THE MODERN INFORMATION SYSTEMS FOR CONTROLLING THE RAILWAY TRAFFIC AS AN INDISPENSABLE TOOL OF AN INFRASTRUCTURE MANAGER

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The information systems of an infrastructure manager (IM) are today an indispensable part of its basic technological processes. Their significance has been growing even more in the setting of the liberalized transport market, where many private railway undertakings (RU) or operators enter the railway network and content for its spare capacity. The contribution discusses covers the high-level structure of the key information systems of the infrastructure manager, their coverage of the aforementioned technological processes, from designing the timetables and ordering ad hoc paths, to the operational control in all of its spatial and time levels, to assessing the traffic and resolving the exceptional situations. As the most important feature, the authors emphasize a profound integration of all these systems, which involves unifying all the databases and facilitates reusing the captured data, which boosts the overall efficiency of the system. The authors draw from their huge experiences of developing, solving, implementing, and operating these systems, above all in the environment of Czech and Slovak railway networks.

Key words: railway transport, infrastructure manager, traffic control, information systems, integrated solution, information interoperability, mission-critical systems, planning

1 Introduction

The transport industry has a very significant role in the modern society and economy. In the growing economy the demand for timely and reliable transport also grows at a rapid pace. Modern production and modern traffic has brought a higher stress on the environment, however. A balance must be established between the benefits of modern live and healthy living conditions.

As a sustainable surface transport, the railway transport now re-gains its former position on the transport market. The key "buzzwords" – and at the same time the key challenges – are competitiveness, open access for the railway operators, and interoperability. The basic conditions for undertaking in the railway industry have been set by the European Directive 91/440 adopted by the Council of Ministers in 1991, then by Directive 95/18/EC (licensing of railway undertakings in EU) and Directive 95/19/EC (allocation of railway infrastructure capacity, later replaced by Directive 2001/14).

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These directives are by no means the only factors changing the face of the railway transport market or influencing the development of information systems, however. The business requirements of both the infrastructure managers (IM) and the railway undertakings (RU) have also to be considered, as well as the international cooperation and interoperability. No modern railway organisation can rely upon the legacy "PPP" technologies anymore – Phone, Pencil, Paper.

2 Digital Technologies in the Railway Transport

As briefly stated above, information have always had a key role in controlling the railway traffic, although for many years they were stuck with the legacy, traditional manual technologies, which could be designated "PPP" or Phone, Pencil, Paper (Figure 12). These technologies have obvious disadvantages:

- time-consuming, manual input into the paper documents, cumbersome "transmission" and processing
- error-prone when processing and transmitting (i.e. distortion during voice communication)
- high risk of introducing wrong data (e.g. a incorrect engine or train number)
- high latency in data communication (dependent on the instant personal presence of both communicating parties)
- cumbersome or impossible further processing (e.g. in GVD Analysis, archiving and others)

Figure 12: "PPP" technologies or Phone, Pencil, Paper in the railway traffic

An answer to these challenges of legacy technologies is replacing them with a comprehensive information system based on a **digital model** of the railway traffic. This model is built upon the basic objects as a train, an engine, and a closure. The digital model and digital technologies rely heavily on the following conditions, however:

- **comprehensive digital model** of the railway traffic (as specified), which forms the unified data base for capturing all the relevant objects and events in the planned and realized level
- **direct integration into the railway technologies** – the information systems have to be integrated into the existing workplaces and the existing dispatching network, not into a mirrored structure
- **network-wide data capture** – the information systems should be deployed in the network scope, preferably without any "deaf spots" which can introduce undesirable inconsistencies in the data
- **full-scope planning** of the train traffic (as ensured by the under mentioned systems)

- **coupling with DOZ** interlocking systems – when possible, such an integrated solution provides the highest consistency, accuracy, and timeliness of the data

3 An Overall Structure of the IS for an Infrastructure Manager

As any other enterprise, the infrastructure manager can see its business activities separated in three broad levels, and their support include the key IT solutions provided by OLTIS Group a.s., as detailed below:

- **strategic management** – long-term general planning, the infrastructure development (IS of infrastructure), planning the maintenance works and temporary closures (IS Closures), planning the capacity (ISOR KADR), archives and decision support systems (ISOR APD)
- **tactical management** – mid-term planning, specifying the closure plans (IS Closures), designing timetables (IS KANGO), selling the capacity (ISOR KADR), managing personnel (EDO)
- **operational management** – short-term, instant traffic control with local scope (IS Station Master), regional scope (ISOR VD), and network scope (ISOR CDS)

The overall schema (Figure 13) suggests also communicating with a railway undertaking (RU), on both the process and information level. Here, any licensed RU can be assumed, either a passenger RU, or a cargo RU; describing the information components and/or systems of any particular RU is out of scope of this article.

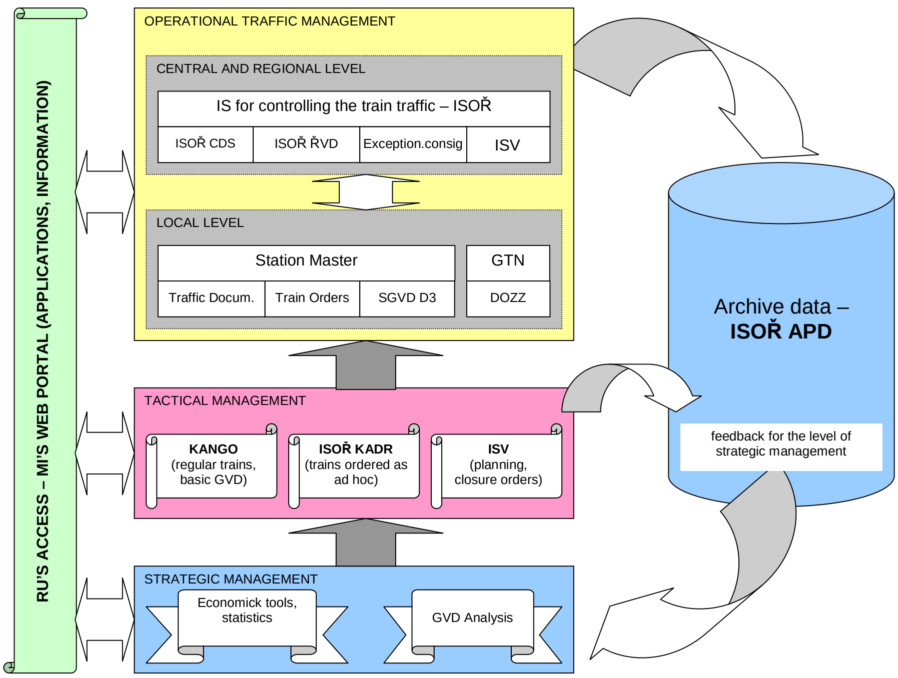

Figure 13: Architecture of the integrated IT solution for infrastructure manager

4 Mission-Critical Systems for Controlling the Train Traffic

The information systems of the operational management can be seen as the **mission-critical** systems for controlling the train traffic. However they cannot get along without a support of other underlying systems concerning mainly data on the network, timetable (GVD), and overall decision support and capacity planning.

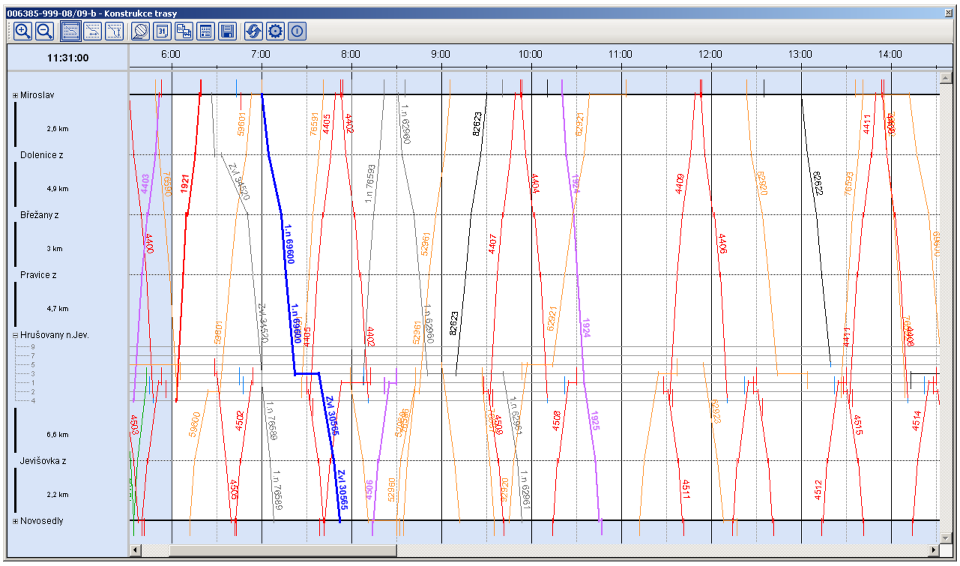

Figure 14: ISOR KADR: constructing the ad hoc paths

Just to name the most important systems provided by OLTIS Group a.s.:

- **IS KANGO –** designing the timetable (GVD) as the basic plan for controlling the railway traffic
- **IS Closures** – planning and monitoring the closure activities and maintenance work, communicating within MI and with RUs
- **ISOR KADR** – selling the capacity of the railway network, planning the train routes, acknowledging the RUs’ requirements
- **ISOR CDS** – an umbrella system for supervising the whole railway network or its part (as configured in the site)
- **ISOR RVD –** collecting the shift plan, distributing and communicating within MI and also with RUs
- **ISOR VD –** supporting the activities of a Train Dispatcher
- **Station Master** (DK) – supporting the Station Master as the local level of the technological processes
- **SGVD D3 –** recording the technological events and controlling the train traffic at the regional railways (D3)

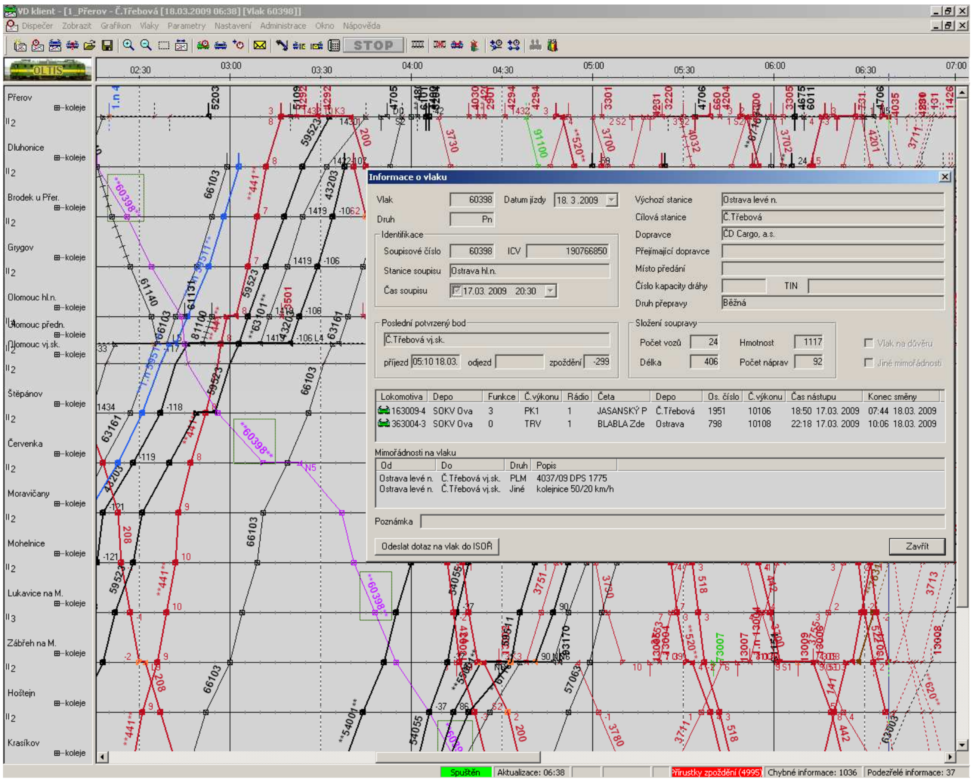

Figure 15: ISOR CDS: an umbrella system for supervising the railway traffic

5 Case Studies: Successful Implementation in CD and ZSR Network

After splitting Czechoslovak Republic into two independent states, the national railway organisations were also detached. Then two independent subjects were born – Czech Railways (CD) and Railways of Slovak Republic (ZSR). Both railways has then undergone a lengthy process of separation into an independent infrastructure manager, a passenger RU, and a cargo RU.

Both aforementioned railways had grown from the same environment which includes identical or very similar hauling vehicles, operational technologies, regulations, and other aspects. The similar present environment simplifies therefore the implementation of the information systems.

Figure 16: Modern IT for controlling the railway traffic (Station Master, DOZ interlocking)

In Czech Railways network, the Station Master (DK) information system experienced a pilot deployment in Rudoltice v Čechách in 1996. During the upcoming years it was integrated with other information systems and with DOZ interlocking systems. It has overcome its "childhood diseases" and nowadays it is operated routinely in the whole network scope, i.e. in all the railway stations.

The Train Dispatcher (ISOR VD) started its deployment in 1998 and from 2002, after the pilot deployment, it is operated routinely in all the Train Dispatcher circuits. It also facilitates the operation of the umbrella system ISOR CDS which supervises the traffic in the railway network as a whole. An integral part of the operational control is also a full-scale planning of all the trains in ISOR RVD system.

Nowadays the ISOR family of information systems for CD is deployed as an outsourced service provided by OLTIS Group a.s., running in 24x7, in a fully redundant cluster environment. The systems are therefore concentrated in one site, with high-end 24x7 administration and supervision. The customer (CD) obtains a high-quality service for affordable costs.

In ZSR network the information systems are being deployed since 2006. The pilot deployment of the Station Master (DK) involved the lines Štrba – Košice and Kúty – Bratislava – Štúrovo; the technologies are amended by the umbrella system ISOR VDS with several dozens of clients. The planning of the train traffic is provided by PIS.

The systems rely heavily on data communication, both among their various components, and with external IS (mainly systems of the railway undertakings). The local level also communicates with the interlocking systems (SZZ-ETB, ESA, and DOZ). The development in the nearest future concerns implementing TSI TAF and other standards necessary for achieving the information interoperability.

6 Conclusion

The area of information systems for the railway transport is ever-changing, ever-developing and ever-challenging one. It also relates with many environment factors on the transport market, including the legislation and technical standards as TSI. No brief article can cover this area as a whole, but it can give an overview of the present technologies and modern information systems used by a modern infrastructure manager. The authors present the key components of the overall solution developed and operated by OLTIS Group a.s. The mission critical systems are the core foundations of modern operational technologies.

The OLTIS Group company, based in Olomouc, Czech Republic, is a leading vendor of the information systems for controlling the railway transport, from preparing and planning the transport to real-time monitoring and assessing the transport. It delivers and operates many mission-critical systems for controlling the railway traffic, and also for planning its operation. Its customers include both state-owned and private organizations from the transport industry, both railway and road transport. The company is also a leading exporter in IT railway industry.

Literature References

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