



SYSTEMS FOR VIBRANT CITIES

How mobility as a service is changing public transport

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It's quite the promise: all transport services in a single app, seamlessly connected and perfectly matched. The app offers customers suggestions for the best ways to get to their destinations, which could mean bus, rail, taxi, ridepooling, ridesharing, electric scooter, carsharing or bike-sharing. Mobility as a service is the future of transport. For it to work, integrated software systems are essential.

In Berlin, the future has already arrived. Jelbi, a name derived from the way locals pronounce gelb, the German word for 'yellow', combines a wide array of transport services into one. The customer selects a destination, then the app calculates the best route in the current conditions and presents the various services and their prices. The idea is to persuade people to move away from driving their cars as a means of lightening the load on densely populated and increasingly congested towns and cities, caused by private transport, creating a better quality of life and helping to protect the climate.

Jelbi is operated by BVG. Its aim is to make it as simple as possible to use alternative transport services. "Jelbi makes us an integral part of the move to more sustainable modes of transport, because we are adding another element to our already exceptional local transport services using buses and rail," commented Sigrid Nikutta, then CEO of BVG, at the launch of the pilot phase in June 2019.

Transport operators as service providers

The fact that a public transport operator is bringing private-sector providers on board with BVG is no accident. BVG is at the heart of local transport in Berlin and already operates buses, trams, ferries and the underground railway system. Since late 2018, it has also offered the BerlKönig ridepooling service, created in collaboration with the start-up ViaVan. With more than 500,000 pass-holders, BVG is also in a unique position to spark interest in new transport services.

Transport operators in other cities are making progress as well. Hochbahn, an operator in Hamburg, has been working with VW's MOIA ride-pooling service since 2017. ASEAG in Aachen launched its Mobility Broker project for integrating various services back in 2013. Deutsche Bahn is also involved in the market with its Flinkster and Call a Bike brands and holds a majority stake in ridepooling provider CleverShuttle (see also page 3). Many other transport operators also offer discounts with carsharing or bikesharing providers, or operate their own.

One thing that they all share is a commitment to the idea of getting passengers to their destinations safely, quickly, and easily. Meanwhile, in areas with limited public transport, alternative services can help to bridge the 'last mile' from the bus stop to the customer's front door. In city centres, they are an important complement to existing transport systems. In the future, autonomous vehicles will also



PREFACE

Dear readers and IVU customers,

What does public transport actually look like in a connected world? Is it just buses and trains – or might it involve something else as well?

Mobility as a Service is in the process of permanently transforming our understanding of what transport operators offer. Regular service is now coming to include ridepooling or bikesharing, electric scooters to cover the final mile and autonomous buses that dynamically head for their destinations. In our cover story, you can read about the role of transport operators in this area and how all these offers can be integrated in a way that makes sense.

At the same time, the move towards electric vehicles is a hot topic for the industry. More and more battery-powered electric buses are now entering regular operation. On page 5, you will learn how we help our customers to make the most efficient use of their vehicles. We also had the opportunity to speak to Ascan Egerer, technical managing director of Albtal-Verkehrs-Gesellschaft and, as usual, we will be presenting all the latest news from our projects.

We are proud that we can use our solutions to contribute to your success and we will be happy to continue to assist you as you move into the future of transport. If you would like, please pay us a visit at our annual User Forum in Berlin in March and talk to us about your current topics as well as developments from our industry. I look forward to seeing you there!

Best regards,

Leon Struijk
CCO

be a perfectly normal part of integrated public transport services, as with testing already underway in the town of Monheim, for example (see page 3).

Integrated system landscape

However, there are still a few technical obstacles to overcome before customers can be offered a single consistent 'mobility as a service' landscape. "Combining various services in one app is just one side of the coin," explains Claus Dohmen, head of Research and Education at IVU. "The most important thing is what is going on in the background. Data from a whole range of areas needs to be integrated and made usable; we need new, standardised interfaces; we need to develop smart routing and predictive algorithms." Only by achieving these things will it be possible to create the smoothest possible user experience.

Take connection management, for instance. If a customer uses a ridepooling service or, one day, an autonomous shuttle, to get to the next bus in a low-frequency area, the routing algorithm will need to calculate the best route so that it can collect any other passengers and still make it to the stop on time. At the same time, the driver of the bus needs to be informed of the shuttle's expected arrival so that he or she can wait if necessary. Things become ever more complex with longer routes and additional transfers. That is why IVU is currently carrying out trials to see how it could all work in the future with its U-hoch-3 and MaaS L.A.B.S. research projects (see page 4).

Scheduling will also require adjustments. The more shared taxis, shuttles or on-demand buses are out on the road, the more essential it becomes to respond flexibly to fluctuations in

demand and to take action such as deploying additional vehicles for short-term use and, if these vehicles are not autonomous, extra personnel.

Smart predictions

"Transport operators are going to work a lot more dynamically in future than they have done to date," says Dohmen. "Consequently, sophisticated forecasting models that make it easier for transport operators to adjust their services to suit actual demand constitute a vital prerequisite for MaaS."

This calls for equally sophisticated algorithms. Thanks to machine learning, scheduling systems such as the tools offered as part of IVU. suite will soon be able to use completed trips to make detailed predictions of how many trips and passengers to expect on a wet Wednesday evening, for example. IVU.fleet and IVU.real-time are already using real-time data from public buses to calculate anticipated arrival and departure times so as to ensure that connections link up properly and passengers are kept informed. Meanwhile, IVU.fleet is helping control centre employees by providing information on expected range for electric buses, making dispatch a simpler task.

In other words, IVU's customers are already well-equipped to handle the future of mobility. The integrated system makes it easy for transport operators to manage, exchange and analyse information consistently so that they can provide their customers with the best and most up-to-date transport services at all times – and persuade them to leave their cars at home or share them with others.

PUBLIC TRANSPORT
IS THE BACKBONE
OF TOMORROW'S
MOBILITY



AUTONOMOUS PROGRESS

The 'Bahnen der Stadt Monheim' railway infrastructure company last year launched a project that is the only one of its kind in Germany and indeed the whole of Europe. For the first time, five autonomous electric buses are to run on regular routes within a local authority. The public transport operator has already been using IVU.suite solutions for scheduling and managing its 45 regular buses. In the future, the system will also integrate autonomous buses made by French manufacturer EasyMile.

To achieve fully driverless operation, the engineers at IVU had a few challenges to overcome. For example, in normal buses, drivers generally receive information from the control centre via displays on their on-board computers, or via voice radio. Things are different in the case of an autonomous bus. To implement dispatch information relating to connection management or detours, for example, IVU worked with EasyMile to develop dedicated special interfaces for bus control systems that convert driving instructions directly into machine-readable commands.

This means that the control centre will still be able to keep an eye on all its operations within a single user interface and will be in a position to respond quickly whenever necessary – and that applies to both autonomous and driver-operated buses.



Photo: Thomas Spekowius

FLEXIBILITY FOR RIDEPOOLING

Get from door to door flexibly and economically while caring for the environment – CleverShuttle operates with this quality aspiration in six German cities. About 1,500 drivers and more than 500 vehicles allow CleverShuttle to provide wide-scale coverage in the cities that are served. The entire fleet consists exclusively of hydro- or battery electric-powered vehicles. Customers book the service using an app, after which an algorithm intelligently pools the passengers and determines the quickest route. The products included in IVU.suite will allow CleverShuttle to respond quickly to changing requirements and to deploy employees more efficiently and more economically.

"Sustainable mobility means responsibility – for the environment, our customers, and our employees. IVU.suite increases our efficiency and flexibility when we plan our shifts," says Bruno Ginnuth, CEO of CleverShuttle. The staff dispatching system IVU.crew assists CleverShuttle with all of its duty scheduling for the drivers on per-



manent contracts, whose extremely flexible working models and hours create complex requirements.

All process steps benefit from powerful optimisation algorithms: from long-term planning four weeks ahead of time, to medium-term dispatching one week before duty start, to daily staff deployment. Automatic personnel dispatch is especially helpful in creating efficient and fair duty schedules. In addition, a mobile employee portal for swapping duties, absence scheduling, and submitting requests speeds up dispatching and simplifies communicating with drivers.

"Ridepooling is an important addition to urban mobility," says Martin Müller-Elschner, CEO of IVU. "This is why we are extremely pleased to support CleverShuttle with our expertise in enabling sustainable local transport. In addition, the order highlights the capabilities of IVU.suite in highly flexible environments in which efficiency is especially required."



Photos: CleverShuttle



Photo: Peter Deijus / Alamy Stock Photo

RESEARCH PROJECT MAAS L.A.B.S.

Mobility as a service is the future of public transport – you go from the train to a rental bike and then finish the journey with an autonomous bus all seamlessly connected in a single system. IVU is now researching ways of making this idea a reality together with its partners in the MaaS L.A.B.S. project funded by the German Federal Ministry of Education and Research.

MaaS L.A.B.S. stands for a user-centric mobility-as-a-service platform that is lively, automated, demand-based and sharing-focused. The research project is looking to combine flexible and demand-based public transport with automated on-call micro-buses and car-, bike- and ride-sharing services. MaaS L.A.B.S. is testing the relevant technologies, combining them all in a multi-manufacturer app and developing the requisite background systems.

“Users’ expectations of public transport are changing. Today’s passengers want to be more flexible, especially when travelling in cities,” says Matthias Rust, CTO of IVU Traffic Technologies. “This shift presents some big opportunities for transport companies. By participating in MaaS L.A.B.S., we are hoping to continue to drive forward the transport transformation and offer our customers solutions for the mobility of tomorrow, today.”

IVU is bringing its expertise as a specialist in integrated software solutions to bear within the MaaS L.A.B.S. project in the development and implementation of forecast and routing algorithms for on-demand transport. IVU engineers are also developing interfaces with transport operators’ control and management systems, and integrating the MaaS system within into the existing passenger information service.

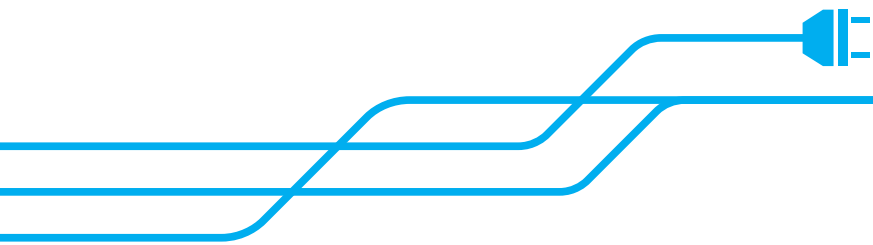


Photo: Adobe Stock

IVU.suite ^{eReady} ALL ELECTRIC

Electric buses are increasingly becoming part of everyday operations. This poses many challenges for planners and dispatchers. For this reason we have reissued our electric bus brochure: On 24 pages we cover all aspects of electric bus operation and explain how the IVU.suite integrates the new requirements across the entire process chain.

Download now: www.ivu.com/eready

NEW TECHNOLOGIES FOR PUBLIC TRANSPORT

Whether a seat on the bus, the right transfer connection or a goods delivery service, the University of Kassel’s U-hoch-3 research project for easy urban transport wants to give customers a better experience of using public transport.

The aim is to develop an assistance system that helps passengers in line with their needs in the course of their journeys. Its features include an app for intermodal travel planning and an inner-city delivery service that passengers can use to deposit their bags and have them dropped off at home. “Given the increasing strain being placed on cities by population

growth and growing levels of traffic, steps need to be taken in the medium term to encourage more people to switch to public transport,” says Dr Claus Dohmen, head of Research and Education at IVU. “U-hoch-3 is giving us the opportunity to try out new technologies at an early stage to reduce existing barriers to access and spur on the development of future inner city mobility.”



DEPOT MANAGEMENT FOR E-BUSES

Qbuzz is making itself fit for the future. With the help of the integrated IVU.suite depot management system, the Dutch transport company will soon be dispatching all of the vehicles serving its Groningen and Drenthe concession using a single system. To this end, IT specialist IVU Traffic Technologies is implementing an integrated depot management system for more than 400 diesel and electric buses.

Qbuzz has already been counting on the IVU.suite for over ten years: More than 900 vehicles are now equipped with the on-board computer IVU.box and provide a reliable service in the Netherlands thanks to the traffic control system IVU.fleet. To achieve efficient deployment of the roughly 160 electric buses that Qbuzz operates in the Groningen and Drenthe region, we are now also supplying our integrated dispatch and depot management system IVU.vehicle.



Photo: IVU AG / Qbuzz

“The IVU.suite gives us not just individual functional modules, but also an integrated solution for the various process steps involved in operating electric buses,” explains Gerrit Spijksma, Chief Executive Officer at Qbuzz. “At the same time, the IVU solution brings all vehicles together in a single system, so it makes no difference whether diesel or battery-powered vehicles are out on the road.”

This software will help Qbuzz to make the best use of all vehicles in future: For rostering, IVU.vehicle automatically takes into

account the current recharge statuses and anticipated remaining ranges of the e-buses and assists by making appropriate suggestions. Directly connected to the vehicle working dispatch, it enables IVU.vehicle to formulate the best possible plan for the charging infrastructure and parking at the depot in order to ensure reliable operation. In addition, the ITCS continuously monitors the recharge status and remaining range during transport operations – and alerts traffic control personnel in good time so that they can intervene.



Photo: ESWE Wiesbaden / Daimler Truck AG

WIESBADEN GOES ELECTRIC

In 2019, Wiesbaden’s public transport operator, ESWE, placed an order with Mercedes-Benz for 56 new eCitaro electric buses. As part of this order, the vehicle manufacturer adopted the general contractor role as the supplier of the complete system including construction measures for the infrastructure. Another component of the order is charging management based on IVU.suite.

Among other functions, the IVU system assigns each individual bus a defined charging point following its depot entry. Smart charging management ensures that all electric buses are charged with the necessary amount of electricity for their next trip, including preconditioning of the battery and passenger compartment for maximum efficiency.

With this electric bus campaign, ESWE and the local authorities are pursuing the ambitious goal of making Wiesbaden the first city in Germany to realise the vision of zero-emissions local transport. The team from Daimler Buses eMobility Consulting is helping ESWE to convert its fleet to electromobility.

JOINT VENTURE

Electric buses are taking over public transport – and fundamentally changing rostering. In response, IVU together with its partner ebusplan founded EBS ebus solutions GmbH to develop software, software modules and components for electric buses. The systems are intended to enable a consistent planning process in five fields, where the special features of electrically

powered fleets in particular are taken into account. From strategic planning and vehicle scheduling to charging phase planning, depot management, and vehicle dispatch, transport companies therefore get an integrated solution for the future of electromobility.



Photo: IVU AG

5 QUESTIONS: ASCAN EGERER

About Albtal-Verkehrs-Gesellschaft:

The Albtal-Verkehrs-Gesellschaft mbH (AVG) with 180 railcars, 30 buses and 950 employees transports about 75 million passengers in the Karlsruhe-Heilbronn region every year. It enjoys a worldwide reputation as a central component of the "Karlsruhe Model", in which dual-system light rail vehicles operate both in the inner city tram network and in the regional rail network.



As technical managing director, you are in charge of the Albtal-Verkehrs-Gesellschaft. What does AVG offer?

AVG is an integrated transport company in the rail sector and a railway infrastructure operator. We are also a railway transport company, transporting passengers and freight.

A special feature of AVG is the Tram-Train concept. What is it all about?

The first TramTrain system came into operation here in Karlsruhe. The term TramTrain does what it says on the tin – it's a combination of the two modes of transport.

What challenges does AVG face today?

Our regional urban railway network – the Karlsruhe TramTrain system – has continued to grow

over the last few decades, and it's now time to set this up for a new future and to consolidate it.

Three years ago you decided to procure a new planning and scheduling system. What goals did you have in mind?

We had a large range of IT structures with very different systems, including subsystems that weren't compatible with each other. That meant that many different manual steps were needed to transfer data. We wanted to move away from this to integrate the planning process.

The IVU.pad also played a central role for AVG. Why?

Of course, this is a part of ongoing digitalisation and modernisation and makes us even more attractive to our employees driving the trains.

Watch the movie:



Photos: IVU AG / AVG Karlsruhe



Photo: Transdev GmbH

TRANSDEV GROUP STANDARDISES ITS PROCESSES

says Henrik Behrens, Managing Director for the bus division at Transdev GmbH. "Thanks to the IVU.suite, we can largely align and centrally manage our processes. This allows us to achieve a very high level of efficiency and makes life easier for our employees. The now completed project acceptance is a major step for us towards equipping other operators with the IVU system over the next few years and positioning them optimally for future growth and the challenges on the market."

Transdev GmbH, the largest private operator of bus and railway services in Germany, has been using the IVU.suite for some time now to efficiently schedule, deploy and manage its vehicles and employees. Last year, the company has reached another milestone: seven subsidiaries operating around 450 buses have commissioned an integrated, all-in-one system for ITCS and ticketing.

"As the largest private mobility provider in Germany, we need uniform and standardised processes across the company,"

The hub that ensures the continuous data flow from the bus to settlement procedures is the tried-and-tested IVU.ticket.box on-board computer, which has been installed in all vehicles. The device continuously records the bus position data and transfers this to the IVU.fleet ITCS, which, in turn, forwards this data so that it can be used for real-time information. For simpler payroll accounting, the actual number of hours worked by drivers can now for the first time be recorded and transferred to the IVU.crew duty scheduling system.

AWARDED

Adolf Müller-Hellmann, a member of IVU's Advisory Board for many years, has been awarded Germany's Federal Cross of Merit, First Class. Armin Laschet, Minister-President of the state of North Rhine-Westphalia, presented him with the honour in recognition of his extraordinary professional and voluntary commitment to better and more environmentally friendly public transport.

As a lecturer in electric local transport systems and electric railway operators at RWTH Aachen University, Professor Müller-Hellmann has made a name for himself as an expert in sustainable and environmentally friendly transport. He has been working to promote public transport in various positions at the Association of German Transport Companies (VDV) since the early 1980s.

Professor Müller-Hellmann has been a consultant to IVU since 2010. As a member of the Advisory Board, he has lent considerable momentum to the evolution of the product range and, in doing so, helped in no small measure to prepare IVU for the electric future of mobility.



Photo: Land NRW



Photo: IVU AG

Photo: Adobe Stock



INTEGRATED PLANNING IN TRANSPORT ASSOCIATIONS

The Bremen/Lower Saxony transport association (VBN) has launched a groundbreaking project that could serve as a model for an integrated system architecture in transport associations. Based on the IVU.suite, a central planning system is being created, which enables the members of the association to complete all their timetable planning, vehicle scheduling and duty scheduling as independent operators.

As an amalgamation of over 30 private and municipal transport operators, VBN provides all public transport in the network region covering the cities of Bremen, Bremerhaven and Oldenburg. Every year, more than 175 million passengers use the services provided by the member companies.

"We were particularly impressed by the integrated approach of the IVU solution. The option of having IVU host the entire production environment in particular was an important advantage for us as it saves us time, resources, and costs," says Michael Lorenzen, Project Manager in the area of information systems at VBN and the future system administrator. "This enables us to support our members as they digitalise their entire resource planning system and in doing so help them to further improve their services for their passengers."

VBN has already been using the fleet management system IVU.fleet for network-wide fleet management and connection management since 2013. Now, the association is adding the planning products IVU.run and IVU.duty to the tools available to its members. The integrated system allows transport companies to use a computer-supported vehicle and duty scheduling system to deploy vehicles and employees efficiently. Up to 30 VBN members with around 1,000 buses will be able to upgrade to the new environment over the next few years.

To ease the workload of the association, the Bremen/Lower Saxony transport association administration union (ZVBN), and the individual companies, IVU will also be taking care of all hosting as well as the technical operations management for the system within the IVU.cloud. The high-performing Amazon Web Services server ensures complete operational reliability.



SAVE THE DATE

VDV Electric Buses Conference

4. – 5.2.2020, Berlin

IT-Trans

3. – 5.3.2020, Karlsruhe

IVU User Forum

23. – 24.3.2020, Berlin

InnoTrans

22. – 25.9.2020, Berlin

Photo: © SBB CFF FFS

IVU.cloud FOR SBB

Improved employee communication and optimised staff allocation: SBB is using IVU.rail to ensure the efficient planning and dispatch of all employees in the stationary areas of sales, service and marketing. IVU is also responsible for hosting the integrated standard system.

Conveying around 1.25 million local and long-distance passengers every single day, SBB is the biggest railway company in Switzerland and the backbone of the country's public transport network. To provide the best possible customer service, SBB employs 2,300 people – including trainees – at its contact centre and its currently around 150 travel centres throughout Switzerland. The company has recently started planning and dispatching its services in a standardised manner with IVU.rail in IVU.cloud.

“We were really impressed with the huge functional scope offered by this standard solution from IVU, which right from the outset covers very many of our requirements,” says Urs Fürst, who is responsible for financial management and personnel dispatch at SBB Bedienter Vertrieb. “In addition to the close involvement of employees in dispatching, IVU's highly practical and flexible hosting service was central to our decision to choose this solution. This means that we are well prepared for future developments.”

Originally developed for transport operations, IVU.rail offers numerous functions that can also be used for planning and dispatching SBB's stationary personnel. Automatic personnel dispatch (APD), for example, ensures optimised duty schedules and, in turn, faster workflows. The digital employee portal also makes in-house communication easier because it allows SBB employees to view duty schedules, place requests and swap duties.

IVU.cloud ensures that everything runs efficiently. The standard system runs exclusively on Amazon Web Services servers operated and maintained by IVU, which means that SBB no longer has to perform complex and time-consuming operations management. Of course, all the data is stored redundantly and secured in accordance with the most stringent standards against unauthorised access.

Marc Schaffert, branch manager of IVU in Switzerland, considers the order from SBB to be a huge success: “We are delighted to continue our partnership with SBB, this time in the field of public transport, and are proud of the trust they have placed in us. The project highlights the breadth and depth of our rostering expertise paired with the technical flexibility of our cloud.” The affiliate SBB Cargo last year also shifted all its processes for planning and dispatching vehicles and personnel in freight transport with IVU.rail to IVU.cloud.

Railway country: Switzerland

A dense network of various means of public transport, the only one of its kind in the world, makes Switzerland one of Europe's most dynamic and important transport markets. To achieve that, the alpine country invests a lot of money in its railway network. Switzerland is currently spending €362 per capita on railway infrastructure every year and is thus leading the way in Europe. And the investment is paying off. Nowhere in Europe do people travel more frequently and further by rail than in Switzerland – to the great benefit of the environment.

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