



# ON THE RIGHT TRACK

Digitalisation is transforming railways

## CONTENTS

	<b>DIGITAL PLANNING</b> DB Regio opts for IVU.rail	p. 3
	<b>IVU.RAIL WORLDWIDE</b> Globally in use at railways	p. 4
	<b>SIMPLY COMPLEX</b> Planning runs and duties more efficiently	p. 6
	<b>TABLET IN SERVICE</b> Drivers in Switzerland work with the IVU.pad	p. 7
	<b>OPTIMISATION</b> A look behind the schedules	p. 7
	<b>STRONG IN SWEDEN</b> Integrated system in ten months	p. 8

Save the date	p. 8
Imprint	p. 8

Digitalisation is rapidly transforming the rail industry. All over the world, railway operators are investing in their IT in order to leverage the benefits and opportunities of the digital transformation and make themselves more competitive. They are using sophisticated IT systems to evaluate their comprehensive data, simplify processes and boost their efficiency.

Until a few years ago, the tasks at most rail companies were largely separate: the paths of planners, personnel dispatchers, vehicle dispatchers, operations managers and drivers rarely crossed. Each task had its own systems and workflows that were often vastly different. Although IT systems were used in many places, the operational view of the processes remained analogue and geared towards conventional roles.

This is now changing: “With the rise in digitalisation, the previous limited understanding of roles is increasingly being replaced by a holistic system view,” explains Martin Müller-Elschner, CEO of IVU. “Individual departments operating solely for themselves are disappearing fast. Instead, tasks and roles are converging, in some cases overlapping and influencing each other.” What once seemed impossible due to the manual processes involved is now being performed by IT systems that simplify the complex interactions between timetables, runs and duties.

### Continuous workflow

The basis for this is shared digital data storage. It eliminates redundancies and inconsistencies and enables a continuous workflow from planning through to settlement. This calls for optimum interaction of all components. Integrated systems are required – systems such as IVU.rail. In this case, all units work with the same data pool. Consequently, changes in one place reach all other relevant departments immediately. Besides speeding up workflows, this also ensures more efficient planning outcomes.

“If the software knows all the runs and shifts, it can plan them in an integrated way and use intelligent algorithms to coordinate them in order to produce an optimum outcome that meets operational requirements as well as deploying all resources as cost-effectively as possible,” says Martin Müller-Elschner.

The drivers and mobile employees are also involved in the digital planning and dispatch process. Via app or web client, they enter their holiday and duty requests in the system, record their times and read instructions. In the event of changes at short notice or operational disruptions, the dispatchers, drivers and payroll accounting are notified immediately. This saves time and ensures consistency.





Martin Müller-Elschner, CEO

**Dear readers and  
IVU customers,**

Nine state railways and numerous international private railway companies, ranging from high-speed trains, regional railways and metros to freight transport – they all use the same software to deploy their resources efficiently: IVU.rail. We are proud to have created a truly standard system with our solution that meets the various requirements of railways worldwide.

Our approach of performing fully integrated planning and dispatch of vehicles and personnel combined with powerful optimisation algorithms is satisfying a strong demand. In the last few years, more and more railways have opted for IVU.rail. We present some of them in the middle of this issue. On pages six and seven, you can read more about the optimum deployment of vehicles and personnel.

Our cover story is devoted to the digital transformation of railways, the role of the planning system in this, and the opportunities that arise from it. This topic is also the key theme of our “IT for Rail” management conference in June, where we will be discussing current developments with some of the leading figures in the industry. Do you have any experience with digital systems? You’re welcome to join the discussion and write to me at [mme@ivu.de](mailto:mme@ivu.de). I look forward to hearing from you!

Best regards,

Martin Müller-Elschner

**One standard for all**

IVU’s standard system is now firmly established as the reference in Europe. Numerous state and private rail companies rely on IVU.rail to put their vehicles and employees on the track in the best possible way. One of the first companies to set up centralised and integrated planning and dispatch was the Italian state railway operator Trenitalia. Since 2009, the company has been planning and dispatching around 8,000 trains per day and 14,000 employees with IVU.rail. With IVU.cloud, IVU has now taken on overall technical operations management of the system and provides it entirely as a software-as-a-service solution.

The state railways in Sweden (SJ), Finland (VR) and Hungary (MÁV-START) also use IVU.rail for efficient planning and dispatch of trains and personnel, as does SBB Cargo, the freight transport subsidiary of Swiss Federal Railways. At international level, the likes of VIA Rail Canada, the Vietnamese state railway company VNR and the operator of the Bangkok metro BEM have opted for the integrated solution. Abellio, National Express and Transdev use the IVU solution in Germany.

Recently, DB Regio, Germany’s leading local public transport provider and one of Europe’s largest rail companies, also concluded a framework agreement on the deployment of IVU.rail in all German transport networks.

When the contract was signed in March 2017, Frank Scholz, CIO of DB Regio, said: “We were especially convinced by the scope of performance and the usability of IVU.rail.” DB Regio chiefly benefits from the continuous process chain and uniform data storage for planning and dispatch in IVU.rail. For the group, the software is a key component within a wide-ranging digital transformation process.

DB Regio has recognised that digitalisation is radically changing the role of IT within a rail company. Rather than merely ensuring provision of operations as in the past, it is becoming a driving factor for enhancement of business models. This is because undoing the traditional separation of roles in the operations area and the growing importance of technical solutions are giving rise to a continuous exchange between specialist departments and IT, resulting in new impetus for business. For instance, IT can perform a targeted analysis of the data obtained, evaluate it on the basis of specialised criteria and use it with the customers in mind.

In this way, the integration of the system landscape and the creation of entirely digital workflows are driving forward the evolution of railways into a modern, competitive form of transport for the 21st century.

**BETTER  
WORKFLOWS AND  
MORE EFFICIENT  
PLANNING – THE  
FUTURE OF RAIL IS  
DIGITAL.**



# DB REGIO OPTS FOR IVU.RAIL

IVU and DB Regio enter into a framework contract for the delivery of an integrated planning and dispatch system

Planning and dispatching vehicles and personnel in one system – this is what the largest German regional public transport supplier will be able to do in the future, thanks to IVU.rail. A corresponding framework contract has been signed by DB Regio and IVU.

The contract envisages the uniform replacement of DB Regio's existing planning and dispatching systems with IVU.rail. In the future, all of DB Regio's transport networks will conduct their rail-related resource planning and dispatching through the integrated IVU system. "Our dispatching and planning will be digitalised by the IVU.rail product. In doing so, we will ensure our competitiveness," said Oliver Terhaag, DB Regio AG's production executive. Dr. Frank Scholz, DB Regio AG's CIO, added: "With IVU, we are delighted to have won an experienced partner for this ambitious project."

DB Regio will particularly profit from the integrated production processes and the standardised data management by using the IVU software. Automatic consistency checks make it easier for planners to create suitable vehicle round trips and composite configurations. The powerful optimisation tools of IVU.rail supports the best possible results and, when needed, can generate diverse variations for advanced planning and tenders. Legal, fare-based and technical guidelines will be considered for compliant rostering.

IVU has prevailed in an international tendering process. "Within our field, this is one of the largest IT projects in the world," said Martin Müller-Elschner, CEO of IVU. "The decision in favour of IVU.rail underlines the unique performance of our standard solution, which already meets almost all of DB's requirements and thus enables a rapid rolling-out."

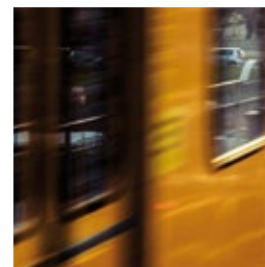
DB REGIO HAS OPTED FOR A **CONTINUOUS PROCESS CHAIN** AND WILL BE USING IVU.RAIL IN AN **INTEGRATED MANNER** TO PLAN AND DISPATCH TRAINS AND PERSONNEL ON ALL ITS REGIONAL RAIL NETWORKS IN FUTURE.



With more than 1.8 billion passengers per year, DB Regio is the market leader in Germany's regional rail passenger transport. The company operates numerous local public transport networks all over Germany, including bus transport and suburban railway services in the large metropolitan areas. The suburban railway services in Munich and the Rhine-Neckar region have already been using IVU.rail successfully for planning and dispatch since 2003. Since then, intelligent optimisation algorithms and automatic personnel dispatch have been ensuring efficient planning processes. The fully integrated system ensures that all planning and dispatch data is consistent at all times, from timetable planning all the way to settlement with the public transport authorities. The result: reliable duty schedules and run schedules plus full transparency with regard to all personnel and vehicle services provided.

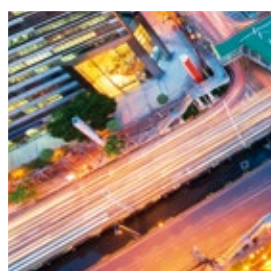


# IVU.RAIL IN USE WORLDWIDE



## BLS SWITZERLAND

**COMPLEXITY IS SIMPLIFIED:** BLS MANAGES SUBURBAN RAILWAYS, REGIONAL RAILWAYS, FREIGHT RAILWAYS, BUSES, BOATS AND 2,000 STATIONARY AND MOBILE EMPLOYEES IN ONE SYSTEM.



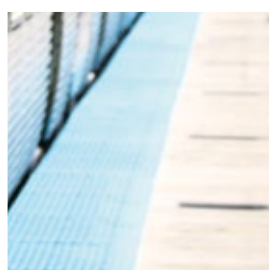
## SJ SWEDEN

THANKS TO AUTOMATIC PERSONNEL DISPATCH, SWEDEN'S LARGEST RAIL COMPANY CREATES **FAIR AND BALANCED WORKING HOURS** FOR ITS EMPLOYEES.



## MTR NORDIC SWEDEN

**HIGHLY EFFECTIVE OPTIMISATION** HELPS MTR TO DEPLOY TRAINS AND EMPLOYEES OPTIMALLY AND ENSURE RELIABLE OPERATION OF STOCKHOLM'S COMMUTER RAIL SYSTEM.







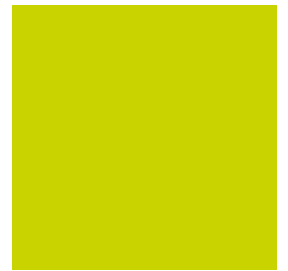
## ABELLIO GERMANY

THE ABELLIO GROUP IS COMMITTED TO **TOP QUALITY**. THE FULLY SCALABLE SYSTEM FROM IVU ALLOWS FAST AND FLEXIBLE START OF OPERATIONS OF ALL ITS CONCESSIONS.



## VIA RAIL CANADA

LONG DISTANCES MAKE DUTY SCHEDULING IN CANADA A REAL CHALLENGE. VIA RAIL DEPLOYS LOCOMOTIVE ENGINEERS AND ON-BOARD PERSONNEL **EFFICIENTLY AND IN LINE WITH THE RULES**.



## TRENITALIA ITALY

OVER 15,000 LOCOMOTIVE ENGINEERS AND ON-BOARD PERSONNEL IN PASSENGER AND FREIGHT TRANSPORT – TRENITALIA PLANS, OPTIMISES AND DISPATCHES ITS EMPLOYEES **ENTIRELY IN THE CLOUD**.



## VNR VIETNAM

LARGE SECTIONS OF VIETNAM'S RAILWAY NETWORK ARE SINGLE-TRACK. VNR USES THE IVU SOLUTION TO PLAN THE APPROPRIATE CONNECTIONS AND **INFORM PASSENGERS IN REAL TIME**.



## SBB CARGO SWITZERLAND

FROM LONG-TERM PLANNING TO SHORT-TERM CHANGES, SBB CARGO RELIES ON THE **INTEGRATED PLANNING AND DISPATCH** OF 350 LOCOMOTIVES AND 2,500 EMPLOYEES.





# TRAINS AND PERSONNEL OPTIMUM DEPLOYMENT

Putting trains on the track is demanding – deploying all resources cost-efficiently is a challenge. There's no doubt that it's worth the effort: by making runs and duties just a few percent more efficient, rail companies can save large sums each year. Sophisticated software solutions help planners to keep track of complex vehicle run and duty schedules and to get

the most out of the available resources. Every company works with different conditions and requirements in this area. Here, you can read how IVU.rail solves these problems, what lies behind the optimisation and how the integrated system helps to incorporate employees in the planning process more effectively.

## THE PERFECT MATCH

Optimum pairing of train runs and duties is the key to efficient deployment of resources. However, whereas trains only have to be maintained relatively rarely, employees need regular breaks. Timetables are also primarily geared towards demand and the stipulated lines rather than the drivers' working hours. "Reconciling the various requirements of rolling stock and personnel in such a way that no resources are wasted poses major challenges for planners and personnel dispatchers," explains Oliver Grzegorski, Head of Development Public Transport at IVU.

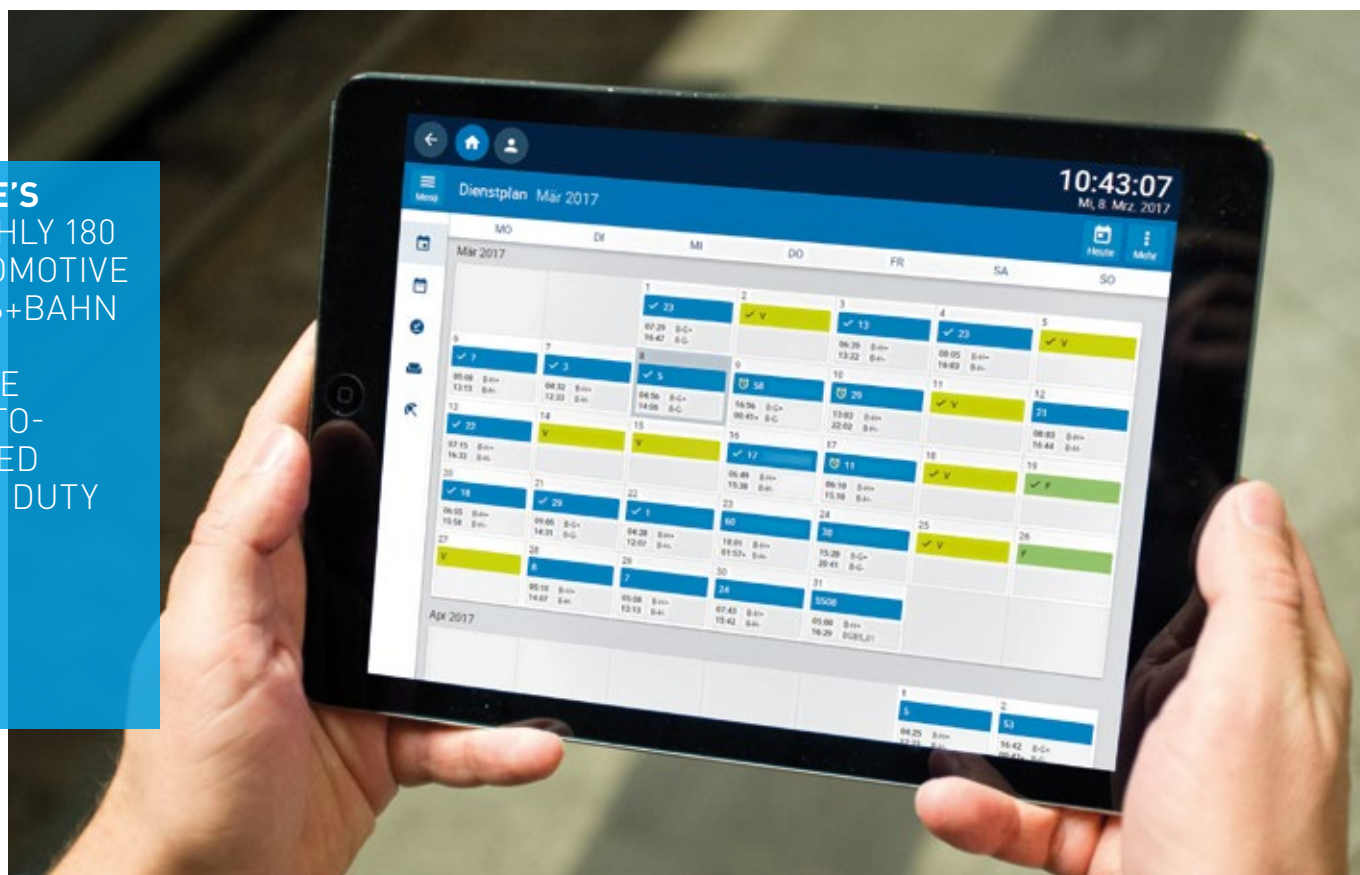
They have to contend with huge complexity: working-time restrictions, breaks, travel and preparation times, qualifications, opening hours of break rooms and deployment locations must be taken into account. At the same time, compliance with laws, works agreements and union agreements is required. In addition, there are holidays, days off and, where relevant, shift preferences of employees, which – to make matters even more complicated – are also weighted in different ways. For instance, in North America, the seniority principle determines which duty request is permissible and takes priority. In Italy, it is based on fairness, and in Hungary, the factors include distance to the work location.

Intelligent software systems are needed to handle all this. With IVU.rail, IVU has created a standard solution that is deployed by customers all over the world. Highly developed optimisation algorithms assist planners and dispatch managers in their complex task. They take on the elaborate calculation of duties and runs so that each train and employee is deployed in the best possible way. "The integrated rule editor makes our system extremely flexible," says Oliver Grzegorski. "As a result, various planning requirements can be taken into account easily." In this way, the IVU solution always ensures the perfect pairing – whether in Europe, Asia or North America.



## DUTY SCHEDULE AT ONE'S FINGERTIPS.

THE ROUGHLY 180 BUS DRIVERS AND LOCOMOTIVE ENGINEERS AT AAR BUS+BAHN IN SWITZERLAND WORK DIGITALLY. THEY RECEIVE A STEADY FLOW OF UP-TO-DATE AND PERSONALISED INFORMATION ON THEIR DUTY VIA TABLET.



To provide its drivers with more up-to-date information more quickly and with less logistical complexity, AAR bus+bahn relies on the IVU.pad. The tablet app displays current, personalised messages on upcoming journeys and vehicles and automatically synchronises all important documents. It is also firmly integrated with duty scheduling. In future, AAR bus+bahn's drivers will be able to view individual messages from the dispatch unit, record their working hours on the move and submit holiday requests on the IVU.pad. Duty requests thus reach the planning unit directly, and can be taken into account more effectively. As well as increasing the satisfaction of mobile employees, this also makes them a core part of the company's digital workflow.

## FULL STEAM AHEAD WITH OPTIMISATION

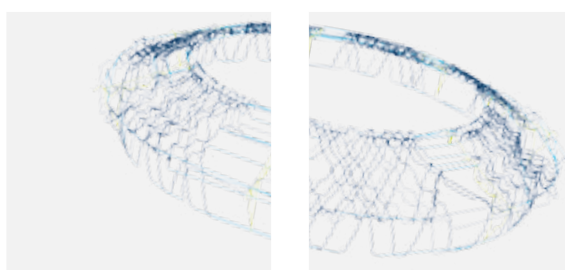
Optimising runs and duties is extremely complex. That is why IVU has been working very closely with the mathematicians at LBW Optimization GmbH, a spin-off of the renowned Zuse Institute in Berlin, for nearly 20 years. The algorithms they have developed form the centrepiece of the optimisation cores of IVU.rail. The IVU software is therefore one of the few solutions worldwide that is able to optimise train runs automatically.

The technical nature of rail transport makes the development of optimisation algorithms particularly challenging. The fact that the vehicles are attached to the track and the option of combining several vehicles into trains significantly increase the level of complexity. For instance, numerous factors must be taken into account when creating vehicle runs, such as coach sequence and orientation, parking capacity, maintenance intervals and track topology.

In mathematical terms, the multi-week runs normally used for trains constitute circles of a

hypergraph with which the train runs with mutual dependencies can be precisely modelled.

LBW develops new mathematical optimisation processes based on current scientific findings. The algorithms break down the huge combinatorial planning problem into individual, structured mathematical parts known as layers. These are used to ensure a transition between overarching aspects such as train selection and turnarounds through to coach sequence and orientation. Complex parallelisable high-performance algorithms can then be used to calculate extremely efficient runs in the IVU.rail planning system.



**HIGHLY ADVANCED ALGORITHMS** HELP RAILWAYS TO DEPLOY TRAINS AND PERSONNEL EFFICIENTLY AND TO **MINIMISE COSTS**. IVU IS COLLABORATING FOR THE OPTIMISATION WITH **LEADING MATHEMATICIANS**.





## SAVE THE DATE

### APTA Rail Conference

11 – 14/6/2017, Baltimore

### Africa Rail 2017

13 – 14/6/2017, Johannesburg

### IT for Rail Conference

26 – 27/6/2017, Berlin

### APTA Expo

9 – 10/11/2017, Atlanta

### IT-Trans

6 – 8/3/2018, Karlsruhe

# STRONG IN SWEDEN

With its highly liberalised railway market, Sweden is among Europe's most competitive countries, and IVU solutions are especially in demand here. Transdev Sverige AB, the Swedish branch of the globally active transport company Transdev, recently decided to use IVU.rail to plan all rail franchises' trains.

Transdev Sverige is one of Sweden's largest transport companies and has multiple subsidiaries across the entire country. Among others, this includes the long distance train connection Snälltåget, which runs from Åre via Stockholm to Malmö, and even as far as Berlin in summer. Within just 10 months IVU.rail was implemented for the planning and dispatch of approximately 75 trains for the Krösatågen and und Kustpilen franchises. The project was officially approved at the beginning of June 2017.

IVU.rail makes it possible for planners in Sweden to create efficient timetables, vehicle workings and run schedules. Automatic suggestions and a freely configurable rule system accelerate planning. The system takes service intervals and train units into account in the process, as well as track and depot capacities. Dispatchers receive all important information about the current operating situation, and can therefore react swiftly to disruptions.

"We have continually expanded the number of our connections in recent years," said Petra Lagerkvist, Head of IT at Transdev Sverige AB. "With IVU.rail we are optimally prepared for the continued growth of our network and the increasing complexity of planning." In the future, IVU.rail will be the preferred solution for all of Transdev's upcoming operational launches across Scandinavia.

"We are linked to Transdev Germany through our long-term positive collaborative work and we are very much looking forward to enhancing this connection with the contract from Transdev Sverige," said Robert Mulder, sales director at IVU, when the project was commissioned in autumn 2016. "This project underscores the efficiency of our system and significantly strengthens our position in Scandinavia."

The largest Swedish rail company, SJ, ordered IVU.rail for the planning and dispatching of all of its trains and employees in 2015. In addition, MTR Pendeltågen AB, a subsidiary of the Hong Kong MTR Corporation, last year opted for IVU's solution to be used with the Stockholm suburban railway.

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