



## E-READY

Integrated planning and efficient deployment of the fleet of the future

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Optimally prepared for e-mobility

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**The German federal government is giving local authorities up to EUR 350 million in the next few years to step up e-mobility in Germany as part of the “Immediate Action Programme for Clean Air 2017–2020”. It is clear that electrically powered buses are the future. Planners and dispatch managers now face the challenge of deploying the expensive vehicles as efficiently as possible.**

E-buses are already in widespread use in many places. With a total of 71 vehicles, London currently runs one of the largest electrically powered fleets in Europe. The number of electric buses is set to rise to over 170 by the middle of the year. In a total fleet of over 9,500 vehicles, that may not seem like much, but for the transport authority Transport for London, it is a source of valuable experience for future development.

“The use of e-buses does not just place high demands on the charging infrastructure and technical equipment of the vehicles and depots. Planners, dispatch managers and fleet managers also need to adapt to the special requirements,” said Dr Claus Dohmen, Head of Research and Education at IVU. “For instance, the restricted range imposes strict limits on run schedules. The longer charging times are another key factor. And that ultimately impacts personnel deployment.”

### Adjusting operations

The optimum solution for e-bus deployment differs depending on the company and the region. This means that planning and dispatch play a key role right from the decision-making stage. Using various run schedule scenarios, they provide the basis for defining aspects such as the right charging concept and the best locations for the charging stations. Deployment of e-buses impacts the full range of operations here. Standard procedures and processes need to be reconsidered and restructured:

- Run scheduling: e-buses cannot be assigned to all vehicle runs. Which they run on, and when, chiefly depends on their range, the charging opportunities and charging times. The usual traffic volume, the topography and even the seasonal weather conditions also come into play.
- Vehicle dispatch and depot management: before daily vehicle assignment, it is necessary to clarify whether the bus has sufficient battery charge for the planned route. When the bus returns, charging times and the right parking spaces need to be taken into account.
- Fleet management: along with the traffic situation, dispatch managers must always keep an eye on the recharge status and the range of the individual vehicles. To this end, it is im-

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Leon Struijk, CCO

**Dear readers and  
IVU customers,**

E-mobility is a hot topic in the transport industry. In Germany and elsewhere, more and more bus companies are ordering environmentally friendly electric vehicles – which then have to be used as efficiently as possible. It helps if the planning system is already prepared. In our title story, we take a detailed look at the adjustments that planners and dispatch managers have to make when dealing with electric buses.

In the interview on page 3, Bart Schmeink, CEO of Transdev Netherlands, talks about his experience with e-mobility and the opportunities presented by the new technology. On page 5, you will learn how we are already conducting research into the efficient deployment of driverless buses in public transport. As always, the other pages also contain interesting news from the world of IVU.

To finish with, I would like to briefly introduce myself: I ran a transport operator myself for many years, and was always keen to pursue innovation. One example is the introduction of the first nationwide e-ticketing system in the Netherlands starting in 2003. I also know IVU from my work as a managing director, having been responsible for projects and sales here in the role of CCO since February. I am really looking forward to applying my experience here and contributing to our customers' success.

I hope to get to know as many of you as possible soon, maybe at our annual user forum next month in Berlin – you are warmly invited!

Best regards,

Leon Struijk

portant to know where the next charging options are situated.

- Staff planning and personnel dispatch: the new technology also involves new activities and qualifications such as charging vehicles. In addition, shorter run schedules and/or interim charging can lead to more frequent trip interruptions. This must be factored in so as to avoid unnecessary waiting times or breaks – or to use these times as scheduled work time breaks.

**Preparing IT systems properly**

“Transport operators should ensure that their software and hardware can handle the specifics of electric buses – ideally before the first vehicle is in the yard, but no later than the transition from pilot operation with a few vehicles to the large-scale live launch with a large number of e-buses,” said Dr Dohmen. “The IVU.suite enables us to implement the vast majority of deployment scenarios smoothly already. The great flexibility of our standard system makes this possible.”

As with conventional buses with combustion engines, the vehicle properties of e-buses are also stored in the IVU.suite. Route and infrastructure data is collected, too. In addition, the vehicles' recharge statuses enter the system via an interface. On this basis, the IVU solution can help planners and dispatch managers in their work by suggesting suitable suggestions. IVU.suite's powerful optimisation plans run schedules and duties automatically, ensuring efficient use of e-buses and optimum deployment of employees.

As battery-powered vehicles still have a limited range at present, mixed fleets will initially be the norm in the next few years. To ensure smooth internal operations and prevent service restrictions during this time, the IVU.suite plans and controls buses with combustion engines and electric vehicles from all manufacturers and integrates them in a single system.

**E-mobility is coming**

E-buses still make up only a small proportion of Europe's bus fleets. However, numbers will grow significantly in the next few years. For instance, operation with e-buses only is scheduled from 2025 in Amsterdam, whereas it will start as early as 2020 in Eindhoven. That is why transport operators like the Dutch Transdev subsidiary Connexxion are now putting more and more electric vehicles on the roads.

In Germany, the federal government's immediate action programme has got things moving. Among other initiatives, Wiesbaden-based ESWE plans to use the funding to put over 220 new e-buses on the roads by 2022. Many other towns and cities have set similar targets. This makes it all the more important for transport operators to prepare for e-mobility now. Because the transport of tomorrow starts today.

**E-BUSES: THE RIGHT  
IT SYSTEM HELPS TO  
ENSURE EFFICIENT  
USE OF THE NEW  
TECHNOLOGY**



# „E-BUSES ARE AN IMPORTANT USP“

Bart Schmeink, CEO of Transdev Niederlande, which is the mother company of Connexxion, talked to us about IT and e-mobility.

**IVU: Connexxion and IVU are currently working closely together to modernise your fleet management and ticketing. What are your aims and expectations with this project?**

Bart Schmeink: We aim to implement our vision on smart payment. This vision seeks the introduction of new methods of payment and personalised services for our clients and passengers. With IVU's system, we can now offer our customers payment by OV-chipcard, apps and cashless options through one integrated solution. We expect that our partnership and the hardware and software platform will be the basis to keep offering our customers new and innovative services.

**Usage of data is becoming more and more important, at Connexxion as well as at other transport operators. Which data do you already collect and what do you achieve with them? How will data usage develop in the upcoming years?**

We collect a number of different kinds of data to continuously improve the efficiency and quality of our services. In operations, this includes drivers' working hours as well as their driving style, employee satisfaction, energy consumption of our buses and our overall punctuality among others. We also use anonymised customer data such as chip card and ticketing sales, customer experience or demographical data of an area. This helps us to better plan and use our vehicles and predict long and short term demand. This kind of data usage will increase considerably in the coming years to improve performance on all levels even more.

**Regarding the workflows within your company: What do you expect of an IT system? What would the ideal IT landscape look like?**

An IT system nowadays needs to be based on industry standards in terms of infrastructure, software and databases etc. in a complete virtualised redundant environment. Ideally, IT resources can be shared and scaled up and down if needed in a pay per use model. This can be done in a SaaS solution such as IVU.cloud or on-premise depending on the business process dependency for instance. To develop these IT systems, development and operation already have to work closely together. The changing world of mobility consequently demands co-creation between the IT supplier and the transport operator for both new offers and continuous improvement of existing services.

**Mobility is rapidly changing. How do you think public transport will look like in the future?**

In the future, public transport will see a growing gap between high frequency mass transportation on the one hand and flexible on-demand solutions on the other hand. Mass transportation by train, metro, tram or bus will still guarantee the accessibility of urban areas. For both urban and rural areas, on-demand solutions will provide either a complementary or a stand-alone service, which we expect will not only be run with electric vehicles but also will be fully autonomous.

**Connexxion already operates 43 fully electric busses on regular services. Which challenges in planning, deployment and fleet management did you come across?**

Because of the limited range of e-buses we had to create not only a schedule for our drivers but also a schedule for charging the buses at the right time during the day. With that, availability of the charging infrastructure was also an issue. For efficient timetabling, we additionally had to take into account other factors such as ambient temperature, driver behaviour and the number of passengers.

**In the discussion, the switch to electric mobility often is associated with difficulties. Which opportunities do you see in the use of electric buses compared to today's diesel powered vehicles?**

With less noise and no emissions, e-buses contribute to a better living environment, which is particularly important in densely populated city centres. Their driving comfort is very good too, not only for the passengers but also for our drivers: no noise, less vibrations. Our drivers in Eindhoven say that the e-buses are the best buses they have ever had. In the highly competitive tender environment in the Netherlands, our knowledge of e-mobility is an important USP. We are the first mover on e-mobility and thereby increase our chances of winning a contract.

**FRAMEWORK CONTRACT:**  
IN ADDITION TO IVU.FLEET, ROUNDABOUT 2,000 VEHICLES AT CONNEXXION, OF WHICH ALMOST 150 ARE ALREADY ELECTRICALLY POWERED, WILL RECEIVE THE IVU.TICKET.BOX WITH E-TICKETING AND A PIN TERMINAL FOR CASHLESS PAYMENT UNTIL 2019.



Bart Schmeink, CEO Transdev Netherlands



# SOLUTIONS FOR TOMORROW

The transport revolution is in full swing. What is still state-of-the-art today may be obsolete tomorrow. The early 21st century has brought some of the most radical transformation that public transport has ever seen: from the spread of apps for passenger information and ticketing, to the extensive introduction of electric vehicles, to driverless buses – every development involves changes to operational flows

and poses new challenges. To ensure that IT keeps pace with all these changes and transport operators benefit from the opportunities of new technologies from the outset, IVU is already working on the solutions for tomorrow – in collaboration with its customers, in research projects with start-ups and in the context of innovation projects.

## ÜSTRA AND IVU DEVELOP TOGETHER

ÜSTRA Hannoversche Verkehrsbetriebe AG and IVU have a common goal: to always deliver the best possible service to customers. The two companies will be coming even closer together in the future. With a cooperation agreement, they will further the development of systems and standards for public transportation together.

The goal of the contract is to implement industry advancements into software developments more quickly and put them into operation. To accomplish this, IVU product developers are going to be working on site at ÜSTRA in Hanover in

the future. Together with the IT department at ÜSTRA and specialised operators, they will identify early needs and process potential solutions. Having close accessibility to the IVU release cycle ensures that the ÜSTRA projects immediately flow into product planning. Thanks to the standard concepts of IVU.suite, solutions developed in the course of the collaboration will be available to all IVU customers worldwide.

ÜSTRA and IVU have worked together closely for a long time. Multiple IVU systems are run by the Hanover-based transportation company, which

was a pioneer in traffic engineering. Up to now, that has included many custom developments whose upkeep is cumbersome. These proprietary solutions are expected to be carried over into IVU's standard products. What's more, ÜSTRA will have up-to-date system updates within a few weeks of finalisation, ensuring that improved solutions will be more quickly available to ÜSTRA and its customers.



# RESEARCH FOR AUTONOMOUS TRANSPORT

In December, IVU partnered with BestMile to provide mobility solutions fully integrating autonomous vehicles in traditional transportation systems.

Together, we have launched the Autonomous Driving for Public Transport project aka "ADxPT". We are jointly developing a test and demonstration system in which public transportation companies can integrate and efficiently operate hybrid fleets of autonomous and driver-operated vehicles. A central focus is to interconnect our respective solutions in order to allow for the integration, real-time routing and dispatching of both vehicle types.

"The 'ADxPT' project will provide crucial insights and is of the utmost importance to guarantee a seamless transition towards autonomous mobility. We are proud to collaborate closely with IVU in this essential step for the future of public transportation," stated Raphael Gindrat CEO of BestMile. "The operation of hybrid fleets will be the cornerstone of the autonomous mobility revolution."

BestMile's cloud platform enables the operation and optimisation of autonomous mobility services. In 'ADxPT', the company leverages its expertise with real-life deployments of autonomous vehicles. IVU provides its smart software solutions for fleet management, passenger information and ticketing.

"Autonomous mobility will blur the frontier between public transport and individual transport services," explains Matthias Rust, CTO of IVU. "Working with BestMile allows us to gain first-

hand know-how in deployment of autonomous mobility solutions and further our commitment to providing state of the art solutions to transport operators and cities."

BestMile's cloud platform enables the intelligent operation and optimisation of autonomous mobility services, managing fixed-route and on-demand services, regardless of the vehicle brand or type. Incorporated in 2014, BestMile has global offices in San Francisco (USA), Lausanne (Switzerland) and London (UK).

FUTURE MOBILITY  
WILL BE **AUTONOMOUS**.  
FOR THE MEANTIME,  
IVU AND BESTMILE  
DEVELOP A SYSTEM FOR  
THE **INTEGRATED AND  
EFFICIENT OPERATION**  
OF HYBRID FLEETS IN  
PUBLIC TRANSPORT.



## VIA APP TO THE FLOWERS

From April to October, last year's International Garden Show drew crowds to Berlin with flowers, indoor and outdoor exhibitions and events. An app created by IVU on behalf of the state of Berlin helped visitors to find their way around the site and discover the various attractions. The application also met the special requirements of people with visual and physical impairments.

The app provided information on each exhibition and the plants on display by way of an audio guide. To make this possible, special Bluetooth beacons were installed at around 150 locations.

If they wished, visitors could also explore the exhibition via various tours. The app took them on

predetermined routes to each stop on the tour. IVU also integrated a navigation functionality.

The route was calculated in real-time on IVU's servers. In order to guarantee exact guidance, the system had access to high-precision survey data of the IGA site, which included all the structural features of the paths and buildings, as well as GPS coordinates. This allowed it to offer people with visual impairments and wheelchair users routes that met their requirements, for example by only going via accessible paths. For people with visual impairments, the app had a complete audio navigation system.





## E-READY

BATTERY POWERED BUSSES ARE CHANGING THE DAILY ROUTINE AT TRANSPORT OPERATORS. THE NEW TECHNOLOGY CHALLENGES PLANNERS AND DISPATCHERS AND RAISES MANY QUESTIONS. THE IVU.SUITE PROVIDES ANSWERS.









# TICKETING MADE EASY

The success of public transport hinges on ticket sales. Straightforward ticket sales and a clear price structure make services more accessible. At the same time, operators need stable income for their calculations. E-ticketing delivers on both fronts. App-based payment makes it simpler than ever to use bus and rail services. And electronic data storage

enables development of flexible pricing models that meet passengers' expectations. The IVU.suite's integrated ticketing products put transport providers in control of ticket sales – from pricing to settlement, for conventional or electronic tickets, in transport associations as well as in their own companies.

## MODERN E-TICKETING FOR LIMA

Bus company Buena Estrella aims to impress its passengers in Lima with app-based modern e-ticketing and passenger information in real time. With around 130 buses, Buena Estrella has been delivering reliable local transport in the Peruvian capital, which is home to millions of people, for over 15 years. The fleet is set to grow to 400 vehicles by 2019. We are supplying our IVU.suite standard system for the entire workflow from planning, fleet management, ticketing and passenger information to controlling.

All of Buena Estrella's vehicles will be equipped with the IVU.ticket.box on-board computer. As well as containing all the peripheral ticketing devices and the card reader for electronic tickets, it also transfers the vehicle's position data to the IVU.fleet traffic control centre system and the IVU.realtime passenger information system. The Bus.Altoke app, which is based on the customisable IVU.realtime.app and has already been helping passengers in Lima with departure times and an active trip companion since last year, is connected to this. Finally, IVU.control is used for statistics and settlement.

The transport operator Grupo Express del Perú (GEP) has been using IVU.suite in Lima since 2015. The two companies have now formed an operational alliance to advance development of local transport in Peru. "What attracted us to the system was the outstanding collaboration between IVU and GEP," said Rufini Flores Pimentel, Managing Director of Buena Estrella. "IVU.suite meets our requirements perfectly and can be extended flexibly. Consequently, we can offer our passengers a modern, secure service."



**GOOD BYE CASH!**  
PASSENGERS IN  
LIMA USE THEIR APP  
FOR INFORMATION  
AND PAY WITH THEIR  
E-TICKET.



# ALL-ROUND TICKETING SOLUTION

MANY OPERATORS, ONE SYSTEM: TRANSDEV USES **MULTI-TENANT TICKETING** FROM IVU – EASILY IMPLEMENTED, QUICKLY READY TO USE. THE STANDARD SOLUTION **INTEGRATES PROCESSES AND OPERATORS.**

With 43 subsidiaries – including 27 operating in the area of bus transport – the Transdev Group is the largest private rail and bus operator in Germany. The company has around 1,200 buses providing reliable public transport services, particularly in more rural areas and towns. Transdev has been relying on the IVU.suite's planning products since 1997 to make optimal use of its buses, trains and staff.

Together with IVU, the company is now implementing a central multi-tenant system for ticketing and fleet management. This way, every new contract the subsidiaries of the Transdev Group win will receive a simple solution for handling all ticket sale activities: ranging from IVU.fare for settlement and fare management to the IVU.ticket.box on-board computer for selling tickets in the vehicle. The computer serves as a vehicle environment interface and gathers all data and transfers it to IVU.fleet, which will be the central fleet management system at Transdev in the future. The entire on-board system is fully compatible with IBIS-IP and can already be used for e-ticketing.

"The IVU solution has an extremely high level of standardisation that meets even our extensive requirements. As a result, we are certain that the system can be implemented smoothly at all our transport companies," explained Dr Tobias Heinemann, Marketing & Sales Director (CCO) at Transdev GmbH.

"We are very pleased with Transdev's decision to reach this strategic framework agreement with IVU. Dual integration – i.e. the integration of the various business processes and of the geographically dispersed transport services – is a complex challenge. Working this out day after day is exactly what we aspire to achieve with our IVU.suite," added Martin Müller-Elschner, CEO of IVU.



+++ **NASA orders on-board computers and software for real-time data, connection management and e-ticketing:** The order covers 570 sets of equipment for buses and trams, including the IVU.ticket.box on-board computer with the IVU.cockpit app. IVU.fare is being used as the background system. +++ **Flexible ticketing in Schweinfurt:** Since August, people in Schweinfurt can travel using one of the most advanced e-ticketing systems in the country. Thanks to the new flexi-tickets, customers have maximum flexibility with complete control over cost, whether they use the bus only once a month or every day. +++ **Successful start of the WestfalenTarif:** Within only a few months, IVU updated in total 1,350 on-board computers, 70 pre-sale devices, 200 mobile handhelds and 650 e-ticket validators. +++ **10,000th IVU.ticket.box delivered:** Easy-to-use and with an award-winning design, the on-board computer has been setting standards since back in 2011. Recently, it was also made compatible with debit and credit cards. +++



# ALL RESOURCES PERFECTLY PLANNED

Creating routes, planning run schedules, assigning duties, deploying staff, scheduling maintenance, approving holidays – there's a lot to do to keep traffic flowing. As well as a long-term view and awareness, proper resource planning requires the right tools that give the planners optimum assistance with their challenging task. This involves highly effective opti-

misation as well as extensive flexibility for mapping various requirements and job groups. Seamless integration of dispatching is also essential: if all the data is in a single system, this facilitates collaboration, accelerates processes and creates a continuous workflow. The IVU.suite is designed with this in mind.

## COHERENT PLANNING THROUGHOUT SWITZERLAND

For more than 100 years, the PostBus brand has ensured reliable and safe public transport in Switzerland, from the large urban centres all the way to the remotest regions in the Alps. With a transport volume of more than 150 million passengers annually, PostBus Switzerland AG is the largest bus company in the country today. Last year, the company successfully completed one of the most complex introduction projects of recent years: Since then, all operating regions are using the integrated products of IVU.suite for planning and dispatching the roughly 3,000 drivers and 2,200 vehicles in a standardised way.

In particular, it is the IVU system's powerful integrated vehicle and duty scheduling that supports the planners in their work. It makes it easier to create efficient and resource-saving vehicle runs and duties. Moreover, automatic personnel dispatch ensures that the duty schedules for the drivers are balanced and fair. Thanks to the fact that the rules allow flexible editing, it also takes into account the respective special features with regard to payroll rules and work agreements in the individual regions automatically. The drivers can use the browser-based employee portal to view their duties and send their requests to dispatch via stationary computers and also tablets in the future.

form standardised processes. Nevertheless, we are still flexible where necessary," explained Jean-Pierre Boillat, former Head of Production Projects at PostBus Switzerland AG. "It allows us to considerably increase our efficiency, reduce our costs and thereby ensure that PostBus retains its competitiveness in the future."





SINCE LAST YEAR, **SALES-LENTZ ALSO OPTIMISES** PLANNING AND SCHEDULING OF ITS ROUNDABOUT 260 VEHICLES AND 400 DRIVERS WITH IVU.SUITE.



Sales-Lentz – one of Luxembourg’s biggest transport operators – operates 120 lines in the RGTR network, including routes to Belgium and France. The company also conducts charter trips for schools and factories, private hire, catalogue and group trips and night bus services. Using the planning and dispatching products of the IVU.suite, Sales-Lentz is now able to more effectively coordinate driver duties in scheduled services with the separate and sometimes multi-day charter trips. “IVU.suite enables us to manage both in a single system, which makes scheduling much easier. As a result, our employees benefit from better rotas,” said Wolfgang Schroeder, chief executive of Sales-Lentz.

## TRAINS AND PERSONNEL IN ONE SYSTEM

As the largest subsidiary of Hungarian state railway MÁV, MÁV-START operates the majority of the passenger rail transport in Hungary with approximately 1,000 locomotives and motor units and 3,000 locomotive engineers. The company has been using IVU.rail for planning and dispatch since 2008. Last year, MÁV-START extended its contract with IVU and included 6,000 additional employees in the system, including 3,000 train conductors and 3,000 stationary employees such as cashiers and safety inspectors.

IVU.rail’s intelligent suggestion system supports MÁV-START planners in the process of creating stable needs-based duty schedules and weekly templates. In the process, the system takes the applicable legal and operational rules and required qualifications for the corresponding personnel group into account. Furthermore, the mobile employee portal IVU.pad.employee allows employees to see duties or current information online and make holiday requests.

MÁV-START PLANS ALL ITS VEHICLES AND EMPLOYEES **IN ONE SYSTEM**: 1,000 TRAINS, 3,000 DRIVERS, 3,000 CONDUCTORS AND 3,000 STATIONARY PERSONNEL. IVU.RAIL HELPS TO **OPTIMALLY DISPATCH** EACH EMPLOYEE GROUP.

“IVU.rail has demonstrated its performance capability in the previous years. Through the system we were able to handle both the centralised and the decentralised deployment of vehicles and employees for the entire company,” said Imre Rácz, Head of Operation Support, from MÁV-START. “Now we have the dispatching of all employees in one system, which enormously simplifies the planning work. Through this we gain flexibility and receive more options for the dispatch of railway operation.”







## SAVE THE DATE

### IT-Trans

6–8 Mar 2018, Karlsruhe

### ElekBu

6–8 Mar 2018, Berlin

### IVU User Forum

19–20 Mar 2018, Berlin

### VöV Bustagung

29–30 May 2018, Fribourg

### InnoTrans

18–21 Sep 2018, Berlin

# MORE OF IVU IN AUSTRIA AND SWITZERLAND

With two new offices, IVU has strengthened its presence in two important markets: IVU customers can now reach direct contacts in both Switzerland and Austria.

IVU has long been successfully represented in Switzerland: more than 30 Swiss transport operators such as SBB, VBZ and PostAuto already use IVU.suite solutions to plan and manage buses, trains and ships or to sell national travel tickets. In August, IVU acquired its long-time partner company Soft Tech Informatik AG (STI) and formed a new company called IVU Traffic Technologies Schweiz AG based in Zurich.

The new company will be managed by Marc Schaffert, who heads up the current IVU office in Basel and is responsible for Sales and Key Account Management in Switzerland, together with Stephan Keiser, STI's former managing director. "The aim is to bundle our joint activities under one roof in order to give our customers here even better service and to tap into the additional potential of the Swiss market," explained Marc Schaffert. Stephan Keiser added: "Our long-standing and very good partnership with our IVU colleagues is an excellent foundation for the im-

plementation of new projects. We are very much looking forward to collaborating even more closely from now on."

Parallel to expanding its business in Switzerland, IVU is also strengthening its presence in Austria: Many IVU customers there, including Wiener Linien, ÖBB, ÖBB Postbus, Stadtwerke Klagenfurt and, since 2016, Steirischer Verkehrsverbund rely on IVU.suite products. To offer them a direct local contact and to expand sales activities in the country, IVU founded IVU Traffic Technologies Austria GmbH, which is based in Vienna.

Wolfgang Alfanz, who can already look back on a long career in the public transport sector, is the head of IVU Austria. He has worked for ÖBB and most recently represented PTV Group in Austria. The Austrian has extensive experience in both the railway as well as the bus business and can rely on a close-knit network in Austria's transport sector. Based in Vienna, he provides specialist advice to IVU customers and is available for any inquiries regarding IVU products. Marketing IVU.suite and IVU.rail will also form a core part of his work.

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