Modelling

Railway Domain Ontology

Ontology Standard for Information Interchange and Reasoning

Integration of information is key for further growth of railway transport volume. Decision makers will be able to make better decisions once they have the right information at hand about their own processes and about the processes of their partners in business. InteGRail is the project that developed an enabling technology to allow universal access to existing information systems, be it databases, monitoring systems or existing user applications. For this purpose InteGRail defined a standard approach for architecture and communication. Using this standard approach a number of example applications were developed. The objective of the Railway Domain Ontology is two fold: to provide a standard for information interchange that can be shared by the producer and consumer, and to provide an extensible mechanism for recognising context, creating opportunities for improved performance.

What is the Railway Domain Ontology (RDO)?

The *Railway Domain Ontology* (RDO) provides a means of creating a machine interpretable conceptual model of physical components and domain data concepts. The model was created using the Web Ontology Language (OWL), which is a W3C standard for encoding knowledge. The proposed solution implements a semantically enabled network of reasoning nodes, where information is integrated and shared using the RDO and distributed reasoning[t] over a service orientated architecture (SOA). The application of the RDO aims at solving the integration challenge within the railway environment.

Who can benefit?

The major players in the railway industry, who rely on numerous vendors for systems that produce and consume data, can benefit the most from this solution.

How is the benefit realised?

The RDO provides a generic solution for information interchange. It is proposed to be particularly appropriate in an environment where there are numerous heterogeneous information sources. The major players in the railway industry, who rely on numerous vendors for systems that produce and consume data, can offer the RDO as a standard interchange format. The vendors can use this standard to exchange data with other information systems and use reasoning features to enable applications to interpret that data. This is beneficial to the companies, as it addresses technical challenges associated with information interchange and integration. This solution offers other benefits associated with data analysis. OWL ontologies can be used to capture domain knowledge such that information that is implicit in data is inferred from explicit data. Since the RDO is machine interpretable, it means that applications can readily receive data from numerous systems, inferring implicit information from explicit statements. The benefit of this approach is considered in areas such as fault detection and diagnosis, where tacit knowledge can be captured and used during decision making tasks.

[t] *See the Distributed Reasoning fact sheet*

Present status, availability and future possibilities

Ontologies have been implemented to solve integration and interchange problems in a number of domains. Organisations that have numerous information systems with similar concepts, but different data structures, appear to have yielded significant benefit. In particular, medical, military and automotive industries have undertaken significant work. However, to yield this benefit, these organisations have committed to some technological and behavioural changes. The work undertaken in InteGRail has demonstrated that there are opportunities to take advantage of the features that ontologies offer. The first phase of ontology work has resulted in a set of domain ontologies that meet the requirements of the Demonstrations Scenarios[t2] within the project. These ontologies are now available. The future possibilities are dependent on stakeholder's willingness to commit to technological and behavioural changes. The perceived possibilities are the creation of semantically enabled railway applications sharing information using a refined RDO set.

The primary research in this area has led to the creation of a number of prototype applications. These are being used to test and further develop the railway ontologies. These resources are currently available though they are subject to change during further developments. At the end of the project, a refinement exercise will be undertaken prior to the release of the final project ontologies. These ontologies will be available to anyone who is interested in the research results.

As applications utilising this technology are becoming more common, it is likely that in the future, ontology based systems and applications will become ubiquitous. As the internet and XML have been utilised by the railway community, so the implementation of semantic technologies will form part of a natural progression.

[t2] See DS1, DS2 and DS3 fact sheets

Other results of InteGRail

Architecture definition of integrated information systems: IGRIS

Semantic data structure of the railway domain, the InteGRail ontology

Example user applications: ODSS for on-line operational decision support, IAC for on-line infrastructure availability, IDT for on-line vehicle maintenance information

Description of interdependence of performance of railway processes: the railway KPI tree, and a tool to assess and visualise performance

InteGRail - Facts and Figures

InteGRail started on 1/1/2005 and ends on 31/12/2008

Total project budget:
20 million Euros

EC funding : 11 million Euros

Total effort over 125 person-years

39 partners from 11 countries

Partners of InteGRail:

UNIFE • Alstom Transport • AnsaldoBreda • Bombardier Transportation • Siemens Mobility • UIC • Trenitalia • D'Appolonia • TSB-FAV • DeltaRail • ATSF • CAF • Nortel Networks • Laboratori Guglielmo Marconi • FAR Systems • MER MEC • Italcertifer • ATOC • České dráhy • MAV • UNICONTROLS • Strukton Railinfra • Deuta-Werke • Heriot-Watt University • IMEC • OFFIS • Televic • Seebyte • Kontron • University of Chile • INRETS • Wireless Future • University of Birmingham • ADiF • RFF • ARGE Corridor X • Network Rail • ProRail • SNCF

More information:

For more information on the InteGRail project contact: helene.koepf@unife.org, or surf to www.integrail.info
For more information on the Railway Domain Ontology: R.Lewis.1@bham.ac.uk

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