IVU.rail
INTEGRATED
RESOURCE
PLANNING
IVU MAKES INTEGRATED RESOURCE PLANNING POSSIBLE AND EASY.

All planning and dispatch processes for personnel and vehicle deployment in a universal system.

The deployment of the key resources “employees” and “vehicles” is a central component of rail operations. In the past, paper and pencil, as well as magnet boards, were chiefly used for this purpose. Later on came computer programs that were tailored to individual procedural steps. This then led to the emergence of a heterogeneous system landscape made up of many individual software solutions. All of these parallel systems had to be meticulously linked together via interfaces. The redundancy of the processed data brings with it the danger of inconsistencies. In addition, each of these systems must also be operated and maintained separately.

In recent years, the possibilities for IT support have increased significantly, with regard to both the amount of data processed and the functional complexity. Over more than 40 years, IVU Traffic Technologies AG has acquired a wealth of expertise in the field of planning and dispatch software. IVU.rail provides our clients with a standard solution that covers the planning and dispatch process in its entirety, from supply planning and operational implementation in predefined vehicle workings and duties to the daily dispatch of roll-out materials and train drivers, train conductors and shunting personnel. For the first time, all planning processes have been consolidated in one system and in a single database – technically, temporally and spatially.

In cooperation with leading railway companies, IVU.rail is continually being upgraded and adapted to technological advances. Additional optimisation components have been included over the past few years, which are based on elaborate mathematical algorithms, but which, at the same time, take into consideration rules and parameters from manual planning to attain results that can be directly used for operations. This means that the processing time for the implementation of a new timetable can be drastically shortened and the resources needed for such a procedure can be reduced.
Plan efficiently with IVU.rail

Whether for personnel or vehicle deployment, IVU.rail efficiently manages all conceivable planning tasks. The system can even incorporate the planner’s operational rules and quality guidelines. With its fully automated variation calculations, parameter analyses and intelligent algorithms, IVU.rail paves the way for dependable decision making. The possibility for using flexible cost weighting, operational stability and employee satisfaction guarantees optimised planning scenarios according to individual requirements. In addition, IVU.rail provides an array of interfaces for follow-up systems and allows for the generation of various statistics and printouts.

Dispatch quickly and flexibly with IVU.rail

The daily deployment of vehicles and personnel poses a challenge to dispatchers in long-distance, regional and city transport. Can duty roster scheduling be optimised in such a way that employee requests, legal regulations and economical aspects are taken into consideration? Have any train drivers called in sick? Have the vehicles been deployed in accordance with the service interval guidelines from the maintenance workshop? IVU’s dispatch systems indicate which resources are currently in use and where. Thus, railway companies can quickly react to unpredictable events in a flexible manner – e.g. they can switch out personnel or deploy replacement vehicles. This flexibility provided by IVU.rail.crew and IVU.rail.vehicle is of utmost importance in order to ensure smooth transport and quality services for the passengers, without losing sight of the costs involved.
Integrated Resource Planning

**IVU.rail.timetable**
Manages the entire route network and develops the timetable services available – from strategic planning to date-specific exceptions. -> page 10

**IVU.rail.duty and IVU.rail.run**
By using intelligent algorithms, IVU.rail.duty and IVU.rail.run optimise vehicle workings and duties, and at the same time consider any operational rules and guidelines from the planner. Track occupancies can be recorded in detail in stations and parking facilities, and shunting processes can be planned. -> page 8

**IVU.rail.crew**
Manages the entire personnel deployment, from long-term vacation planning to daily dispatch and precise payroll accounting. The dispatcher is provided with optimal support via the automatic personnel allocation and mobile duty sign-on control functions, in which the personnel can participate by entering individual preferences. -> page 13

**IVU.rail.vehicle**
Plans and controls the entire vehicle deployment and monitors the individual run performances and service intervals. -> page 22

**IVU.pad**
The IVU.pad is a reliable companion for driving personnel, customer service and advisors and stationary personnel. The mobile app always keeps them up to date – any time, any place. -> page 18
IVU.rail is tried and tested and has been implemented by railway companies around the world. IVU.rail was developed in close cooperation with leading European railway operators and is the only standard product that supports complete and integrated resource planning. At the same time, this standard product is integrated in the developed system landscape and can be adjusted to individual needs. This is facilitated in the system by the flexible parameterisation of rule systems, interfaces and printouts. Project implementations, which in the past might have taken several years, can now often be completed in only a few months.

IVU.rail for Trenitalia

Planning of vehicles and crew, optimisation and dispatch of over 15,000 members of staff and 6,000 train runs per day – entirely cloud-based. Companywide data integration for long-distance and regional transport, the creation of timetable booklets and the provision of data for booking and reservation systems.

IVU.rail for MÁV-START in Hungary

Personnel and vehicle dispatching for 1,000 locomotives in passenger transport. Centralisation of planning and dispatching processes, which were previously divided across various locations. Early detection of delays via incorporation of the vehicle location system.
IVU.rail in Canada
Efficient duty scheduling and dispatching with optimisation for over 1,200 locomotive engineers, train conductors and other on-board personnel. Supports double-staffing and seniority bidding for preferred duties.

IVU.rail at DB Regio
Integrated planning and dispatching of vehicles and personnel for all regional rail networks operated by DB Regio AG. Setup of a continuous process chain and standardised data storage in one of the largest IT projects in the rail industry worldwide.

IVU.rail at SJ AB in Sweden
Planning and dispatching environment for the deployment of resources at Sweden’s largest rail operator SJ AB, with over 5,000 employees. Every day, 85,000 people travel with SJ. Optimisation of duty schedules using automatic personnel dispatch in order to achieve fair and balanced work times.

IVU.rail at SBB Cargo
Replacement of several individual systems to achieve the efficient planning and dispatching of some 350 locomotives and 2,500 employees. Integration of existing timetable planning tools for the cross-system display of transport processes from a long-term and short-term perspective.
USING LIMITED RESOURCES OPTIMALLY.

A stable timetable that meets demand and requires as few personnel and vehicles as possible – this is a challenge for railway companies everywhere, and optimisation here offers the greatest potential for improving efficiency.

The planners face the difficult task of taking into consideration client requests, vehicle equipment, labour law provisions, special incidents, such as roadworks or sporting events, and much more – and all of this on a real-time basis. At the same time, however, the planner must provide for an operation that is as economically viable as possible.

This is hardly conceivable without technical support, since the creation and evaluation of timetable planning, vehicle working scheduling and duty scheduling scenarios according to specified criteria is fundamental for optimal planning.

Depending on capacity demands, train formations must be assembled together and split apart. When doing so, the entire planning occurs in an integrated manner, taking into consideration existing company supplies, special equipment, available personnel, qualifications, legal and labour-law-related provisions, passenger counts and predefined rule checks.

“IVU.rail is used by DB Regio for integrated and cross-resource production planning and dispatch. The highly integrated editing and the associated optimisation algorithms allow users to respond immediately to last-minute timetable changes, which could be caused by additional orders for special transport services and unscheduled rail works throughout the year.”

Dr. Frank Scholz
CIO
DB Regio AG
TIMETABLE PLANNING AT A GLANCE.

IVU.rail.timetable manages the entire route network and develops available timetable services, from strategic planning to date-specific exceptions. The system plans any number of changing train information and integrates track occupancies, parking actions and maintenance planning.

Supply planning

- From the long-term yearly timetable to short-term changes
- Data transfer from track planning systems in the standard railML format (www.railml.org)
- Compilation and revision of timetables

Train trips and vehicle workings

- Combining trains and connecting them to vehicle working series
- Automatic calculation of the position and orientation of a vehicle in the train formation
- Consideration of vehicle types, service intervals and layover times in vehicle working scheduling

Shunting and parking

- Track-specific shunting and parking in the train station or in the parking facility
- Consideration of track and depot capacities (restrictions)
- Planning service units (refuelling, cleaning, maintenance)
- Preplanning maintenance capacities and workshop workloads
THE RIGHT EMPLOYEE.
THE RIGHT PLACE.
THE RIGHT TIME.

Which train driver is driving which train today? Different vehicles, equipment and link courses require appropriate qualifications. In addition, working time regulations, operational provisions and vacation/day-off requests must be considered in duty scheduling. Therefore, vehicle and personnel dispatch should be integrated in order to achieve the optimal deployment of resources.

Once the duties have been planned, the dispatcher must check duty sign-ons, find any replacements as quickly as possible for cancellations due to sickness or delays and prepare all of the data for payroll accounting. These tasks would be virtually impossible without software support.

The dispatcher is provided with optimal support by means of the automatic personnel allocation and the mobile duty sign-on control functions. Clear displays provide a current picture of the duties for which an employee actually signed on. Aside from manually entering this data, the registered times can also be evaluated by card readers and stationary or mobile devices.

By entering their individual preferences, the driving personnel also take part in duty scheduling. Requests can be entered via terminals, mobile devices or the Internet – just like duty queries and signing on and off. During duty allocation, the automatic personnel dispatch is utilised as a means of keeping the employee’s work time accounts balanced, considering the employee’s requests and creating fair duty schedules. Absences, due to vacation or sickness for example, are also considered in the process, as well as the qualifications of the respective employees. In order to guarantee a continuous flow of data, IVU.rail.crew contains standardised interfaces to all popular HR management systems.

“With IVU.rail, we have reached a new level of transparency and flexibility in duty scheduling and optimisation. IVU.rail now allows us to cover all duty classes and find the best possible solution. With the help of the vehicle scheduling program that is currently being implemented, all resources will soon be planned in one integrated step, boosting our productivity on a long-term basis.”

Mauro Natali
Production Manager for Regional Transport
TRENITALIA
SATISFIED DISPATCHERS, AND EMPLOYEES TOO.

IVU.rail.crew manages the entire personnel deployment, from long-term vacation planning to daily dispatch and precise payroll accounting. The dispatcher is provided with optimal support with the automatic personnel allocation and mobile duty sign-on control functions, while the personnel are involved by entering their individual preferences.

Building efficient duties that conform to the rules

- Duty suggestion system and duty optimisation
- User-definable fare and work-time regulations
- Planning of on-board personnel (train drivers, train conductors) and stationary personnel (shunters, board piece managers, supervisors etc.)
- Integrated multiple crewing with user-definable rule system

Long-term preliminary planning

- Long-term vacation and roster planning
- Weekly template optimisation for a cyclical, even distribution of employee activities
- Planning on the basis of shift classes and concrete duties

Allocating and accounting

- Employee participation via shift classes, duty requests and vacation requests
- Automatic personnel dispatch on the basis of qualifications and employee accounts
- Online communication with driving personnel via mobile devices
- Transfer of actual data to payroll accounting
Engineering ingenuity, IT expertise and mathematical research are the cornerstones of systems that enable public transport to flow smoothly. More than 500 customers trust this tried-and-tested combination. With more than a dozen locations worldwide, IVU is always near at hand for its customers. Our team includes employees from more than 20 different countries. Irrespective of the location, we speak the language of transport operators and understand their needs.
ABELLIO, GERMANY
IVU’s fully scalable system allows new franchises to start operations quickly and flexibly.

BLS, SWITZERLAND
Making complexity simple: regional trains, suburban trains, freight trains, buses, boats and 2,000 stationary and mobile employees in one, integrated system.

EUROPORTE, FRANCE
Eurotunnel Group’s freight subsidiary plans its 150 locomotive engineers and 40 trains in a central system. Five decentralised depots handle the dispatching.

MTR CROSSRAIL, UNITED KINGDOM
From East to West: in a highly competitive market, MTR Crossrail provides reliable connections in Britain’s capital London.

ONTARIO NORTHLAND, CANADA
In the severe Canadian winter, the train is often the only reliable means of transport. IVU.rail supports duty scheduling and disruption management.

BEM, BANGKOK
Bangkok is one of the world’s biggest cities, with millions of inhabitants who are always on the move. New underground train connections meet the city’s growing need for mobility. Bangkok Metro plans and optimises its network, timetable and personnel with IVU systems.

VNR, VIETNAM
Vietnam’s railway network includes a lot of single-track links. VNR uses IVU’s solution to plan suitable connections and inform passengers in real-time.

VR GROUP, FINLAND
To avoid conflicts at Helsinki’s busy main train station, VR Group plans and dispatches its regional trains with IVU.rail.

LOCATIONS

BERLIN (HEADQUARTERS, DE), AACHEN (DE), OLTEN (CH), VIENNA (AT), VEEENENDAAL (NL), PARIS (FR), ROME (IT), BIRMINGHAM (GB), BUDAPEST (HU), ISTANBUL (TR), MONTRÉAL (CA), SAN FRANCISCO (US), BOGOTÁ (CO), SANTIAGO (CL), HANOI (VN), HO CHI MINH CITY (VN)

SELECTED REFERENCES
THE DIGITAL WORKPLACE.

The IVU.pad is a reliable companion for driving personnel, customer service advisors and stationary personnel. The mobile app always keeps them up to date – any time, any place. Important documents such as duty schedules, manuals and forms are always available at their fingertips. At the same time, the IVU.pad also supports the most important processes: from damage reports and ticket sales to duty scheduling. With the IVU.pad, heavy briefcases full of papers are a thing of the past.

New rail works, damage to the vehicle or a postponed duty start: with the IVU.pad, all relevant information is always up-to-date and available. Very important messages appear as clearly visible push notifications.

Confirming duty regulations, requesting preferred duties, recording work activities at a later date: the IVU.pad supports a variety of work processes, documents them and reports the results directly to the control centre or dispatchers. Workloads are reduced and workflows become faster.

The IVU.pad is intuitive to use, information is easily accessible and forms are quick to fill in. Eliminating the need for paper is good for the environment and means there is less to carry.

The app is device- and platform-independent and data transfer is encrypted. Interfaces connect the IVU.pad to peripheral systems, allowing it to integrate seamlessly into the existing IT landscape.

“With the IVU.pad, we can digitalise the entire work flow of our driving personnel. This saves lots of time and paper and ensures more efficient processes and more up-to-date information. There was also the opportunity to help shape the IVU.pad during product development, and we have clearly benefited from this.”

Andreas Kleiner
Head of Dispatching/Planning
AAR bus+bahn
duty roster

notifications

damage report

documents
7 confirmed
26 unread

payroll

map
DISPATCHING AND PARKING VEHICLES.

Once the timetable and vehicle working schedule have been created, then the dispatchers are faced with the challenge of organising the vehicle deployment as efficiently as possible. Vehicle management is particularly complicated in rail transport. Train formations may be split and continued as separate services, or vehicle groups may be removed or added. Such reconfigurations are all part of the dispatchers’ everyday work.

IVU.rail.vehicle plans and controls the entire vehicle deployment in passenger and freight transport. The run performances and service intervals of the individual vehicles are monitored continuously and exchanged with the maintenance workshop systems via online interfaces. The detailed depiction of the parking facilities helps to pre-plan shunting procedures.

During operation, the dispatcher must react quickly to delays and cancellations. IVU.rail.vehicle supports this with the planned and actual displays and the calculation of arrival prognoses, including their effects on layover times and following trips.

When doing so, the dispatcher must be careful to consider vehicle equipment and conditions, integrate special transport, plan maintenance actions, relay and assign open parking spaces and take into account personnel allocations. Therefore, modern dispatch systems should give an overview of which vehicle is currently deployed and with which crew.

“With IVU.rail, we were able to centralise the planning of personnel and vehicle deployment for all of Hungary. The integration of the actual data from our vehicle location system helps our dispatchers to react quickly to planning deviations and to reduce their effects on following trips.”

Ferenc Márton
Chief Operations Officer
MÁV Hungarian State Railways
ALL VEHICLES IN THEIR PROPER PLACE.

IVU.rail.vehicle plans and controls the entire vehicle deployment, from long-term maintenance planning to the current timetable situation. IVU.rail.vehicle monitors individual run performances and service intervals. Track occupancies can be recorded in detail in stations and parking facilities, and shunting processes can be planned.

Optimising vehicle workings

- Planning locomotives, multiple units and passenger carriages
- Vehicle working optimisation taking into account operating guidelines

Managing maintenance and operations

- Pre-planning the maintenance window for the optimal utilisation of vehicles and maintenance workshops
- Monitoring run performances and service intervals
- Dispatching parking facilities and maintenance workshop transfers

Reacting to disruptions

- Displaying vehicle positions in real-time, analysing the effects on subsequent trips
- Maintain all delays and cancellations in view
- Monitor pull-out and pull-in trips and vehicles’ parking locations
- Find and allocate replacement vehicles, integrate short-term transfer trips
OPTIMISATION AS AN EFFICIENCY ENGINE.

Calculating complex scenarios in the blink of an eye

Attain the best results while observing all requests – that is the job of the optimisation. If you are looking for the shortest path between two points, then the solution is fairly simply. However, if you wish to find the fastest travel path for a multitude of points while considering all of the boundary conditions, then optimisation turns into a highly-complicated arithmetic problem. Multi-layered automation tasks and decision-making processes can only be solved with IT and mathematics. Therefore, IVU cooperates with the "Optimisation" department of the Konrad Zuse Institute in Berlin (ZIB) for the development of optimisation components.

The optimisation of personnel and vehicle deployment is especially challenging. Thousands of duty elements must be combined into as few duties as possible within a short period of time. When doing so, all hard and soft rules for work time, breaks, qualifications, fares, travel paths and capacities must be observed. Therefore, the optimisation relies on a comprehensive data base and complete rule systems. Experience from past optimisation projects has shown that this can reveal vehicle workings and duties that were built in an invalid manner.

The creation of optimisation parameters, especially for larger scenarios, is a very complex and challenging task. The complete security of the rule system ensures that the computed vehicle workings and duties conform to the rules and can be directly adopted into the operation. This serves to optimise resource deployment and at the same time accelerates the planning processes while providing for more flexibility.

„There is significant enhancement in public transport. ZIB and IVU combine mathematical research with engineering expertise and practical experience in order to tap this potential. “

Prof. Martin Grötschel
Vice-President of Konrad-Zuse-Zentrum for Information Technologies in Berlin
AUTOMATION AND OPTIMISATION.

Increased efficiency with the optimisation tools from IVU.rail by combining mathematical investigation with engineering know-how and hands-on experience.

Duty optimisation

- Consider hard work-time laws and fare agreements, as well as soft operational guideline
- Guarantee complete scheduling of all duty elements
- Incorporate qualification and capacity guidelines
- Consider multiple crewing/teams
- Short-term adjustment optimisation

Vehicle working optimisation

- Consider service intervals, maintenance cycles and infrastructure capacities
- Ensure uniform distribution of performance over a longer period of time
- Create robust run schedules while simultaneously minimising required vehicles and necessary non-revenue trip kilometres

Weekly template optimisation

- Reduce variations during the week with fewer overtime hours or sub-performances
- Better distribution of days off and undesirable duties (e.g. late duties or split duties)
- Acceleration of the entire planning process

Automatic personnel dispatching

- Observe qualifications, capacities and rule systems
- Keep employee accounts balanced and allocate fairly
- Consider individual employee requests
With the IVU system, we receive everything from a single source. We are particularly impressed by the software’s wide range of functions and its modular structure.

Wolfgang Schuster
Managing Director
National Express Rail GmbH
ALL ADVANTAGES AT A GLANCE.

IVU.rail is a standard product with a modular construction. The modules can be implemented individually, as a whole or in combination with other systems or individual developments. All modules run on a single database, with open interfaces to all common peripheral systems, e.g. from the fields of HR management or maintenance workshop management.
IVU.RAIL.CREW

Roster layout
- Schematic and/or calendar-related planning
- Anonymous long-term preliminary planning
- Weekly template planning and optimisation
- Roster layout optimisation
- User-definable roster layout rule system
- Shift class planning

Personnel dispatch
- Automatic personnel dispatch
- Consider requests, shift classes and accounts
- Report duty sign-on/off from mobile devices as well
- Online communication between train drivers/dispatcher
- User-definable dispatch levels
- Qualification check and extension
- Automatic account update [work time, weekly rest, etc.]
- Integration of telephone system

Payroll accounting
- Connect HR systems (e.g., SAP, Peoplesoft)
- Profit centre splitting
- Assessing planned and actual work times
- User-definable payroll rule system for all personnel timesheets
- User-definable payroll rule system for all wage agreements

IVU.RAIL.VEHICLE

Vehicle dispatch
- Manage all vehicles
- Monitor service intervals and run performances
- Connect to maintenance systems online
- Create special trips and transfer trips
- Process cancellations and disruptions
- Automatic vehicle parking
- All parking facilities at a glance
- Short-term planning changes

Vehicle monitor
- Connect to vehicle location systems for actual data [vehicles, times, travel paths]
- Synchronisation of planned and actual data and delay prognoses
- Support short-term disruption management
- Monitor pull-out and pull-in trips
- Recognise the difference between planned and actual parking actions
- Direct control of passenger information
- Preparation of dynamic dispatch data via railML