Ten years of RailOpt at Schweizerische Südostbahn AG

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Production of passenger traffic services at a railway operating company is a complex and lengthy process that starts years in advance with the initial service concept and culminates in the detailed billing and generation of key figures of the services provided. It is always important to maintain oversight over the available rolling stock, personnel and their performances. Deployment of resources must also be planned in every detail.

The Schweizerische Südostbahn (SOB) began back in 2005 with the phased transfer of paper-based documentation and Excel spreadsheets to the "RailOpt" planning system developed by Qnamic, a Swiss software company with headquarters in Hägendorf. In 2008 operational planning for rolling stock and for locomotive and train personnel attained the target depth from preliminary duty rostering to subsequent time accounting. However, this initial target only marked the beginning of a wave of digitalisation that followed rapidly.

The operational focus was originally on clean hardcopy documentation that was to be compiled with the support of RailOpt. This requirement rapidly became obsolete due to the increasing pace of development in railway operation. Although there are still documents today generated from RailOpt in PDF file form, the information they contain is obsolete almost as soon as it is compiled because of continuous amendments. Today`s dynamic railway operation can therefore no longer live with this sort of static information and needs other communication channels. In addition there are numerous work processes that were initially outside the main field of focus but which today are automatically integrated in the RailOpt product. Introduction of the system thereby launched a real digitalisation wave.

Over the last ten years RailOpt has evolved from what was originally a resource scheduling system into a central traffic production tool. SOB will therefore continue to rely on this product in the future. Railway production at SOB today without RailOpt would be tantamount to "flying blind", not just as far as resource scheduling is concerned but also with respect to costs.

Increasing process requirements and regulations

The external regulatory requirements that railway operators face have increased continuously. In today's environment, no one can afford process gaps any more. It is therefore taken for granted, for example, that metrics relating to many items of information can be delivered promptly and accurately. In addition there are more and more general conditions that need to be monitored. These monitoring processes cover, for instance, compliance with working time legislation, the qualifications necessary for certain activities, loco-

motive crews' knowledge of the vehicles and routes, as well as important vehicle quality features such as filling of water reservoirs for the WC system. IT-based support for this multitude of processes, regulations and quality requirements therefore needs to become more consistent, especially to ensure that there is a modicum of simplicity and transparency in the hectic daily working routine of the planners in this environment.

Greater dynamism of railway operation demands a reaction

The higher workload on the railway network due to more frequent services and construction sites as well as sporadic faults means that the course of an operating day is unpredictable. Changes must be able to be incorporated in the planning quickly and easily.

In this age of smartphones, passengers have higher demands in terms of information. This inevitably impacts on the planning processes as well. For example, importing timetable updates into RailOpt from an interface of the infrastructure operator once an hour used to be perfectly adequate. Today on the other hand updating every ten minutes is considered the absolute minimum. The timetable data is then processed very quickly in RailOpt and sent back via the formation service (FOS) to the infrastructure operator after addition of the planned vehicle deployment information. This is essential for ensuring that the correct data on the platform displays and traffic management systems is always available in good time for customer information on apps and in the internet. This not only speeds up the exchange of data between infrastructure operators and SOB but also allows a lot more detailed information to be transferred.

Higher quality through new media

With the emergence of new media such as tablets and smartphones RailOpt has been further developed to include these technologies. This has made it possible to reduce numerous items of information previously distributed in hardcopy form within SOB

by publishing them on the RailOpt web. This simplifies and also speeds up the flow of information to the end user.

One particular application is the locomotive driver's service information system (DIS). The driver must not only know the timetabling for the train service he is operating but also additional details of the route table (infrastructure data), such as position data and permissible speed on speed restriction sections. This information is displayed for SOB locomotive crews on iPad devices in the RailOpt DIS app. It was a logical further step to use this app to display additional information for personnel about important functions such as decoupling of another vehicle in multiple traction. In addition, drivers can also see all work details relevant for them for that day and for the following day. They can also read out at any time precisely which vehicle from a depot they are to use, and where this vehicle has come from. In the event of malfunctions during the train journey the driver can also see whether other employees are on board and could help with finding a solution. Other personnel categories that have no iPad can consult their duty rosters via smartphone, keeping them up to date with the latest scheduling status.

In this way it is possible to guarantee the uniform quality of the processes consistently from start to finish despite the very large number of influencing factors and changes to planning that occur daily.

Systematic utilisation of synergies

The continuous further development of RailOpt has now resulted in enormous functional depth and flexibility. A multitude of functions can be adapted and changed on a time-dependent basis by means of configurations without the need to involve the software company. For instance, SOB can if necessary modify the form of the system in many areas itself according to its requirements.

This configurability also allowed the creation of other personnel categories apart from locomotive and train crews, for example for rail traffic controllers or dispatchers at the control centre. Different configuration parameters can
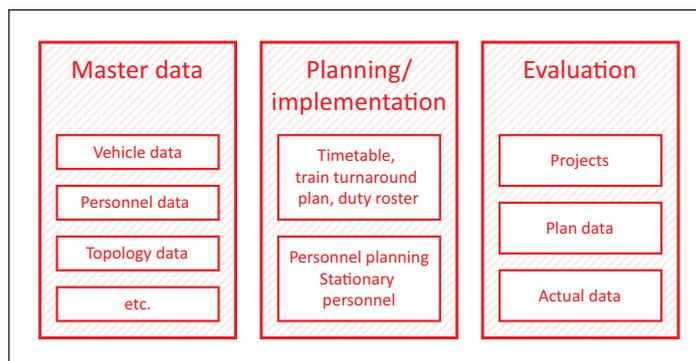
Block diagram of the main planning work areas (drawing: SOB).

Block diagram of the integrated interfaces and work areas at SOB (drawing: SOB).
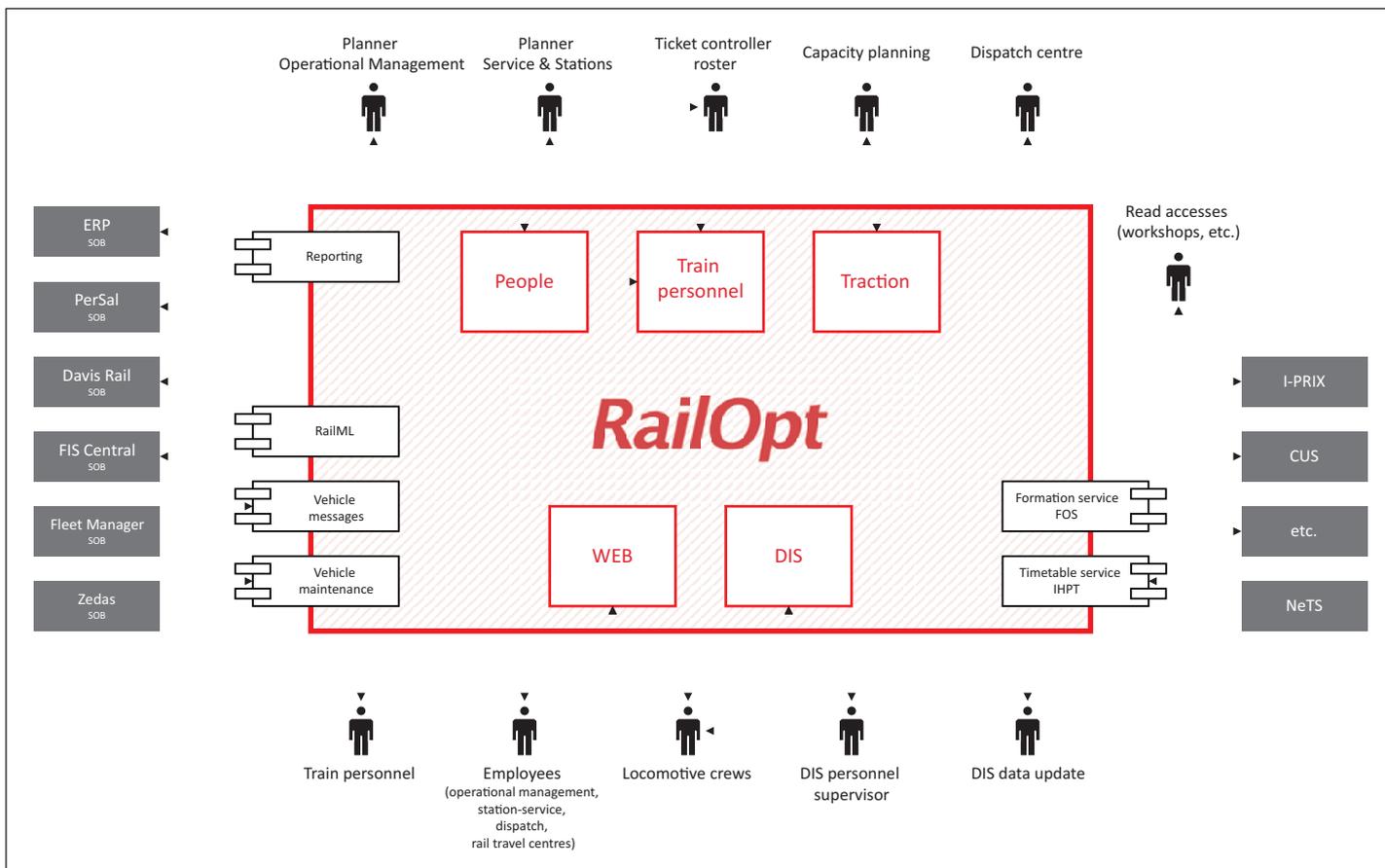
be applied in these areas so that these personnel areas can if necessary behave completely differently and independently of each other.

Thanks to the standard and centralised storage of master data, interfaces can still be reduced to a minimum since technically there is only ever a single product with its centralised master data administration in the background. That reduces management costs and simplifies system operation. If an employee changes to another planning area starting on a particular date this can be done with a few mouse clicks.

Further developments can thus be scaled easily as well as directly to several different planning areas thereby achieving even greater economic benefit.

The interfaces implemented at SOB can be used to check multiple quality features. For example, by means of the vehicle messages the location information and position of individual vehicles in the train composition can be compared with the planning in RailOpt and suitable instructions issued in case of deviations from the plan. This provides a means of ensuring that unplanned deviations can be quickly detected and corrected.

Entering the age of big data

With so much planning and updating it is frequently forgotten that these activities do not just involve management expenditure. They also generate a veritable gold mine of data that is waiting to be made use of. The greatest benefit is therefore in the systematic evaluation and analysis of this data. The original version of RailOpt came with a data warehouse system (centralised database) for this purpose that allowed first evaluations of performance data. However, the increasing planning depth in the system quickly led to ever larger amounts of more detailed data that could no longer be adequately collected and analysed by the data warehouse.

In order to make full use of the data potential, SOB successfully created a new reporting module together with Qnamic and played a key role in its design. Since its implementation in 2014 SOB is now capable of carrying out any form of analyses of the entire data inventory according to its own requirements. Thanks to this valuable contribution the

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Südostbahn on the Gotthard – RailOpt in use for planning

In the run-up to the cooperative venture between SBB and SOB, a focal point for the planners was the services in the Basel/Zürich – Gotthard – Ticino corridor. The first concepts for services were compiled by the product development team in the "classic" form of Excel spreadsheets (tabular timetables).

In preparation for the detailed production planning, the rolling stock specialists at Fleet Management, the locomotive and train personnel supervisors, and Railway Production formulated the general framework as the basis for the actual planning processes (for example commissioning times of new rolling stock, changes to the conditions in working time legislation looking ahead to 2021). After prioritising and narrowing down the various timetabling options the line structure was developed in RailOpt with all relevant stopping and operating points.

After the product development department had handed over the requested offer to Railway Production, i.e. every single train connection, including definition of reinforcements to train compositions, all vehicle deployments were compiled in RailOpt in the form of turnaround plans. The result of this planning step could be used, for example, to define and analyse mileages, the parking space of all rolling stock and the overall number of vehicles needed for operation and maintenance.

Initial planning variants for the deployment of locomotive crews were drawn up as a next step. Thanks to RailOpt it was possible to merge the additional new Gotthard services with the existing services from the rapid transit (S-Bahn) area and the Voralpen-Express traffic in a short time and to draw up an overall plan and overview of all key figures. This also allowed depot location variants to be prepared for assessment within a short period of time. Fundamentally the same steps then followed for train crew planning, although in this case the different roles ("normal" train accompaniment function, carrying out spot checks and frequency recording) were taken into account separately.

All results obtained will be used for further analyses and form the starting point for the precise planning of the 2021 timetable for SOB services on the Gotthard route. This planning phase begins in August 2020.

company is today in the position of being able to quantify and validate the hours worked by employees and the costs per kilometre of the rolling stock far more accurately.

There are a large number of tools available for the analyses. For this purpose, additions to the existing master data can be made via any input fields should this information not be migrated electronically via external interfaces. It is possible in this way, for example, to add the topological data with the missing information for the train path price calculation (demand factors or stop supplements). This information can then be combined via freely definable program codes with all planning data and the desired result computed for output. These outputs can be generated fully automatically at regular intervals in the form of Excel reports or as direct database exports.

SOB uses more than 15 different reports for analysing its extensive database. Essentially this consists of

– commercial performance data for personnel and rolling stock, considering idle/down times and order numbers,

– calculation of key figures in accordance with the guideline for regional passenger transport (RPV) of the Swiss Federal Office of Transport (BAV),

– data for calculation of the train path price,

– data on the technical availability of rolling stock,

– data relating to the compactness of the duty roster and the projected work performances,

– information about time and expense data and employees' time accounts,

– personnel requirement calculations.

The reports are used to analyse the data at various levels, beginning with project planning and continuing through target duty rostering to the performances actually provided by personnel and rolling stock. In this way the results act as the basis both for calculating quotations as well as for billing. This makes it possible not only to ascertain the particular work performances but also to allocate them proportionally on the basis of actual usage, for example to a transport route.

After the work is completed RailOpt generates new reports with the actual performance data for further processing in the ERP system. This means that the same reports can be reused throughout the process in all planning stages which provides us with highly accurate performance data.

Planning of services starts years ahead

SOB not only uses the RailOpt system to plan the current timetable but also for developing initial concepts for possible new transport services and improvements many years in advance. Train movements on any routes can also be drawn up independently of interfaces in RailOpt and analysed by means of a train and network graphic. This enables initial train turnaround schedules to be drawn up and depending on the expected accuracy requirements preliminary deployment plans can

also be drafted for personnel. Production scenarios of this kind can be repeated and copied as required. The real advantage then lies in the fact that such scenarios can be commercially analysed immediately with the defined reports. Accurate information about these scenarios and their economic viability are then readily available.

Apart from future scenarios, planning for the company's medium-term plan can also be modelled to the required accuracy. The analyses generated in this way then form the basis for drawing up the offer for regional passenger services to ordering bodies.

As the next timetable year approaches, the degree of detail becomes correspondingly more concrete and deeper. The exact duty roster for the following timetable year starts after finalisation of the train path allocation in August when train movements with schedules to an accuracy of seconds are first available for the target duty rostering. The duties for the next timetable year are then copied and amended from the current timetable year or drawn up new if necessary.

Data is continuously updated with additional information during the current timetable year so that the desired level of detail is available in good time.

At the end of the month, the time calculations for employees and all commercial reports (again) are drawn up with the actual data and compared with the original target data. This enables accurate conclusions to be drawn on the costs incurred and the economic efficiency.