Optimizing rail resource dispatching in Austria

DI Walter Schneider [1]; Mag[a] Elisabeth Mrakotsky [2];
Mag. (FH) Harald Strubinsky [3]; DI Dr. Andreas Schöbel [4]

[1] arsenal research, Austria, Vienna, walter.schneider@arsenal.ac.at
[2] arsenal research, Austria, Vienna, elisabeth.mrakotsky@arsenal.ac.at
[3] ÖBB Infrastruktur Betrieb AG, Austria, Vienna, harald.strubinsky@oebb.at
[4] Vienna University of Technology, Austria, Vienna, andreas.schoebel@tuwien.ac.at

Abstract

According to European legislation the field of railway operation is divided in infrastructure management (IM) and railway undertakings (RU). The IM must ensure that every RU can operate under a secure and reliable timetable without risk of delay or inefficient use of resources. Consequently, dispatching becomes an essential topic. A raising number of operators and different kinds of trains e.g. heavy load cargo vs. high speed passenger trains are running on the same track. The study 'OPTIMAL' (Optimization of dispatching processes with applicable solutions), initiated by the Austrian Ministry of Transport analyses the state of the art in Austria and detects gaps in the value chain. As a result, clear recommendations on technological and organizational improvements can be given for the actors in this field.

Keywords

Dispatching process, operational control of railways, train path management, Austria, Federal Austrian Railways

Background

The break-up of historically grown structures of what used to be known as the National Rail Systems into separate infrastructure and train operating companies has induced a series of significant changes in common operating procedures and business processes in general. In this liberalized environment many newcomers are now populating the scene of train operators all over Europe, interacting with the infrastructure operating companies. These changes simultaneously came about with major advancements in High Tech Equipment especially in the Information and Communication Technology sector. In the light of these developments it is quite natural that the need for information exchange via interfaces among these actors has dramatically increased and becomes even more complex. The need to harmonize these processes is obvious.

In the consortium several companies of the Federal Austrian railways are representing the entire value chain, two research partners are directing the survey. A lot of associated partners coming from public and private operators have contributed with their knowledge through interviews and have participated in an expert workshop.

The Study

This project is targeting the sector of resource dispatching aiming to develop a method for optimization analyses (process engineering). It is structured in four main segments which are also reflected in the work package breakdown structure.

- Analyses – Fact Finding Mission on the national level and research for best practice models in the international area. Organization of expert workshop individual interviews. Assessment of internationally established procedures and generally accepted standard documentation.
- Analyses and detailed description of shortcomings identified
- Statement of possible optimization measures; design of recommendations for system improvements, focusing also on trans-national procedures.
- Design of specific use-case scenarios for implementation of said recommendations on the national level. Evaluation of the proposed measures with regard to cost, risk and time to completion.

The cooperation of all partners of the entire chain of dispatching in this project consortium ensures a representative result on the national level. Such it will also ensure coverage of requirements from associated IM and RUs - national as well as cross-border.

The main focus was set on the entire process of generation of individual train schedules – from the *infrastructure operator's point of view*, starting with an incoming request for a trainpath, track scheduling, resource allocation, all the way finally to an itemized individual train schedule. This is the kind of information detail generally provided to the actual train operator that has to be maintained on a regular operational basis. Secondly, our focus was the *train operator's perspective*, dealing with issues of dispatching of rolling stock as well as personnel, and effecting all resource allocations, personnel scheduling, revolving scheduling, including maintenance activities.

Results of expert interviews

The survey is based on expert interviews with colleagues from Austria, Germany and Switzerland. These interviews have a similar questionnaire schema and deal with topics including terms of definition, used tools and system approach, and changes in processes due to liberalization of rail traffic in Austria. The first surprising result was the different interpretation of dispatching processes. In Austria the whole process chain including strategic planning of tracks and timetable generation is summarized under the term dispatching. In other countries like Germany or Switzerland the termin of 'dispatching' is limited to all processes while the train is running.

The rail system in Austria is mainly operated by the Federal Railways. A lot of smaller railway undertakers are running cargo trains or have passenger transport on their own regional networks. If cooperation with the Federal Railways is needed they use similar processes and have very simple tools like standardized software from Microsoft Office Package. Due to the liberalization of rail traffic in Europe infrastructure and train operating companies in Austria have become separate organizations. This causes a need for more interfaces between the involved systems in the dispatching chain, but the main advantage is the transparency of costs in this system and an increased orientation towards customers. Liberalization caused that freight and passenger transport are not operated by one provider anymore. At least two companies are competitors for the best connections in a scheduled timetable. Problems arise if a delay or disturbance in the network occurs. While a passenger carrier wants to keep the timetable satisfy his customers the freight carrier wants to ensure that an arrival time can be monitored and has a high accuracy. These are different requirements presented to the

dispatcher and the dispatching system. In real operation a passenger train is usually prioritized to a freight train but this kind of procedure will change soon. Just in time production requirements of industry and the imminent loss of market shares calls for more quality and less delays in freight transports. The dispatching processes must take into account to solve these upcoming requirements very soon – given that on some parts of the rail network the capacity load is already at its peak.

The mixed-traffic network cannot be easily extended with additional infrastructure. A lot of tunnels and missing space in the Alpine regions are setting natural limits. Therefore capacity of the network must be improved and managed by a new concept. In Austria a new approach with five control centres will bring more efficiency and better communication between involved dispatchers. In October 2008 the first unit will be operational and until 2012 the whole country will be operated from these five centres. The main advantages are an increase of safety on the network, the implementation of new components and technologies like track-side sensor systems and automatically forwarded data between different domains and at least more efficiency and availability of the network.

Another unsolved topic is the rescheduling and the prediction of the impact of a delay. The required calculation time for real time simulation exceeds the time constraints for a useful decision support tool. Therefore, a dispatcher must act in the case of deviation based on his experience and cannot estimate the impact in the next part of the network. It would be useful to have a global view of the effect of all dispatching activities situated in the control centres with high level management functionality. Of course, this will not solve the prediction problems and cannot provide a non-discriminating solution in case of a deviation. However, it can ensure that every partner of the dispatch chain is involved in the decision making process. Therefore, a recommendation is given to encourage research in this area.

Based on the fact that specific characteristics of rail traffic have an impact to each other all participants of a workshop were pleased to define the optimal mixture regarding the number of trains, stability of the schedule, heterogenity and average speed. Every participant wrapped a cord with constant length around four axes priorizing the parameters he felt to be most important. This diagram is based on the UIC 406 which describes the relationship between the given parameters. In Figure 1 the result of approximately 30 experts is shown.

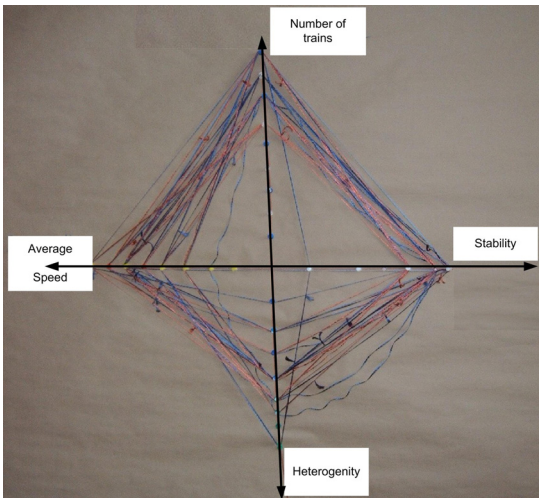

Figure 1: Result of expected optimal relationship between capacity and schedule reliability

The result was amazing, stability should be at a maximum, the number of trains are mainly high but the parameters ‘average speed’ and ‘heterogeneity’ showed a very wide range. Therefore to maximize speed is not the primary aim, at least we cannot guarantee that the number of trains is at its optimum and that the timetable will be stable.

Another big issue is the dispatching of cross-border traffic in Europe. Beside different technical systems the inconsistent data – especially a missing unique train identification number – is one lack in the data exchange between providers. The unique train ID in a defined area is usually valid for one day, but in case of delayed freight trains one train is still in the network while the next train with the same number starts. This is an insecure situation in a technical system with mainly automatically operation. Some projects are focused on this topic but a practicable solution is not at hand. Furthermore the unique train ID is necessary to identify trains and their destination. A delayed and rescheduled train may change its train ID and arrives at the border with a new train identity. The correlation with the former train ID is not given. Therefore the next operator has to combine this train with the primary train ID to ensure the right destination. To avoid this and other problems with delayed trains the European project EUROPTIRAILS is already looking for solutions. The focus of this project is the realization of a real- time management tool for international traffic supplying information, monitoring and suitable train paths for exception management.

Coming back to user needs on a national level the survey identifies that information supply chains are an essential part of the dispatching process. The information design is required to minimize information requests and maximize the necessary information flow.

The approach of the gap analysis

The survey of the complete process value chain has the asset that any kind of interruption or change can be detected. The following types of gaps have been defined in the project:

- Data changes: e.g. translation between different protocols, data type definitions, reference systems, etc.
- Content changes: e.g. different specifications for identical content or identical content with different specifications.
- Time base: Usage of more than one time reference or different update cycles
- Change of technologies: e.g. analogue and digital voice communication systems, different distribution channels and formats (paper, pdf, …)
- Responsibilities: different regional or thematically structures in cooperating companies can lead to various relationships for communication, e.g. in cargo and passenger transport or to the spreading of competences for regional and long distance traffic.

Based on this approach the changes in the value chain can be evaluated and the necessary measures can be discussed. Ongoing projects in these fields are part of the interviews with the responsible persons in the cooperating companies. As a next step the harmonization of all activities allow to draw a very clear picture of the situation and will be the basis for recommendations. The comparison with neighbour countries and their applications allows to identify best practice examples in this topic.

According to the aim of the study some detailed projects for the improvement of the dispatching systems and processes will be developed together with expert rail operators. These use case scenarios will consider the economical and statutory framework and reflect the willingness of implementation.

‘OPTIMAL’ results will contribute to raise the overall productivity by optimizing capacity utilization, availability and efficiency of personnel and rolling stock. These measures will ultimately enable the operators to cope with disruptive situations as well as to improve cost and energy efficiency. The conclusion will finally be summarized in a series of ‘Standard Operational Procedures’ for Austrian rail operators.

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