Intelligent
MENTZ connects bike rental system to public transport

Integrated
New mobility services for everyday life

United
An overview of public transport in Switzerland
Print is dead? Long live print!

Are you getting less and less mail these days too? Lately, even my bank no longer sends me letters. Instead, I receive emails that remind me of messages in my electronic inbox. Is the end of print upon us? The answer is yes if you believe stock market analysts who have already written obituaries for large printing press manufacturers.

From our perspective, the situation is different: the demand for new and continued development of print products has gone on uninterrupted. This past summer, it was more hectic than usual in the printed products development department before the annual timetable change. Today, print products can be printed on a tablet or PC. They still offer a unique advantage in that thanks to their tabular structure in the book or stop timetable form, they have proven to be the most efficient source of information for the needs of many users. With a quick glance, they provide answers to questions like “when do buses operate?”, “what is the service frequency, how long do I have to wait on average?”, “can I take any bus on this route?” Well-structured information is particularly appreciated by regular passengers who are less interested in a single route, and more interested in the entire range of public transport services on offer.

Printed products were also the focus of our project “QuoVadis”. In this project, an integrated system was developed for the Swiss Federal Railway (SBB) to publish information on all Swiss public transport. SBB was able to create PDF files for all public transport services and allow them to be viewed and commented on by passengers. You can see what happened next starting on page 4.

Modern public transport does not end when you get out of a bus or train, but rather at the customer’s house or office door. For the first and last mile, or the entire route if the weather is nice, Freiburg now offers the Frelo bicycle rental system. More details of the intelligent integration of this mobility option and the creation of a customisable, seamless user experience can be found on page 10.

Not printed, but just as user-friendly, MENTZ has been busy working on displaying integrated, adaptive passenger information on the windows of subway and commuter trains. What sounds like science fiction is currently being tested in the German city of Karlsruhe. Starting on page 14, discover how MENTZ is involved in the successful SmartMMI project.

I hope you enjoy reading,
Extensive and complex: the public transport offering in Switzerland is denser than in most other industrialised nations. So, having to create a timetable for all public transport services every year is a highly complex undertaking.

In cooperation with MENTZ, the Swiss Federal Railway (SBB) has successfully taken up this challenge. In the technologically and organisationally innovative QuoVadis project, an integrated system has been developed for the publication of all Swiss public transport services on MENTZ’s DIVA platform. Since May 2019, next year’s timetable (2020) has been available for download as a PDF or via a web-based journey planner.

Initial Situation
A plethora of service providers are involved in Switzerland’s comprehensive public transport system. The Federal Office of Statistics for the Swiss Confederation estimates that public transport accounted for 24% of the total volume of traffic in 2017. This comprehensive service is provided by a number of different transport providers. Their services are spread across rail, road, cable, and water-based public transport:

- Rail: trains and rack railways
- Roads: trams, trolleys and buses
- Cables: cable cars and funiculars
- Water: boats and car ferries

<table>
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<tr>
<th>Rail</th>
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An extract of the key statistics for public transport in 2015 indicates the solution: integrating diverse data into a standardised information product that can be published using various channels. This requires reliable know-how and an innovative spirit.

The Commission
A new timetable, constructed during an intensive preparatory planning phase, is published annually for public transport in Switzerland. In order to facilitate the process, the Swiss Federal Office of Transport (FOT) has commissioned SBB to centrally publish all public transport services at this early planning stage. In this way, municipalities, cantons, and other interest groups have access to the planning data long before the timetable change. As soon as a first version of the data is available, a multi-stage coordination process is run between the FOT and the various transport companies. The current planning status is continually published on a publication portal until the timetable data is officially approved and then it transitions to the productive phase that results in the timetable change.

The Project
Until it is completed, the planning phase requires iterative evaluation and consolidation of the data. MENTZ is providing the requirement-specific system environment to ensure that the data is collected and prepared for publication. Applications, processes, and infrastructures were developed in the QuoVadis project, which was launched at the beginning of 2018. The objective: starting from May 2018, the implementation of all customer requirements within a planned project period of 18 months to be completed by a project team from the MENTZ offices in Zurich and Munich.
The comfort of being well informed while travelling

The Challenges
Which components are involved and what is the data flow? The network structure and the establishment of data flows play an important role in the distributed QuoVadis system. The timetable information from all service providers in Switzerland is imported into the DIVA platform from SBB’s central data collection system. The data is transferred in “Hafas Raw Data Format” (HRDF). The DIVA planning system stores the imported data as the basis for further processing. The consolidated information serves as a source for publication and journey planning.

How are the timetable data prepared?
The timetable is prepared using the new DIVA Client. The volume of Swiss data totals approximately 250,000 trips. The timetable blocks are constructed from the complete set of trips using the proven compositing technique. During compositing, trips from different routes are combined and stored as a separate route. The existing composite technique was expanded within this project in order to establish a conceptual difference between routes and trips.

How are conceptual differences bridged? Problematically, in the HRDF format and within SBB’s planning philosophy, there are only trips and not routes. Connections are modelled via route sections that are served by different trains. These trains either do not have a route number at all, or the planner does not know them. DIVA however, requires the route number as a main criterion. Without this information, data is only accessible using workarounds, and for this reason a substantial reworking of the compositing technique was deemed necessary. This particular issue was solved with the "trip filter module". It allows direct access to the trips, even without the route numbers.

How are standardised routines for data preparation created?
Filters and search criteria support the data selection. The results then flow into the composites or connections. Similar to compositing instructions, the filters can be stored and reused. They can be recalled after each update of the DIVA original data from the SBB collection system and serve as a schema to construct timetable blocks. The output of the process generates almost 3,000 routes, which then are managed by the editors responsible for their publication.

Which challenges with regard to data presentation have to be overcome? The publicly available trips from the railways occupy a large portion of the database. Their presentation presents the system with complex challenges: the publication of a high frequency train route between Bern and Zurich poses greater technical demands than the preparation of information for a single bus line. Many different types of trips with different train numbers, origins and destinations, day validities, and notes operate on the train route. All this information must be displayed for each trip.

How is a layout suitable for publication created? One of the most challenging tasks during the project was to map all the conceivable variants using uniform presentation rules. Eventually, the project team was able to develop a uniform layout design in collaboration with the SBB via a separate working group. Like all standardising processes, the solution required compromises. Another important part of the project lay in finding an optimal balance between all the requirements. The effort required to follow through with these challenges is worth it because the advantages are obvious: the uniform solution significantly reduces manual effort during production, contributes to consistent recognition and is a decisive prerequisite for a barrier-free publication that is “simple and clear”.

How are the timetable data published?
During the planning phase from May to mid-November, the timetable blocks generated in DIVA will be published via the www.fahrplanauskunft-oev.ch portal. When the official timetable is published in mid-November, the timetables will be available at www.fahrplanfeeder.ch.

Additional planning data can be accessed using the EFA journey planner at www.fahrplanauskunft-oev.ch. The data can be fully published via various media channels. The material is available to all interested parties in several different languages. In order to reach the public without any restrictions, the concept of cross-media access has been deeply embedded. The PDF files are read-able using a screen reader and the layout design of the web-based journey planner demonstrates the effectiveness of the technical platform.

The solution creates the complete knowledge for a barrier-free publication.

The Technology
In the QuoVadis project, the design of the system modules and their underlying infrastructure follows the latest technological concepts. DIVA R18, which at that time was still in development, served as the base application from an early stage in the process. In addition to the latest application modules, the technical platform is also ground breaking. The system is based on a PostgreSQL database hosted in the cloud via Amazon Web Services (AWS). This solution has proven to be hassle-free, reliable and stable throughout the entire duration of the project. Such a positive experience re-affirms MENTZ’s strategy to increasingly focus on powerful and flexible cloud technologies both now and in the future.

The Method
Similar to the strength of the technical platform, the quality of cooperation amongst partners is crucial for the success of the project. For this reason, the SBB and MENTZ are committed to discovering innovative methods of cooperation. Project management and development are organised according to the scrum agile process framework. The core aspect of this method is close, regular and continuous communication within the entire project team, especially and across all roles such as project planners, business analysts and software developers. The intensive exchange of information fills the team’s calendars with daily and weekly, forward-looking and retrospective rounds of planning. Demos, roadshows, and retrospectives bind all stakeholders into the project’s progress.

The densely-structured coordination process is rather time-consuming for everyone involved, but it enables transparent, open communication and immediate feedback from the client and user. The result is a set of targeted interventions in short development cycles and, as a result, solutions are developed that meet the customer’s specifications and expectations. The close working context of the agile process framework expressly acknowledges the fact that functional and technical requirements can change during the course of the project as the level of insight into the required solutions emerge. This methodology thus demands a high degree of flexibility and personal responsibility from all parties involved.

The Result
Consistent innovation in the project has paid off: milestones which have been successfully completed within the agreed time frame have proven the effectiveness of this method of collaborative working. The powerful technical platform makes it possible for up to 60 employees to work in parallel on the system before the major publication phases. The remaining work packages will be completed in 2019, and the first system enhancements have already been planned.

Cooperation between the SBB and MENTZ includes both the QuoVadis and other projects. After an invitation to tender in 2017, the SBB awarded a framework contract to MENTZ which includes a whole series of joint projects. What all these projects have in common is a focus on customer information. As part of the implementation process, technical solutions will be developed, most of which will be integrat- ed as extensions to the DIVA/EFA standard products. Successful cooperation with the Swiss Federal Railways, a worldwide leader in the area of mobility, will also bear fruit for other MENTZ customers, as the innovations developed in the QuoVadis project will be available for all future projects.

The comfort of being well informed while travelling

The Challenges
Which components are involved and what is the data flow? The network structure and the establish-
Arrive fast and easy – with an info system that links different modes of transport.

Publication example for a cable car in Western Switzerland

Publication example for a train route in the Canton of Zurich

The DIVA timetable blocks are published with an info system that links arrival fast and easy –

Remarques


Between Chalais and Vercorin:

Average altitude: 1,820 m
Average descent: 782 m
Average time: 7 minutes

User-friendly presentation:
The route suggestions are presented as a continuous route with all modes of transport, connections, times and locations. The display allows for quick comparison of the calculated variations.

Interview

“The basis for successful project work: open communication”

As a product owner in the scrum team of the QuoVadis project, Laurent Prod’hom is responsible for the specification, prioritisation, communication and distribution of tasks and requirements. We spoke with him and asked him about the specific factors that lead to the successful and timely completion of the project.

Mr. Prod’hom, how was your team able to implement such a comprehensive and complex project within the planned time frame and including all the functionality? The basis of our successful project work is constant, open communication. Technical and organisational challenges, but also unexpected issues can only be overcome through a cooperation which is founded on honesty and trust.

How did the agile framework affect team processes?
The framework strongly supported our team processes. Joint planning rounds and retrospectives helped us to become tightly knit. They strengthened our willingness to commit to the project and compromise when necessary. They also gave us a sense of what our priorities should be.

What insight did you gain during the project?
A comparison between project visions and the functional scope of DIVA’s technical platform is essential. What is also important is intense dialogue amongst all project participants about expectations, requirements and goals.

Which topics should you focus less on at the beginning of the project?

The functional scope of the production process. This is not a great priority at the beginning. More important is the result, the artefacts (timetable fields). Team-building activities should definitely be done in advance for optimal collaboration.

Replacing software that has been in use for almost 30 years will always lead to scepticism among its primary users. At the same time, expectations of the new product will be rather high. Due to unfamiliarity in use, the old suddenly seems better than the new. How did you manage to combat negativity and foster a positive attitude toward the change?

We fostered a positive attitude by regularly involving the primary users and stakeholders at an early stage in the project. In collaboration with the project team, we defined the requirements, implemented them and then presented the results to the primary users in a demo after each sprint. Other important actions we took included early training sessions for the core team and quick implementation of change requests, which were gleaned from primary users’ regular feedback loops and then prioritised according to their importance.

Mr. Prod’hom, thank you for your time.

Interview by Michael Stahl.
Freiburg is preparing for mobility 4.0 with new transport concepts. The way to innovation: the smart combination of services from Freiburg public transport (VAG) and the bike-sharing company nextbike, that advocate “using instead of owning”. MENTZ provides the digital infrastructure to integrate both systems, and by using the VAG mobile app users can efficiently combine the mobility services each provider offers.

The Federal Environmental Agency outlines a vision for the city of the future under the banner “priority for eco-mobility”: Commuter journeys in a city, whether they are done on foot, by bike or on public transport, can be managed safely, flexibly, comfortably, timely and cost effectively.

Integrated mobility services like car-sharing, bike rental systems or online car-sharing services complement public transport and are networked with one another.

Freiburg public transport has recognised the current trend. In cooperation with nextbike, it has implemented a multimodal transport concept where public transport and the bike rental system perfectly complement one another.

With nextbike, VAG has a partner that is an established professional. The Leipzig-based company is one of the European market leaders in bike-sharing, has over 14 years of experience in the industry and manages projects in more than 200 cities worldwide. When setting up its bike rental systems, nextbike cooperates with municipal administrations, transport companies, universities and local companies. Integrating its own services into existing infrastructures is part of its business strategy.

»Part of Freiburg’s commitment to sustainable mobility is its bike rental system "Frelo". A joint venture between local public transport companies and the Leipzig bike-sharing pioneer nextbike enables new options and makes moving around the city a breeze.

Freiburg bike rental system: important building block for a multimodal transport concept

Customer project
MENTZ designs the multimodal journey planner in Freiburg, the centerpiece of an innovative transport concept where public transport services and a bike rental system complement each other seamlessly.

Product
Journey planner app and algorithms, which combine public transport and bike rental offerings into a seamless, customisable service

Function
Networking of mobility services to conveniently plan individual routes and choose suitable modes of transport

Contact
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Germany, Freiburg

Multimodal Journey Planner – Freiburg
Convenience for the daily commute: rental bikes get people moving and lets them enjoy a city in a whole new way.

The goal: 400 bikes at 56 stations

In Freiburg, nextbike operates a station-based bike rental system that has set itself the goal to provide 400 bikes at 56 stations. Users can freely select where they pick up or return their bike. An additional option is a parking mode, where the bike can temporarily be parked during the rental period. Rentals and returns are done by customers on-site at a station terminal, by customer card or hotline and even more conveniently by app.

The VAG mobile app coordinates between the VAG timetables and the bike rental service. The user-friendly journey planner makes planning convenient with individual routes and the selection of suitable modes of transport. The concept works: networked mobility services allow for more travel convenience and an improved quality of life thanks to the flexibly available, cost-effective transport options for the city, with the added value that they are also resource and environmentally friendly.

Multimodal journey planner: the bridge between public transport and bike rental

Using the VAG mobile app, Freiburg’s transport users have an easy-to-use tool for connection and time-based planning, as well as for bike rental. The technical platform integrates public transport services with the bike rental system. Users can plan a normal journey using public transport, but they can also calculate an alternative route using Frelo. The app provides an overview of the Frelo stations that have bikes available for rental and where they can be returned. Rental starts when the QR code on the bicycle is scanned, and ends with activation of the bike frame lock at a destination.

Users who wish to access multimodal transport services via the smartphone app only need to register once, free of charge with nextbike. Each additional login to the system can then be done using the VAG mobile app. The app communicates with the nextbike platform via interfaces to handle the logins and rentals.

The main advantage of the VAG mobile app: its integration function.

The particular strength of the VAG mobile app is its ability to access the services of both providers in the multimodal transport system, and to link these services to one another. In this way, users can quickly, securely and conveniently select their preferred transport route at any time.
» SmartMMI – individual and context-dependent: Passenger information for mobility 4.0

Within the scope of the project, MENTZ provides a backend with the latest modules for intelligent, proactive journey planning. Its other responsibilities include the implementation of an innovative app with a new operating concept specially tailored to modern mobility. The Federal Ministry of Transport and Digital Infrastructure is funding the project as part of the mFUND research initiative (modernity fund).

The objective: more convenience for regular users of public transport

A range of different groups use public transport. Correspondingly, the frequency of use, knowledge of mobility services, expectations of services, and the willingness and competence to use technology means that the experiences of obtaining targeted information to get to their destination are mixed.

Young people account for the largest share of public transport users. Regular public transport users are familiar with their daily routes and already have at least a basic knowledge of timetable information.

In frequent passengers need more basic data like available routes and travel times. Experienced passengers appreciate information about current events/disruptions. In this regard, conventional systems are not sufficient. Passengers have to get information by themselves. If they do not, they receive key information about their journeys either too late or not at all. There are apps that report disruptions by means of a push function, but their setup is technically complex, making them unpopular.

The SmartMMI project makes mobility information context-sensitive, simple and user-friendly. The information is displayed on intelligent, transparent display screens that can be installed in public transport vehicles and at stops. The display of sensitive data related to an individual’s mobility behaviour is performed by customisable applications for use on passengers’ mobile devices.

MENTZ’s contribution: intelligent backend modules and an innovative app

Mobility 4.0 focuses on passenger convenience. The SmartMMI project fulfills this need using an intelligent information system. It uses innovative technologies to capture, integrate and display mobility data. MENTZ is developing a backend with the latest modules for journey planning, real-time and event (disruption) management, as well as the provision of push notifications.

Beyond that, an app is currently under development that boasts a completely new operating concept. The user interface can be individually customised by users. All standard functions can be accessed, just like in conventional public transport apps, such as basic information about journeys, departures or disruptions. In addition, users can manage personal content linked to their mobility behaviour. Similar to a pinboard, users can store tickets, maps and favourites for quicker access. Users can set up the interface as they desire.

The technical way: maximum flexibility and adaptive behaviour

The app proactively provides relevant information and saves users the trouble of complex configuration tasks. For the context-sensitive push function, the app communicates with a portal created in collaboration with USU Software AG. Implementation is unique in that the portal automatically learns which information is relevant for users. For example, the application recognises that passenger X gets on bus route Y at bus stop A daily from Monday to Friday at 8:00 a.m. and travels to bus stop B. The portal is also connected to the modules of the MENTZ backend system and thus remains informed about events/disruptions that affect the timetabled journey. If bus route Y does not arrive punctually on Thursday morning at 8:00am at stop A, two proactive reactions are possible:

- SmartMMI enables context-dependent display of information. A train window can thus transform into a transparent monitor that displays information for timetables, weather, location and more.
- SMARTMMI enables context-sensitive push function. A train window can thus transform into a transparent monitor that displays information for timetables, weather, location and more.
The potential: extendibility for an optimal user experience

The performance meets all the expectations of a smart system, without having to set any desired functions up front. Passengers are individually informed, interactively and in real-time as soon as a disruption occurs. The strength of the system lies in its extendibility. In addition to disruptions and delays, many other parameters can be incorporated into the context-sensitive information in the future.

It is even conceivable to link individual or mobility preferences with current weather data. If a passenger usually gets on the bus at a stop without a shelter, a better alternative could be suggested on an unpleasant rainy day. Alternatively, the app could recognise that a user repeatedly buys single tickets for regular journeys and suggest a cheaper option. Calculating alternative journey options could also take into account membership of transport sharing providers or any other savings options.

The advantages for passengers are rather obvious. But the transport authorities and companies also benefit from the advantages: on the one hand, the system offers the possibility to further optimise public transport while offering passengers an optimal user experience.

The status: research and development go hand in hand

SmartMMI may be the passenger information of the future, but all aspects relating to user-friendliness can be realised right now. MENTZ is working closely with Karlsruhe University of Applied Sciences on all usability issues. The goal is to study the acceptance of smart mobility services, with a focus on how services can be optimally presented in order to successfully introduce users to the technology and overcome any possible hurdles.

As part of the development process, the second prototype is about to be completed. The new functions will be integrated into the existing dashboard app. A field test will follow in 2020 during which the third prototype will be used. By then, it will be able to show the complete functionality of the defined use cases.
At America’s second largest commuter rail operator, the past is still alive, at least in the train operator’s job titles, which include “brakeman”, “engineer”, “conductor” and “assistant conductor”. As in those days, they take on important jobs onboard the train, but now they no longer need to have broad shoulders and have the strength of a weightlifter to operate the brakes. Also, the quality of the rolling stock is now so high that an engineer no longer has to remain onboard at all times. The “brakeman” role has transitioned into something similar to a conductor who looks after the well-being of the passengers. The train is controlled by the “engineer”, who does not need a degree in engineering.

Since June 2019, the transport system in the Chicago area, called METRA, has been dispatching all driving personnel using DIVA, MENTZ’s interactive transport management system. Be sure to pick up the next issue of the MENTZ magazine to find out how it works.