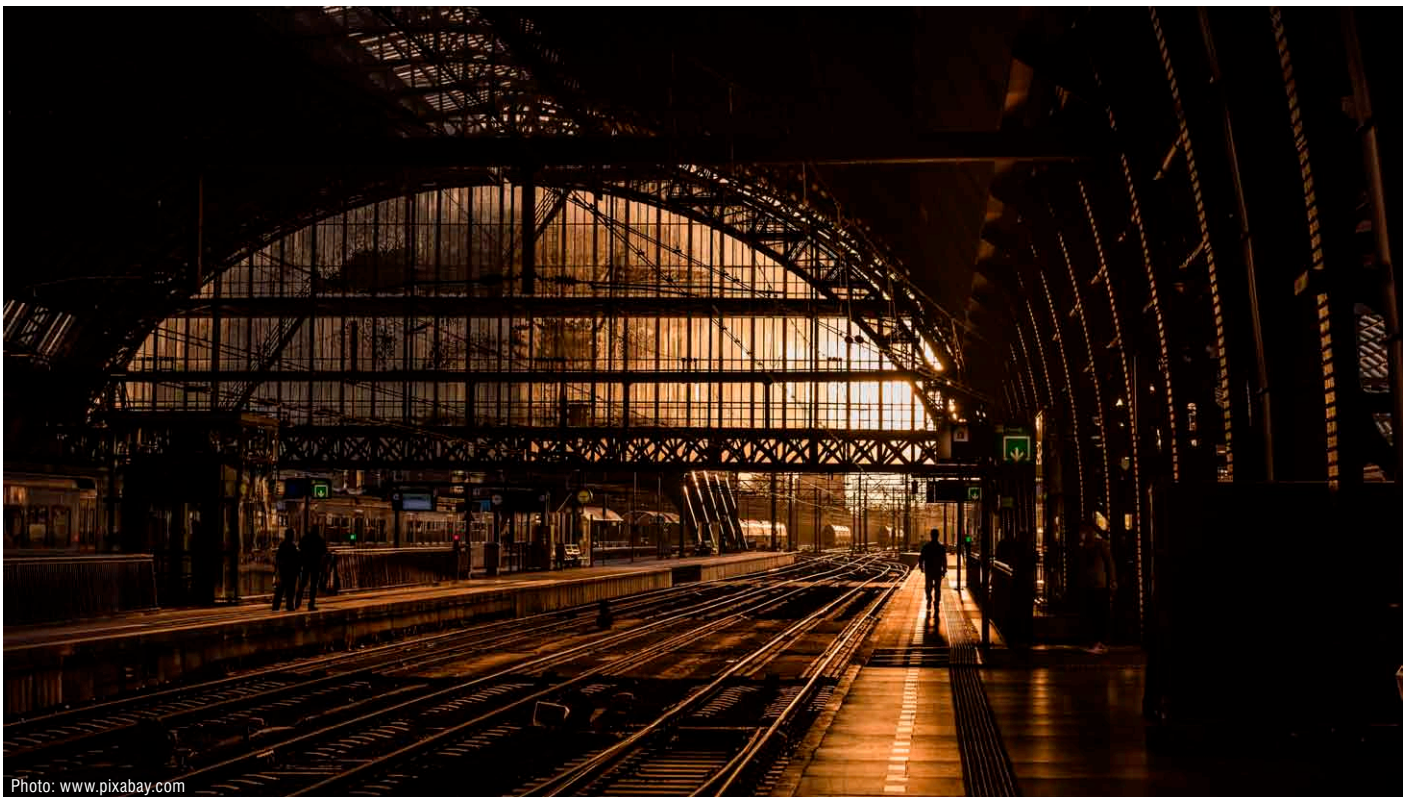
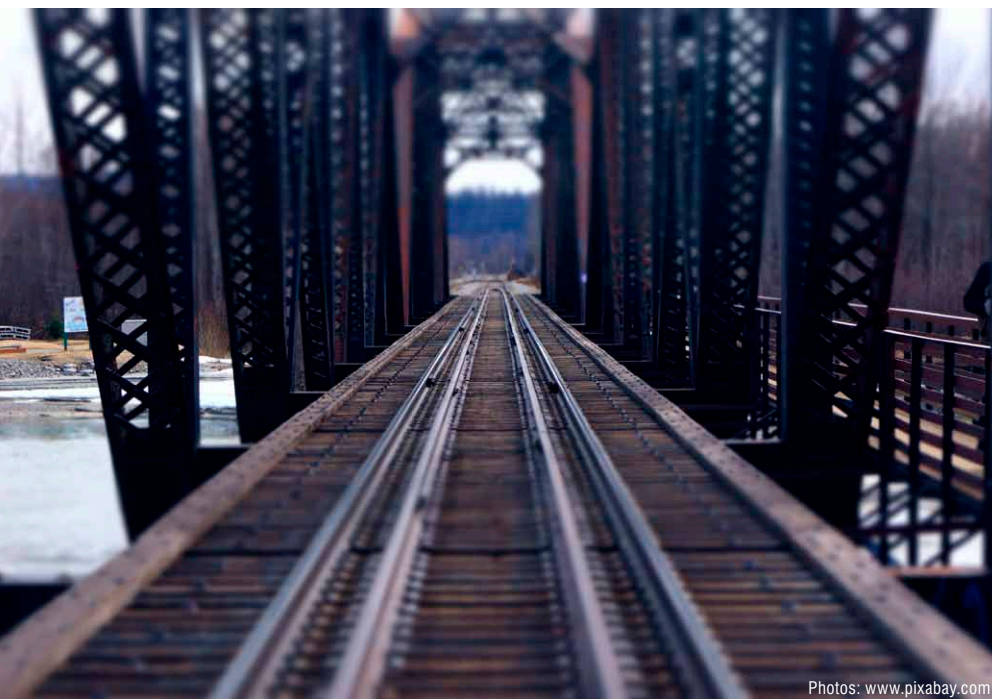
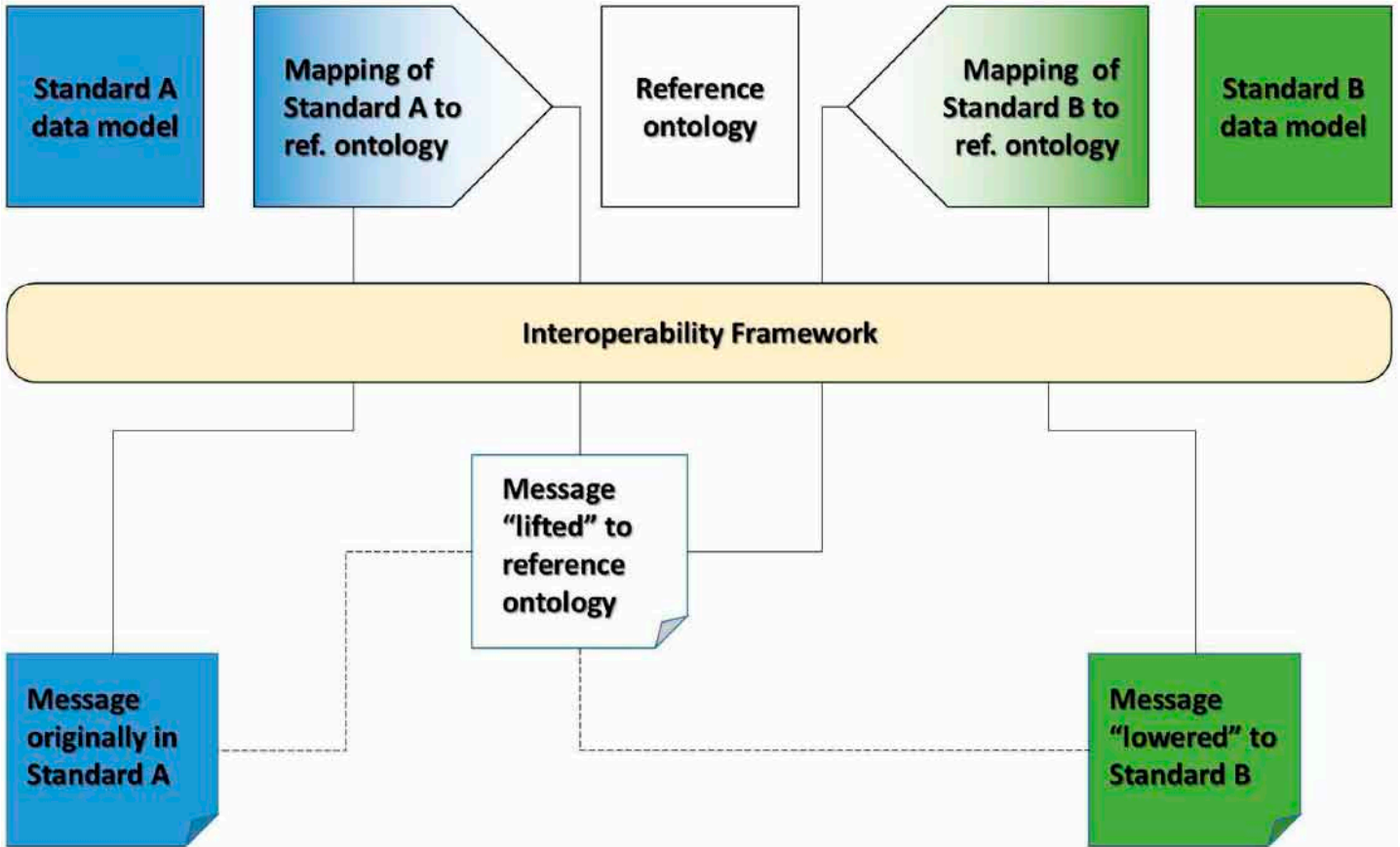


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Fig. 1. The data transformation process in ST4RT project



The situation was therefore in a stalemate, with railways waiting for somebody else to make the first move. The inclusion of the bit-oriented “918” messages in the Technical Document B.5 of the TAP TSI Regulation (Telematics Applications for Passenger Services – Technical Specifications of Interoperability), thus

promoting them to be “the” European standard, didn’t help.

#### A new platform for interoperability

Hit Rail, an organisation founded by several major European railways, which offers interoperability to railway undertakings and infrastructure managers, came to the

rescue by setting up HEROS, a common platform to which railways can connect their ticketing systems. HEROS manages the translation of the various 918 formats (“bit oriented” or XML) of ticketing messages, bridging the syntax differences.

Rhätische Bahn, one of Europe’s major tourist railways, is already using HEROS with much success. Rhätische Bahn runs a number of “red” trains through the scenic routes of the Swiss Alps, hosting lots of tourists from Europe and overseas. Thanks to its connection with the Hit Rail platform, Rhätische Bahn is now able to receive reservation requests and sell tickets through a number of partner railways, such as Deutsche Bahn and SNCF.

Yet Brian Simpson is still not able to buy his ticket from Birmingham to Milan! Why not? The problem is that the “918” standard only covers the very basic functionalities (request for price, request for availability, booking). But train ticketing is far more complex than this. Many railways offer the passenger a possibility to choose his/her seat on the coach map, to keep a seat reserved and pay later, to receive the ticket by mail or by SMS or to retrieve it on paper at the departing station, amongst other options. The 918 does not allow such choices, setting strong limitations in the implementation of information exchange.



Photos: www.pxhere.com

Moreover, outside the rail industry, e.g. among travel agents and airlines, the standards that are specific to railway bookings are not used. Therefore, for each interconnection between a travel agent and a railway undertaking, a precise mapping needs to be performed among the local representations of the ticketing data. The number of railways and ticketing offices in Europe is huge and still growing due to privatisation, and the interested parties' effort needed grows quadratically as this number rises.

#### **A new beginning with ST4RT**

Now Hit Rail, together with partners such as Trenitalia, the Politecnico di Milano, UNIFE and Oltis Group, has decided to design a mechanism to automate the mapping process. In the ST4RT project (see Box 2), which has been selected for co-funding by Shift2Rail, a semantic repository will be built in which information elements related to travel and ticketing will be ontologically defined.

The definitions will be "abstract" enough to allow the matching of elements

that have different names in different standards. For example, one system can use the term "segment" and a second one "travel episode," but if both are annotated in semantic terms as "a journey made by a passenger between an origin and a destination, without change of vehicle and without intermediate stops," a semantic converter can easily transform the request in standard A for a ticket for a "segment" into a request in standard B for a ticket for a "travel episode" (see Figure 1).

Based on this approach, the ST4RT project is developing a tool that will produce the mappings needed to allow data exchange among different actors within the transport ecosystem. Data consumers will be shielded from and unaware of the complexity of different data formats and non-integrated services. Simply put, ST4RT will facilitate interoperability among systems.

Additionally, while the ST4RT project aims at demonstrating an immediate possible benefit to railways, the results are not exclusive to this sector. Increasingly, travellers wish to use services (including

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web-based services) that allow them to book their travel (air and rail), hotel rooms, events (sport and culture) and excursions in one environment. They, and the resellers that run such environments, will also benefit.

Once the project has proven the feasibility for a use case of the semantic approach, this could be extended to more real business processes, ultimately paving the way to the removal of the technical and human barriers that prevent Brian Simpson from buying his train ticket all the way from Birmingham to Milan! ■