

MOBILITY manager

Magazine for Public Transport



System introduction with basic systems

Managing Digitization and Complexity

Product Report

Basic system PSLeDMS start
Let's Get Easy-Started –
3 Steps to a Digital Depot

Product Report

Automation in the rail sector
Digitization Needs Standards
– Urgently!

Success Story

infra fürth relies on Profahr
Seamless Transition for
Passengers and Drivers

EDITORIAL

Dear Reader,

Are you keeping tabs on the megatrend of digitization?

Achieving climate protection goals, maintaining competitiveness, or increasing passenger comfort and benefits – the list of goals for transport companies goes on and on. A decisive and driving influencing factor in implementing these goals – if not the key to success – is the digitization of operational processes.

As experts in this field, we have a lot to report. That's why this is the main topic of the current issue of MOBILITY Manager!

In our cover story, we advise transport companies to break the big project of digitization down into small steps. After all, the complexity of digitization projects should not be underestimated. However, the focus should be on establishing a good foundation which can then be built on gradually. But so much for the theory. We are now providing you with a suitable solution – through our new easy PSiEOMS start. A Depot Manage-



ment System that allows you to digitize your operation in no time at all and provides you with all the main basic functions for managing your vehicles in the depot. Further modules can be added later. If you are curious, you can read more in our article on pages four and five.

The fact that digitization is also making great strides in the rail sector has been clear for a long time. The major challenges comprise increasing the capacity of the rail network and improving operational quality and punctuality. We are active in this sector also through our Train

Management System. This topic is covered in two articles starting on page 11.

Last but not least, we are pleased to report that a lot is happening in the area of personnel dispatching too. This issue closes out with two Profahr customer reports and a new time tracking module.

We hope that you have saved the date of this year's InnoTrans, because we will be there again! You will find us at booth 520 in hall 2.1. Be sure to stop by, we look forward to seeing you.

I hope you enjoy reading this issue.

Torsten Vogel
General Manager
PSI Transcom GmbH

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System introduction with basic systems

Managing Digitization and Complexity

For subsequent users to accept basic systems, the systems need to be made available quickly. This is the case in many IT systems that significantly impact corporate processes – including Depot Management Systems. Functional specifications can take many months to prepare and often are not widely understood. In many respects, a basic system can be the better way to go for system introduction in the long term.

Even during a Depot Management System's introduction stage, many employees in the company have very high expectations. It takes just as long to compile the requirement specifications or functional specifications, in which all functions and processes have to be accurately described. The good news: Actually implementing all the modules described from the very beginning is only necessary in the rarest of cases. Many of your requirements are already

covered in modern systems such as the PSIttraffic/DMS Depot Management System in the basic system as well as through individually configurable workflows. The wheat is already separated from the chaff here and opting for industry-standard systems proves more than worthwhile.

A good basic system forms the foundation

Special additional functions should also be avoided during the introduc-

tion phase. It is fair to say that they promise additional, particularly positive effects that companies do not want to do without in order to ensure vehicle availability. This is certainly understandable. However, the fact is that the meaningful use of such functionalities firstly requires a solid database, which needs to be available at the start of a project. Therefore, it is advisable to wait until after the introductory phase to select and integrate certain modules. Last but not least, the human factor comes into play here: In most cases, key users have to fulfill their role in the complex system introduction in addition to their daily tasks. They are exposed to a high level of stress; particularly in the most intensive phases of the implementation.

As a result, a realistic project scope helps avoid overwhelm among users and ensure that they stay motivated over the long term.

Holistic IT roadmaps considered a recipe for success

A look at practice shows that transport companies that develop, continually refine and consistently implement holistic IT roadmaps are the most successful. Thus, the scope or future viability of the overall DMS system is undoubtedly of crucial importance. However, for long-term suc-

cess, it is important to allow a system to expand its functionalities and to acquire key users and all other users step by step. Furthermore, this is also in line with the reality of IT budgets. The advice: Companies should start by concentrating on the basic system, then develop it functionally and technologically step by step. This prompts digitization and keeps the resulting complexity under control. This in turn leads to high acceptance among users.

Conclusion

Projects for introducing Depot Management Systems still have a rather difficult reputation; for various reasons. Surprises can be avoided by developing a practical IT roadmap right from the start, with the team focusing on implementing a basic DMS system. Thus, digitization and complexity can be managed quite easily. 🌀

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Product Report: New basic system PSiEDMS start

Let's Get Easy-Started – 3 Steps to a Digital Depot

When introducing Depot Management Systems, many companies benefit from implementing a basic system first, then expanding it step by step (see cover story). Our new easy PSiEDMS start now provides such a package.

Our PSiEDMS start offers you a basic Depot Management System that allows you to take the first step from the analogue to the digital world in just a few weeks. Your processes, such as vehicle parking, supply and scheduling, are displayed in one system. Developed based on the market requirements and customer installations,

PSiEDMS start contains modules that guarantee you a quick benefit. The modular structure gives you the security of expanding the system gradually until a fully automated solution in the depot is achieved.

Are you in the process of converting your fleet to zero-emission vehicles? PSiEDMS start takes account of various drive types – regardless of the

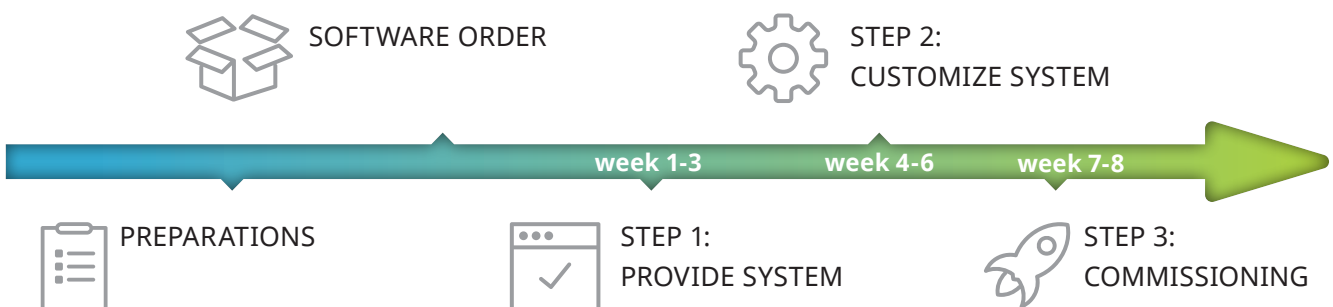
size of your fleet. The basic system already includes the interface to load and charge management – your migration can begin.

Transferred from the existing systems via standard interfaces, timetable and employee schedule data forms the basis for scheduling.

It's that simple

You procure the interfaces from your standard suppliers and configure your driver and vehicle master data – we deliver the system.

Thanks to system training based on



Three steps to the operating system.

operational processes, expert training and corresponding training documents, you can now “digitize” your depots.

The software installation and database/interface connection can be carried out independently by means of checklists (Step 1).

Master data is imported or entered, interfaces are configured and the operating screen is created (Step 2).

Once your team has been trained, the system can be used in daily operations after just eight weeks (Step 3)!

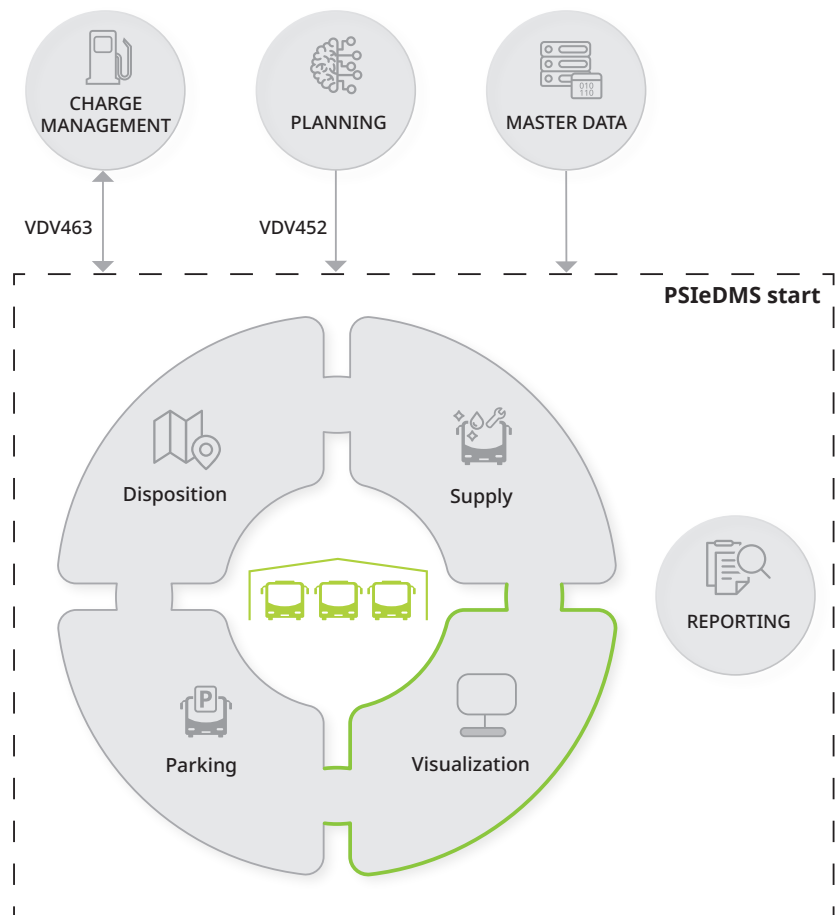
We will of course be at your side to advise you during the system introduction and later during operation.

After installation und configuration...

- you have successfully taken the first step towards digitizing your depots
- your employees can do their work using fewer interfaces
- you can expand the system independently

Small effort, big effect

By introducing PSIdMS start, you are using a system that is based on the requirements of public transport and does not require a long phase for compiling functional specifications. It can be rolled out for extra depots



PSIdMS start – System overview (in accordance with VDV publication 463, 04/2021, p. 12).

and vehicles without any problems – by leveraging the know-how of your own employees.

Already have a PSITraffic/DMS and are procuring e-vehicles?

In this case, our “starter pack” is also interesting for you. We connect your

PSITraffic/DMS to a Charge Management System via VDV interface 463. So nothing stands in the way of migrating your fleet to include zero-emission vehicles and connecting to charging stations.

Whether it's natural gas, diesel, H2 or electric vehicles – we have the right solution for you.

Curious?

If so, visit us at InnoTrans in Berlin! We will be at booth 520 in hall 2.1 and will be happy to answer your questions on PSIdMS start. 📍

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PSIdMS start – the perfect entry-level solution for companies that...

- ✓ ... want to switch to the digital world.
- ✓ ... are starting to use emission-free vehicles.
- ✓ ... are focused on standards in processes and solutions.
- ✓ ... are keen to be up and running in the shortest possible time.
- ✓ ... are eager to improve their process efficiency.
- ✓ ... want to increase the availability of their vehicle fleet.

Product Report: Intelligent charge control

Full Charge Please!

Hamburger Hochbahn AG is one of the transport companies that, in addition to electric buses with conventional battery types, have also begun to use vehicles with solid-state batteries, so-called LMP electric buses. Unlike conventional batteries, LMP batteries do not contain liquid electrolytes, but consist of a solid body. Many aspects, because of their exponential benefits, speak in favor of using this technology and for its further development. These include higher storage capacities, shorter charging times, lower weight and smaller dimensions. An additional benefit: Since internal short-circuits and fires induced by them can be avoided much more easily, solid-state batteries also offer a greater degree of safety. However, it is necessary to take into account an energy balancing method, for all battery types equally, and to include that in the vehicle dispatching.

There are some idiosyncrasies to consider: Note that LMP vehicles must be fully charged during the balancing process – up to a state-of-charge (SoC) of 100 percent. The duration of this process can extend to several hours in just a few days if the balancing does not take place within the respective preplanned period. This has considerable consequences for maintaining a reliable bus operation.

Hamburger Hochbahn relies on PSIEbus

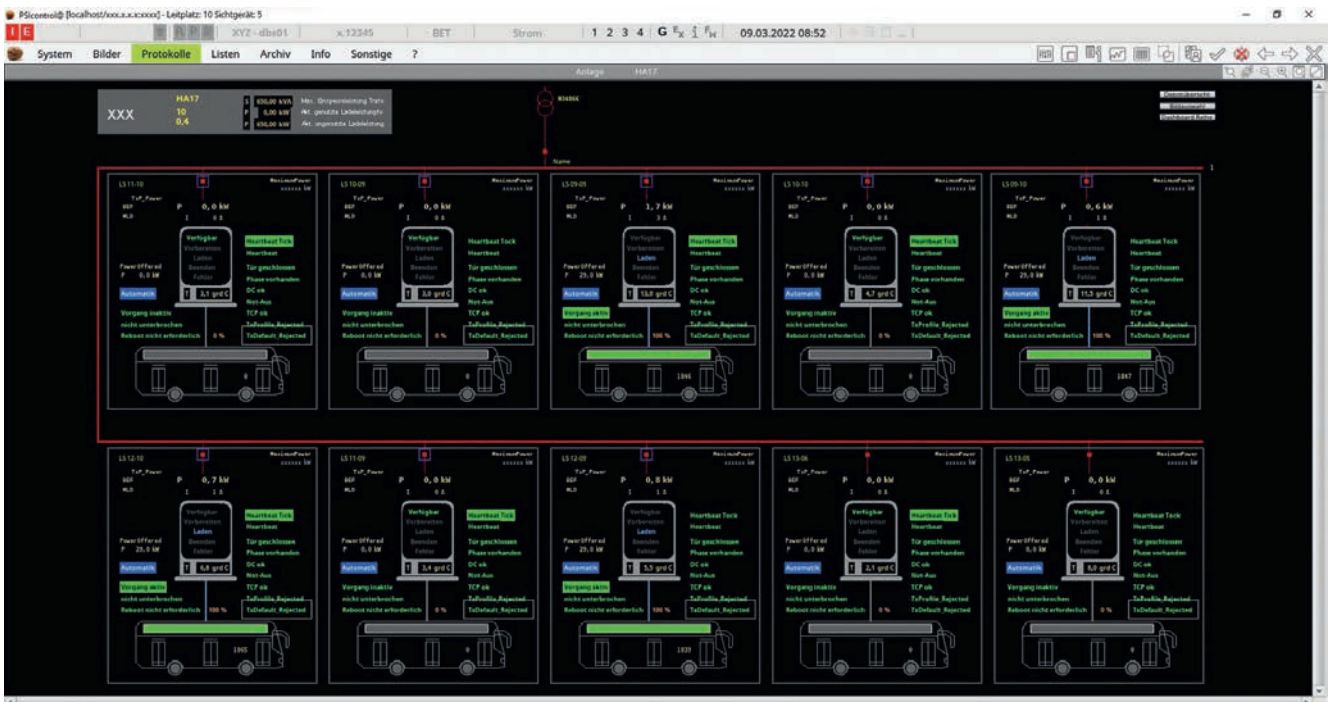
Hamburger Hochbahn AG therefore relies on an automated process for its PSIEbus depot and charging management solution. The solution monitors the balancing of each individual LMP vehicle and is fully integrated into the operational vehicle dispatching. The system determines and dispatches the next balancing order based on the last registered full load. The charging time forecast, which also includes the expected duration for any planned balancing, is decisive for the fixed route dispatching. If the system detects that the calculated time period exceeds the number of set, parametered hours that are configured in the depot management system, the vehicle is blocked from further operation upon entering. A subsequent release of the vehicle takes place only when the balancing has been completed in its entirety. The dispatchers see all information and automatically determined solutions visually prepared on their screen in the overall context of the operating situation.



PSIEbus monitors the balancing of each individual LMP vehicle.

Regular balancing of the energy statuses between weak and strong battery cells slows down decomposition of the cell cores considerably, which significantly extends the service life of the batteries. An intelligent charging and discharging process is therefore of enormous importance. Transport

companies must bring them into line with their vehicles' operating schedule. Hamburger Hochbahn AG is already familiar with balancing conventional batteries and has integrated corresponding processes into its operations. In the context of solid-state batteries, however, this topic is uncharted territory.



In PSIEbus, all information and proposed solutions are processed visually.

Depot and charging management independent of battery type

Hamburger Hochbahn AG systematically implements its goal of operating a completely emission-free fleet in a few years. The Hamburg-based transport company is no longer only

using electric buses with conventional, but also with solid-state batteries. With the help of its PSIEbus depot and charging management system, which has been extended to include balancing functions, it meets their requirements for charging and

energy balancing. This means that the company is ideally equipped to ensure reliable operations independent of any given propulsion technologies. 🌱

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Battery Balancing increases the lifetime of energy storage devices.

Automated balancing in PSIEbus

- ✓ Determination of balancing/full load orders
- ✓ Registration and logging of each full load
- ✓ Automatic blocking of vehicles
- ✓ Calculation of the time until full charge
- ✓ Consideration of balancing for fixed route planning

Product Report: IT-based fire protection systems for vehicles with alternative propulsion systems

Fire Prevention on the Road and in the Depot

According to initial estimates, alternative-powered vehicles do not catch fire more frequently than their fossil-fuel-powered predecessors. Nevertheless, care must be taken when it comes to fire prevention and fire protection measures in road traffic and in the depot. There is a need to catch up with the use of IT-supported solutions. Consistency in load, charging and depot management systems plays an essential role in the reliable cooperation with fire alarm technology in case of an emergency.

Nowadays, alternative-powered buses have become part of the everyday street scene in numerous cities and municipalities. And there will be incrementally more, not least because of the EU's Clean Vehicle Directive, which came into force in 2021¹. At the same time, major fires in bus depots, as we saw in Stuttgart and Hanover, Germany, show that there is a need to catch up in the areas of fire prevention and protection measures when switching to alternative-powered vehicle fleets. The good news is: In most cases, the issues lie not with the alter-

native propulsion technologies themselves, supposedly causing a higher risk of fire or H₂ leakage. Rather, they are the missing adaptations in protection plans, which the transport companies have to retrofit quickly and efficiently or establish from the outset. Modules for early alerting that are fully integrated into the Depot Management System (DMS) can make a most valuable contribution. That way, the system takes over part of the monitoring at the depot throughout the entire operating day, including nighttime hours.

New types of propulsion systems require adapted fire protection systems

Various studies² suggest that both electric vehicles and hydrogen vehicles do not catch fire more frequently than fossil-fueled vehicles. A fire in an electric battery is therefore very unlikely. However, the fire protection measures must consider differences in the propulsion types. For example, diesel vehicles may catch on fire while on the road, while electric vehicles are more likely to burst into flames while charging in the depot – with generally more serious consequences. It is true that each battery has protection against overcharging or deep discharge. However, if an internal short circuit occurs in the core of a cell, for example due to defects or poor quality, a thermal chain reaction occurs – a so-called "thermal runaway". It will quickly cause fires in all the other cell cores. In addition, first signs of this process cannot be seen with the naked eye and once this reaction has gained momentum, it is difficult to interrupt. Therefore, the adaptation of protective measures is paramount, as the following comparison alone shows: If a vehicle is burning at a gas station or if there is an acute risk of fire, fueling the vehicle with gasoline or diesel will stop immediately. Similarly, switching off the charging stations can therefore be a first measure in a depot with a charging infrastructure if critical situations should occur. Since a manual shutdown cannot do this, especially not at the required speed, an automated solution may bring the most gain.



In the fire protection module, measures to be initiated automatically can be configured.



The DMS visualizes warnings and accelerates reporting chains in fire protection.

DMS and CMS can minimize losses from fire

What can a depot management system do for you? A module for early alerting will let you implement necessary measures faster and with significantly higher efficiency – it delivers information about the effected location, the evacuation of people and vehicles, and also takes care of the automatic notification of the fire brigade. Currently we are working on such a module as an add-on to our own depot management system.


The system uses interfaces to the vehicles to detect faults on the basis of

measured values in the battery management system (BMS), then interrupts the charging process, and automatically warns all effected locations in the depot. In the event of an emergency, all relevant employees at the depot can see at a glance where they need to act, and save valuable time in a situation where every second counts.

If the vehicle is connected to a charging station, the data transmission occurs through the charging infrastructure and on route directly from the vehicle. If the vehicle shows a critical condition when entering

the depot, it is dispatched to a quarantine parking spot by the depot management system in order to protect other vehicles, infrastructure, the depot and employees. It will remain there until the workshop releases it again. Due to the linking of load and charging management with the depot management in one system, various charging points can be switched off automatically at the same time.

Standardization of data supports fire prevention

Vehicle data must be transmitted to a control system continuously – while driving, whilst charging en route or when charging in the depot, to make the described fire protection measures possible. Furthermore, rapid development of standards for data content and interfaces is required to ensure interoperability of the background systems with the various vehicle types and manufacturers. Both the VDV and the European non-profit organization ITxPT are currently working on corresponding standardization projects. PSI Transcom has taken a leading role in coordinating this standardization as part of the STAPL research project. 

¹The 2021 EU Clean Vehicle Directive requires transport operators to gradually increase the share of alternatively driven vehicles in their new purchases – to 45% by 2025, and to 60% by 2030.

²ADAC: <https://www.adac.de/>
DEKRA: <https://www.dekra.de>

Fire protection module interaction with the load, charging and depot management system

- ✓ Vehicle interfaces allow the system to detect faults in the battery system.
- ✓ Vehicles transmit warning signals on critical states to remote control units.
- ✓ The signals can be taken in directly and evaluated by fire alarm systems as well as by charging and depot management systems.
- ✓ Upon integration, the DMS can automatically control follow-up measures.
- ✓ Accelerated processes create a time cushion to detect fires and protect people and machine.

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R&D: Standardization and legally-compliant use of vehicle data in public transport

STAPL Research Project

Sensor and diagnostic data from public transport vehicles are becoming increasingly important for transport companies in order to optimize the operation of their vehicles and ensure their availability in the best possible manner. In particular, the rapid shift from traditional combustion engines to low-emission and zero-emission drives requires that current vehicle data be evaluated for operational planning, condition-based maintenance as well as hazard prevention and mitigation.

In this context, we launched the STAPL – Data Governance and Standardization for Vehicle Data Platforms research project at the beginning of 2022.

Funded by the Federal Ministry for Digital Affairs and Transport (BMDV), this project brings together six European partner companies: PSI FLS Fuzzy Logik & Neuro Systeme GmbH from Dortmund, Voyages Emile Weber from Canach (Luxembourg), Capte B.V. from Amsterdam (Netherlands), Hamburg-based law firm BDO Legal, Regionalverkehr Köln GmbH, and PSI Transcom from Berlin as project coordinator.

The focal points

One of the goals of this project is to advance the standardization of vehicle data interfaces in terms of content and technology at European level.

To this end, we are working closely with the Association of German Transport Companies (VDV) and an international organization called Information Technology for Public Transport (ITxPT). The standardization activities of VDV and ITxPT, which are already underway, are to be coordinated and harmonized. ITxPT not only develops standards, but also certifies the corresponding hardware and software products of manufacturers and suppliers.

Another focal point of the research project is in consolidating the legal framework for data collection and use. This is primarily with regard to the relationship between vehicle manufacturers and vehicle owners, but also

concerns the relationship between data users. Ultimately, the data platform should enable both cross-manufacturer and cross-user data analyses.

Unfortunately, vehicle data still cannot be used comprehensively in many cases due to the unclear legal situation. It remains to be seen

whether the EU's recently published draft Data Act will actually enhance legal certainty. Our legal experts from project partner BDO legal are currently reviewing the draft as well as other relevant documents and determining the legal consequences for our project.

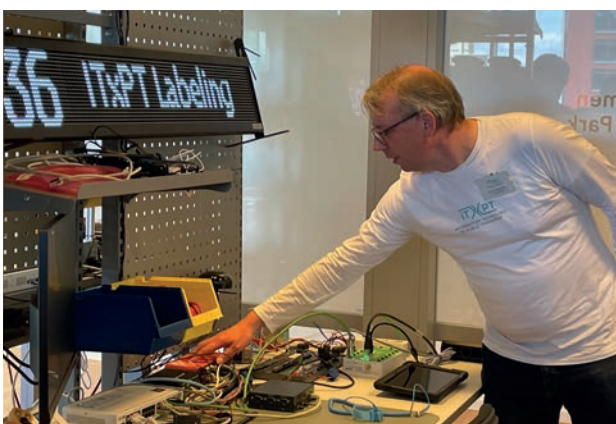
Practical testing

A field test is to be carried out in which the research results are to be verified using selected use cases at our practical partners in the coming year. Voyages Emile Weber already has 100 electric buses from various manufacturers, with another 175 to follow shortly. These vehicles are to be equipped with data loggers from Capte. Cologne-based public transport company Regionalverkehr Köln is also installing data loggers on 25 biomethane buses.

PSI FLS ensures smooth IT operations and performs AI-based analyses on the data platform. PSI Transcom is coordinating the work in the project, promoting standardization and carrying out the further processing of the refined data in the downstream systems, e.g. in depot management. In addition, a community approach to cross-user data analysis will be tested on the data platform.

All interested companies are invited to participate in the community and take part in evaluating vehicle data on a legally secure basis and share the findings with each other. 🌐

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ITxPT-Lab in Göteborg.

Product Report: Basis for all levels of automation

Digitization Needs Standards – Urgently!

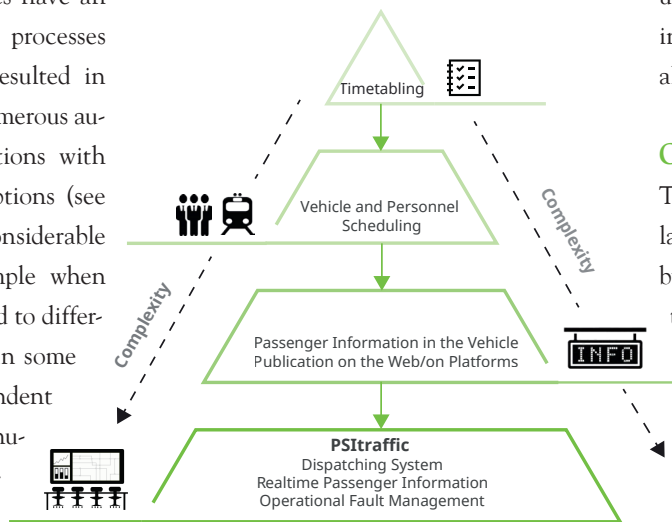
Process digitization on the one hand, manual data transfer to flanking systems on the other: Rail companies have now digitized countless business processes. However, what is missing is becoming increasingly clear – the modeling of these individual building blocks into a powerful overall system. This in turn requires standards.

Enterprise Resource Planning (ERP), personnel and duty scheduling, vehicle scheduling, timetabling, operational scheduling, customer information, and much more: Many rail companies have an extensive list of digitized processes at this point. This has resulted in IT landscapes featuring numerous autonomous individual solutions with just as many media disruptions (see figure). These generate considerable frictional losses, for example when data is manually transferred to different systems several times in some cases, or previously independent inventory systems are manually synchronized at different times. At the same time, the pressure is

high: For instance, customer information re-

lies on planning data that is always up to date – including, in this case, from a vehicle scheduling planning system operated during office hours only. The resulting rework costs time, places additional strain on staff who are already under significant pressure, and is highly prone to errors. In this context, the amount of time and effort that companies have to spend on IT issues is increasing all the time. Those responsible complain that it is becoming increasingly difficult to concentrate on the actual core business of transporting passengers and

goods. Thus, finding a way out is even more urgent. This way out lies in the creation of an overall IT system – with continuous processes through automated transitions.



Every interface in the rail system makes communication more complex.

Existing standards underdeveloped

As simple as this equation sounds in theory, its implementation is problematic in practice. This is because the digital solution modules can only be efficiently combined to form a large whole via standardized import and export interfaces. But this is precisely what most systems fail to offer. Existing standards, in turn, are not fully developed and cannot represent all operational requirements. If these are not further developed, the danger of “self-sufficiency“ increases, lead-

ing to proprietary adaptation in the worst case.

One prominent example for which standards are lacking is the transmission of infrastructure data – which almost all IT systems in rail companies require – from the project planning of interlocking systems through maintenance and timetable planning. And even the systems that are important for operations, such as vehicle scheduling, control systems and passenger information, need infrastructure data; albeit in less detail.

Overall context missing

The fallout when individual systems lack an overall context is illustrated by the example of the timetable. The timetable is populated several times by different systems until it is used for scheduling purposes on the day of operation, making it increasingly complex. For example, rolling stock and personnel as well as information for passengers on the platform, on

the train, and for various pieces of online information are assigned to planned journeys. Various target systems are responsible for this. This in turn means that content and special symbols, as well as languages for announcements and special texts, have to be prepared as appropriate in each case. In addition, very different interfaces often need to be operated. This is because the vehicle fleets of rail transport companies are usually equipped with on-board information systems from various manufacturers. Maintaining these communica-

tion interfaces is time-consuming and costly. In such an iterative data enhancement process, basic data modeling that is coordinated in detail between the system suppliers is even more important. Indeed, interoperability and thus the overall success of the project depend on it. This necessity becomes clear at the latest in more complex operating cases, such as multiple wing train operation.

Fit for the future with standards

The fact is that neither a uniform data model nor a standardized exchange format exists between all these systems. Even existing standard interfaces such as railML (Railway Markup Language) or VDV allow too much leeway in modeling, which ultimately hinders fully automatic data exchange, even if it offers a high level of conformity. It is safe to say that a plug-and-play functionality is not achievable due to the complex system architecture in transport companies. However, the importance of standards that are applied comprehensively is increasing even more. This is because they ensure a cross-system data flow, minimize necessary individual adaptations (e.g. custom tags for railML), while also ensuring the necessary modularity to be able to flex-



Comprehensive standards enable automated communication with the overall system.

ibly exchange or renew system components in the future. Therefore, the advice from the experts is clear: Companies should actively promote the (further) development of standards in committees such as railML (see info box). They are also well advised to rely on standards wherever possible and to define their use jointly with all system suppliers. Using the PSITraffic scheduling and customer information system, for example, the enhanced timetable data can be imported and

processed on the operating day for operational scheduling. Finally, to create an overall system, it is important that the networking of IT systems goes hand in hand with the adaptation of the company's operational processes.

Digital and networked

The digitization of processes must urgently be followed by networking to form an overall system. This is the only way to fully exploit the benefits of digitization in the long term. For this to succeed, transport companies need to rely on data modeling and exchange standards, actively promote their further development in existing committees, and break away from the separation between planning and operational scheduling on the IT side.🕒

railML: Standardized data exchange

railML was developed jointly by Fraunhofer Institute for Transportation and Infrastructure Systems (IVI) in Dresden and the Swiss Federal Institute of Technology Zürich (ETH) in 2002 and has been updated in the railML consortium ever since. A non-commercial association of universities and research institutions, software manufacturers, consulting companies and industry, as well as infrastructure operators and rail transport companies, railML e. V. was founded for this purpose. Cooperation is open to all interested parties.

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Product Report: The networking of processes – foundation for a digital railway

Digital Railway Atlas

Most transport companies have not had to deal with paper mountains for some time now. When we talk about digitalization today we mean the step-by-step networking of formerly autonomous and now digitalized processes into an integrated and highly efficient overall system. To be successful, transport companies need, among other things, detailed and complete route data from all their consumers – a kind of digital railway atlas.

Recent progress in rail transport has been characterized by its digitization. This does not mean the mere automation of previously manual and paper-based processes. The actual task at hand is to fully network the many different areas that were previously independent and are now digitized. The main reason: Their seamless interaction in the sense of a “digital railway” opens up considerably more potential. For example, improved punctuality, energy-optimized driving or an optimal train fleet schedule.

Thorough data collection and collaborative planning across all departments will be required in railway

operations, similar to the “Building Information Modeling” in the construction industry, which takes a comprehensive approach from the outset and not only plans the construction but also the subsequent management of the project components. The railway system is significantly more complex and has more diverse requirements, which makes this project more extensive compared to the building industry, but the goal of creating a digital railway atlas is the same: to avoid having to maintain complex and error-prone duplicate data from various individual projects as well as striving to realize synergies as early as possible in the planning.

Cross linking makes the difference

Linking modern interlocking systems and new safety technology makes it possible for carriers to use advanced train control systems (ETCS) that react quickly and efficiently to resource conflicts – to name just one example. They not only detect technical defects or delays, but also analyze their downline effects. Partially autonomous operations in the first ATO implementation projects also require digital modeling of the entire infrastructure.

Cross linking and integrating all areas via (as standardized as possible) interfaces will massively improve the quality of the operational process. Close interlocking of workshop planning, vehicle scheduling and error management in the timetable will lead to a more efficient utilization of the workshop, reduce costs for vehicle provisioning and ensures higher vehicle availability for scheduling.



Regionalverkehr Bern-Solothurn: The Worbla with the Seconda.

The software market already offers commercially available networked systems just for this purpose.

PSItraffic integrates vehicle and workshop dispatching with a train control system (TCS) or a fully automatically train driving system which detects conflicts at the (partial) route level. Even conflict resolutions, e.g., in the event of a changed train sequence or a necessary bypass of blocked tracks, can be calculated and activated with the push of a button.

Data provide the basis for reliable solutions

Because the system also considers all subsequent trips, connections and workshop orders, station inspectors and dispatchers only have to select the desired solution with a mouse click in the event of a conflict, and that provides considerable relief.

If a carrier plans to build a new interlocking system, create a digital remote driving system, introduce automatic train operation (ATO) or modernize the train driving system, having only information on the railway network and signal positions is no longer enough. To benefit from the advantages of digitization and networking of all systems, the entire project development will be required in electronic form. This also includes data which are often hidden deep in the interlocking system design, e.g., signal overlap sections, flank protection and the resulting incompatibility between routes. In addition, all information from flanking third-party systems must also be included.

An end-to-end system must continuously “answer” the following questions as they show which data the overall system needs and must take into account in deciding dependencies:

- When can an interlocking route be set up without hindering other trains?
- Will the just arriving train leave in time to clear the route for the next train?
- Which bypasses are possible and advisable in the event of conflicts caused by delays?
- Under what conditions will the order of trains be changed if some of the trains arrive late from different lines and now share the same route?
- Where are the hazardous areas that may need to be driven at a slower speed?
- Taking into account track layout geometry such as gradients and curve radii, which acceleration is optimal in order to maintain the arrival time with the least energy consumption?
- Which connections have to be maintained, how much room for maneuvering is there and what transfer times are required?
- When does a stop need to be extended by a few seconds to accommodate a connection in case of a slightly delayed feeder line?

Towards a digital railway

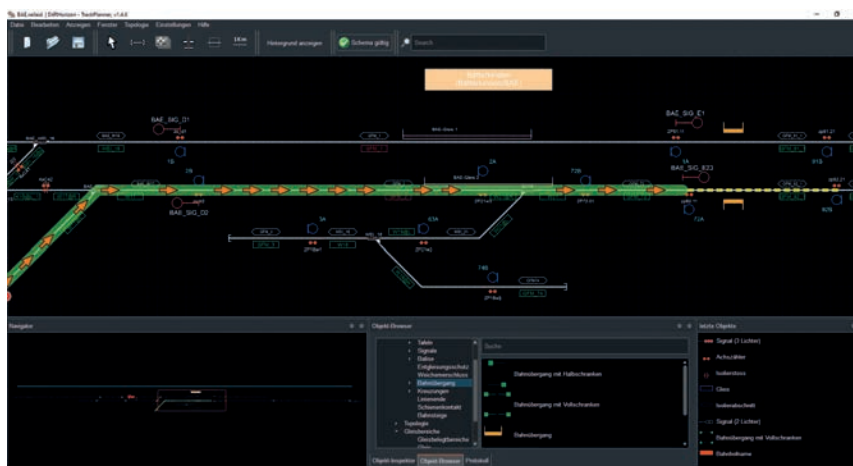
Nevertheless, it is worth working through this phase, especially since a structured approach will invariably avoid surprises down the line. The process typically begins with recording the technical infrastructure on the basis of track diagram documents. The interlocking data (interlocking routes, specified times) are then integrated and checked. The definition of macroscopic network elements – from platform tracks and stopping positions as the basis of external timetable and passenger systems as well as dynamic schedule synchronization – links the railway network with the software components that use less detailed network modeling. Creating backup for regular and alternative travel routes facilitates automatic routing even in the event of a disruption. During the last phase, enhancements are often added from more external data, e.g., GPS coordinates and pull-in ranges for stations/regions. They make it pos-

sible to determine the position and speed of trains on a track section, and the TCS receives precise position information without complex interfaces to the on-board technology.

As a result, all collected data are available electronically and in consolidated form. This way common carriers can prepare for modernization and will also have a reliable foundation for further steps on the way to the Digital Railway. For example, if the route network was digitally captured to replace an outdated interlocking system, it also contains almost all the data that a TCS or ATO system will require. Data for all interconnected systems like data hubs that work on less detailed network models can be extracted as well.

Framework conditions for successful data acquisition

The following framework conditions have proven themselves to be useful for the smooth digitization of a network:



Track diagram (Example).

1. Data collection in standard format

Data collection should be based on a common standard format such as railML or EULYNX. Using a mature standard ensures that the data is complete and consistent and in a well-documented format. This ensures reusability for later projects.

2. Data collection via graphical editor

Using a convenient graphical editor makes the data collection less prone to errors. This editor can be used to identify inconsistencies between the various data sources much more reliably and much more quickly. If the editor displays the configured route with signal overlap section and flank protection, the user immediately sees if a significant error has crept in.

3. Customized views

It is necessary to clarify early in the process which data sources will be integrated in the network data collection, which consumers there are for the data, and how the corresponding data models may differ. Data collection for the track network should be as detailed as possible. An individual track diagram must, for example, generate the following views:

a) Cross linking timetable and interlocking system

Timetable systems often only have a “macroscopic” outline of the network – station tracks and the route options resulting from regular lines. To drive the train, these specifications must be transferred into a detailed track diagram model: If, for example, a train is to be directed from one platform to the next station, the train driving system must assign this specification and it must do this via a sequence of routes that will not run into any conflicts with other trains or route closures.

b) Integration of train driving and interlocking system

Take special care when designing the train driving system topology. It is often equated with the interlocking system view, but it does not always correspond to that: Track sections are often divided into several parts where more than one train can be located, for example with divided platform tracks or in case of defensive/permissive travel (stop, then proceed on sight). The same applies to holding yards which are still built to the classic design without axle counters or insulating joints.

c) Integration of wireless position systems

A complete digital railway atlas also includes the data from wireless position systems – including GPS. They work with spatial coordinates which must be mapped onto track sections, e.g. in certain station areas.

d) Accurate detection of all signaling positions

Systems which in principle work with data of the same depth of detail can still be based on different logics. For example, the interlocking system recognizes sections separated by insulating joints or axle counters and whose boundaries are secured by preceding signals. From the point of view of the interlocking system, if a train crosses a signal, it is already in the next section, although the signal is actually placed a few meters in front of the section boundary. The track layout model must therefore be able to manage “virtual”, consumer-specific positions for some objects in addition to their actual position.

Conclusion

Due to the rapid technological developments of recent years, all required software solutions as well as standards for reliable and secure data exchange are available today. Even if the last details have not been cleared yet, a digital railway atlas can already be used to lay the foundation for a comprehensive, fully integrated planning approach in the railway sector. Anyone who follows this structured system does not need to fear unpleasant surprises. 🌀

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Success Story: infra fürth relies on personnel dispatching system Profahr

Seamless Transfer for Passengers and Drivers

When the new transport service provider took over the bus traffic for the city of Fürth they also decided to take over the established personnel dispatching system Profahr along with it. In doing so, the company not only ensured a seamless transition for passengers, but also deliberately opted for a solution that was tailored to the needs of the transport service.

Transport service operators face a long list of challenges. The tasks include new as well as well-known issues. On the one hand, it is necessary to gradually convert to emission-free drive types in their vehicles and to develop innovative mobility and fare strategies. On the other hand, they must continue to establish efficient, service-oriented processes, all while hiring a qualified drivers pool and retaining them for the long-term. For infra fürth verkehr gmbh (infra

fürth), a transport service provider in the city of Fürth, an additional task was added in 2019: In the course of their takeover of the inner-city bus traffic system from the Verkehrs-Aktiengesellschaft Nürnberg (VAG), the company was also required to procure its own IT systems, such as a personnel dispatching system.

A tried and tested system

“We wanted to create a seamless transfer of operations, without causing any disadvantages for the cus-

tomers or for the transport service,” says Johannes Schuster, describing the initial (the As Is) situation. As operations and transport manager, he bears the entire responsibility for the operation of the inner-city bus traffic in Fürth. His choice turned out to be the established and proven Profahr system also used in Nuremberg, for several good reasons: The decision allowed for an almost 1:1 adoption of the payroll-relevant and work time aspects of the system in Fürth from Nuremberg, as they were almost identical by virtue of the same collective labor contracts and similar work times agreements.

Plus, the system and its transportation service-centric functions were already fully accepted and its benefits had been well demonstrated.



The city of Fürth’s transport service provider carries around 10 million passengers a year on 14 bus routes.

The screenshot shows a software interface for driver scheduling. At the top, there are navigation tabs for 'Beratung', 'Abrechnung', 'Dienst', 'Umsatzplanung', 'Allgemein', 'SR und WFL', 'MOK', 'AGB Verwaltung', 'Quartalsystem', 'Controlling', 'Dokumentation', 'Gefahrenberichte', 'Qualifizierung', and 'Datenmanagement'. Below this, there's a search bar and a date range selector set to '07.08.2020 - 13.08.2020'. The main area is a grid with columns for each day of the week (07.08.2020 Montag, 08.08.2020 Dienstag, 09.08.2020 Mittwoch, 10.08.2020 Donnerstag, 11.08.2020 Freitag, 12.08.2020 Samstag, 13.08.2020 Sonntag) and rows for individual drivers. Each cell in the grid contains a shift assignment code (e.g., D002, A003, N001) and a status icon (e.g., a plus sign, a minus sign, or a red 'Krank' label for sick leave).

185 drivers are dispatched with Profahr at infra fürth GmbH.

The value of industry standards

Against this background, the transfer of undertakings was smooth and almost without incidents: The system schedules about 100 trips on 14 bus lines, which are a total of 185 drivers every day utilizing staff schedule optimization. The company benefits from the many industry standards applied to the solution, e.g., the automatic allocation of available services according to recorded shift statuses, taking into account all required qualifications, hourly accounts, rest periods, etc. This also includes the planning of daily employee trips with the cab pickup service, the 'mixed work' positions (i.e. technical service, dispatch center, ride-pass inspection, driving activities with special vehicles) as well as creating the source data for proper payroll accounting based on the work and holiday accounts of the employees. The additional days off as part of the employee health program as well as any added vacation days created via the collective agreement are recorded there. "All these standards and interlocking processes greatly facilitate the work of scheduling our resources and ensure high efficiency and low error rates," emphasizes Schuster.

Flexible corporate communication

In addition to the valuable standard processes in the core application, infra fürth also appreciates the add-on modules from Profahr, e.g., the integrated education controlling or the Profahr communication module. The latter ensures that mobile employees, such as the driver service pool, also have access to the intra company information and communication programs. Using an internet-enabled device, e.g., a smartphone or tablet PC, the employees can get access to various utilities. In this way they can, for example, call up operational instructions regardless of location and time, call up information on their daily shift assignments and the projected annual work schedule; they can view their work hours and vacation account or enter a taxi pickup request. "The option of confirming assigned services was a major factor in the pandemic, in fact a great advantage, as we were able to avoid in-person contact. In principle, however, we are concerned with involving drivers in corporate communications without detours and at the same time relieve dispatchers, as they

can receive prompt and direct feedback from the employees," Schuster explains.

More flexibility in vacation planning

Further extension plans at infra fürth also focus on the following goals, e.g., introducing on-request vacation planning. With it, the responsible parties want to replace the current division of the driver service schedule into fixed vacation periods and accommodate the desire of the drivers for more flexibility and employee participation. At the same time, the company plans to use a vacation plan optimization tool to retain control of the capacity for deployable driving personnel and to compensate for the fluctuations within an operating year. This also includes being able to tailor staffing requirements in the event of temporary increases in demand.

Keeping an eye on the needs of employees

At the time of the inner-city bus transport acquisition it was clear to infra fürth that there must be a smooth transfer of operations – both for passengers and employees. Using a transport service-centric personnel dispatching system was an important IT component in achieving this goal. With it, the transport company can meet operational requirements as well as the demands on a modern employer. ☺

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Success Story: Münchner Verkehrsgesellschaft mbH uses short-term reserve deployment planning

Short-Notice Reserve Deployment Planning

If a driver is not ready for work in the morning, arrives too late or has to leave early from duty, a reserve driver takes over. In theory this equation sounds quite simple, but its implementation in day-to-day operations can be very challenging. Especially with such a large team as that of the Münchner Verkehrsgesellschaft mbH (MVG): MVG employs more than 2,000 drivers. Therefore, the company relies on integrated processes of its Profahr personnel dispatching system.

“This approach was no longer workable on many levels. With regard to the second question and easy accessibility to the list, for example, it was critical to protect data privacy. But this form of quick reserve deployment readiness was simply no longer

In Formula -1, they are rarely called upon. However, they are always present and ready to go immediately if a regular driver drops out: the reserve drivers. Transport companies such as MVG cannot operate without them. Approximately eight to ten reservists are on standby every day for the route operations. Especially for their daily short-notice business - the uninterrupted staffing of affected services by the dispatchers is not for the faint-hearted. Because then – just like in Formula 1 – high speed, a lot of sensitivity and full concentration are required.



Open services can be filled quickly and automatically.

Tables have become obsolete

In the past, the Munich team worked with an Excel spreadsheet, their Reserve Staffing List. The dispatchers essentially maintained four columns in it:

1. Who is not reporting for duty?
2. Why can the driver not report for their shift?
3. Which services have to be rescheduled immediately?
4. Which reservists are available for this?

To answer the first and third questions, the dispatchers first searched for the relevant data from the per-

sonnel dispatching system and transferred them manually to the list. They filled the second column per their telephone calls, e-mails, etc. To answer the last question, they had to manually compare the unmanned services with a list of available reservists printed the day before, including their respective authorizations. Finally, on the following day, they transferred all the relevant information to their automatic payroll accounting from the paper-based list to the personnel dispatching system. Andreas Pass, Head of Route and Staff Planning at MVG, recalls:

up to date in terms of efficiency, consistency of business processes and operational processes.”

Planning and payroll at the push of a button

Therefore MVG developed a new solution, together with Moveo, that – fully integrated into the Profahr personnel dispatching system – ensures significantly faster, secure and error-free processes: If a driver reports sick, arrives too late or has to leave their shift early, the dispatcher now enters the corresponding information in encrypted form – and thus

in compliance with data protection – directly into the reserve deployment sheet in Profahr. To do this, they use a predefined code, which is stored in the system for each absence reason and can be selected via a drop-down menu. The scheduling and staffing manager emphasizes: “As a result, personal data will not be passed on, and MVG will be in compliance with all data protection directives. The user authorization management in Profahr is instrumental too, which means that user rights are assigned depending on individual activities”. After an entry, the personnel dispatching system automatically accesses all relevant data of the driver as well as of the new route or services in the background. The selected solution takes into account any necessary legal requirements, e.g., qualifications for driving the specific vehicle type or compliance with legally regulated work and break times. The dispatcher then registers at the respective location for the short-notice allocation of the routes. The system not only recognizes and



All data protection requirements are taken into account.


same time – either in tabs arranged side by side or in a small, individually configurable overview.

Faster staffing of open shifts and services

“Faster, more efficient and more secure. These are the main advantages of short-notice reserve deployment planning,” summarizes Andreas Pass.

reserve deployment planning of Profahr takes a lot of pressure out of their demanding day-to-day work.

Schedule reserve staffing without stress

Reserve drivers must be present at MVG as soon as possible when colleagues are absent. With the reserve deployment plan integrated in the Profahr personnel dispatching system, the scheduling department staffs open shifts and services in no time at all and benefits from automated processes that save time, effort and nerves. This means that the company is ideally equipped for short-notice service failures of all kinds and at the same time can meet all personal data protection requirements. 

Faster, more efficient and more secure. These are the main advantages of short-notice reserve deployment planning.

Andreas Pass

Driving and Duty Scheduling Manager MVG

visualizes all unplanned services at this depot, but also the possible reserve drivers. Once it is determined who will take over the shift, Profahr also automatically determines the hours on duty and records them for payroll accounting. The dispatchers can process up to five depots at the

End-to-end digital processes and automated checks of legal requirements ensure a significantly lower error rate and greatly accelerate the allocation of services despite intense time pressure. Dispatchers award top reviews to the system for these same reasons. Because the integrated, short-notice

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Product Report: Profahr Personnel Dispatching

Time Recording for every Work Situation

Work hours, absences, benefits and performance: Employers are obliged to have a system to track and document working hours and mandatory breaks of their employees. Our new time recording module of the personnel dispatching system Profahr offers them the necessary flexibility.

The 2019 ruling of the European Court of Justice (ECJ) came as a surprise for some companies: Because employers in the EU then had to immediately start recording the work hours of their employees systematically and completely and have proof for breaks and rest periods that are compliant with the law. This applies to employees in the office as well as in the home office or in transport services. For many transport companies, these requirements are associated with an enormous, additional administrative effort, which ties up valuable resources and is not even liked by the employees. Although the law stipulates that an objective, tamper-proof system must be used that is accessible to everyone, it is up to each company to decide whether to use pen and paper, email or an app.

Tailored flexibility

Ultimately, a glance into the daily operations shows how valuable digital solutions can be that are flexible and individually adapted to different requirements. This is exactly what our new time recording module from Profahr offers: Companies can use the solution flexibly for a number of tasks and provide access from terminals as well as PCs, tablets or smartphones. In addition, the module is available as a simple or extended, fully integrated version. Opting for the latter will create advan-

tages by using the common data and functional processes of the personnel dispatching system and also from the automatic, dispositive further processing of the collected data. Both versions can transmit the times, recorded via the Profahr communication modules, conveniently and intuitively to the work hour accounts. In addition, employees can view the collected data any time they want.

Option 1: Simple time recording

- Clocking in, clocking out, breaks and duty cycle
- Check-in can be done via mobile devices or permanently installed terminals
- Employee access to the collected data

Option 2: Advanced time recording

- Scope of functions of simple time tracking and recording
- Approval system for the individually recorded data – including authorizations for approvers and their representatives as well as possible time limitation
- Consideration of employee-specific framework conditions such as collective agreements, statutory regulations or work time models
- Management of absences such as sickness and vacation time



Profahr offers flexible check-in options.

- Administration of work time accounts on a monthly and annual basis
- Accounting for and initiation of overtime payments, according to the employee-specific framework conditions

Your advantages

- Legally compliant recording of working and break times
- Convenient, precise time recording
- Easy check-in – mobile or on site
- Automated, dispositive further processing of the collected data
- Individually selectable terminals
- Increased employee satisfaction

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News: Major order from Belgian transport operator De Lijn

PSIebus Will Control E-Buses Throughout Flanders

The Belgian transport operator De Lijn has commissioned PSI with the delivery of the depot and charging management system PSIebus. The system will dispatch, supply and control more than 2,000 buses at over 50 depots throughout Flanders. De Lijn is pushing ahead with the electrification of its buses and their depots, and will convert its entire diesel fleet to zero-emission drives by 2035.

PSIebus will coordinate and dispatch the vehicles and ensure that all buses are reliably ready to start their trips. All depot processes, from parking, supply and workshop, driver registration and vehicle allocation can be mapped in a digital system. The system also incorporates aspects such as the remaining range, the charging status and the required charging time into the charging planning. The dispatching of the vehicles takes place within a few seconds and is based on PSI's own optimization software Qualicision, which determines

the best possible solution in real time based on the operational constraints. The integrated PSI charging management system controls the entire energy demand of a depot and monitors and controls the individual charging devices. In doing so, expensive peak loads are avoided and specifications of the network operator are taken into account.

The new system enables De Lijn to make optimal use of its vehicles and charging infrastructure and ensures the best possible vehicle availability. In addition, PSIebus can be operated

on the IT side in accordance with the rules for the protection of critical infrastructure. 

De Lijn operates an extensive scheduled bus and tram network and several fleet cars in the Flemish provinces in Belgium. The network comprises about 1000 lines, and the vehicle fleet includes 2250 buses and 400 fleet cars. Around 3.5 million people use public transport in the Flanders region every year.

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PSIebus will dispatch, supply and control more than 2,200 buses at over 50 depots throughout Flanders according to demand.

News: Integration of Moveo Software GmbH into PSI Transcom GmbH

Moveo is now PSI Transcom GmbH

Life means change. Our subsidiary Moveo is no exception to this rule! After merging with PSI Transcom gently yet decisively over the course of three years, the next step has now been taken.

Moveo Software GmbH was fully integrated into PSI Transcom GmbH on June 23, 2022.

Your contact persons remain unchanged, but you now have easy access to all PSI products for public transport.

Profahr remains Profahr and is still based in Potsdam. You can reach us at the Potsdam address as usual, but under our new company name

PSI Transcom GmbH.

We look forward to continuing our joint success story which has only just begun and will remain focused on your company's success in the future!

Do you have any questions? If so, please do not hesitate to contact us. We are still here for you as usual. ☺



Moveo is now PSI Transcom GmbH.

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News: Online Marketplace for customers and partners

Industrial App Store from PSI

PSI presented its new Industrial App Store for the first time at this year's HANNOVER MESSE.

The new Multicloud App Store, implemented on the basis of the PSI platform, is an online marketplace offering a globally unique range of PSI software products and services. Customers and partners can discover, try out, buy or upgrade industry software and overarching solutions. The desired ap-

plication is available for testing or unrestricted use in just a few clicks. Procurement and delivery processes for customers and partners can thus be shortened from months to minutes.

The Profahr personnel dispatching system will be available for public transport companies in the store in

the future, while the new PSiEDMS start will also be available for purchase online soon. ☺

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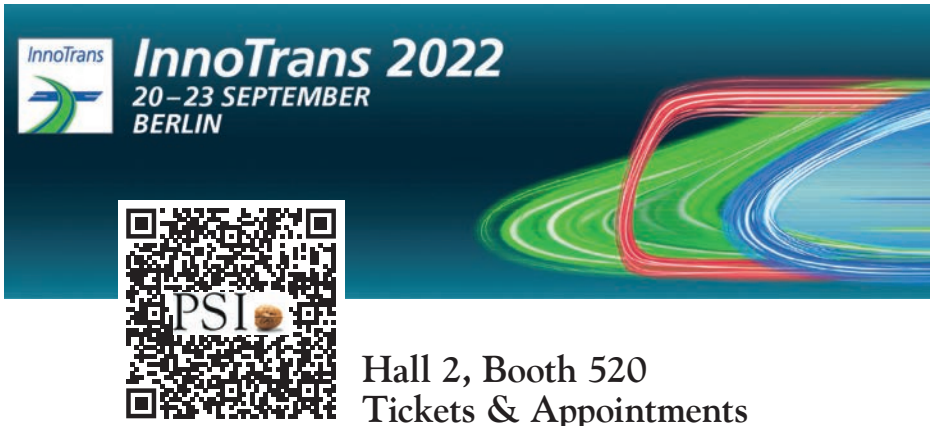
**INTRODUCING
AN INDUSTRIAL
APP STORE**



New at PSI: The Industrial App Store.

News: International Trade Fair for Transport Technology

InnoTrans 2022 in Berlin



Hall 2, Booth 520
Tickets & Appointments

After four years, InnoTrans – the world’s leading trade fair for transport technology – will open its doors in Berlin in September 2022. Of course, we will be there for you in our usual place in Hall 2.1 and with many new topics in our luggage!

With our software systems we support you in mastering current challenges such as

- ✓ the implementation of zero-emission strategies,
- ✓ the control of increasingly complex processes and
- ✓ increasing the availability of personnel and vehicles

Also at the booth: PSI Electric Energy with its system for traction cur-

rent control and monitoring and representatives of the STAPL research project (see p. 10).

In addition to daily presentations, you can also expect a Berlin speciality between 12 and 14:00, in keeping with old trade fair tradition!

Appointments and visitor tickets are available at www.psitranscom.de/innotrans or just send an email to innotrans@psi.de.

We look forward to talking to you!

If it is not possible for you to come to the fair, we will be happy to come to you. Give us a call or send an email to: info@psitranscom.de.

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Product news, trade show news and everything else there is to report, you will find on our channels!



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