Dear Reader,

as this year comes to a close, a new issue of MENTZ MAGAZINE is now available and full of interesting topics.

First we report on a real-time project in the South West of England. This region includes the county of Wiltshire where Stonehenge is located. The ancient monument was named a world heritage site in 1986. The most advanced technology, however, is a MENTZ-installed system for the integration of real-time information of the region.

The second article also deals with real-time. Filsland, an area near Stuttgart, is now using AVM Light by MENTZ. A range of new functionalities is described, in particular the display of vehicle positions on schematic route maps.

The next article is the third about real-time. In Sydney, the AVM systems supply the GTFS-R format defined by Google. To process the data in EFA systems, SIRI or VDV-Format is required. These are not only different formats, but also require specialized supply and processing. We describe how these technical challenges have been successfully overcome.

The last article deals with the electronic mobility service for the Rhein-Neckar Transport Authority (VRN). It combines classic real-time journey planning with modern transport offerings like car-sharing and bike-sharing. The information is presented in the EMA layout, which works optimally on desktops, tablets, and smartphones.

In the news in brief section we report on the user group in Düsseldorf, on the MENTZ exhibit at the InnoTrans and on the new ‘Open-Data-Platform öV Schweiz’.

I wish you a happy holiday season and all the best for the new year.

Dr. Hans-Joachim Mentz
Region South West, Great Britain

Customer
Traveline South West

Project Scope
Supply a data broker and integrate real-time data to EFA

Key Figures
5.34 mil. inhabitants
24.000 sq km area
Important locations: Stonehenge, Tintagel (Arthurian Legend), Salisbury Cathedral

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Customer Project
Real-Time for Traveline South West, GB
In England’s South West there are many decentralized operating systems for real-time data supply of departure boards and other services. The dynamic data integration platform DDIP is England’s first region-wide and central operating system for the exchange of real-time information in public transport. A consumer of the information is the journey planner system, Traveline South West.

With nearly 24,000 square Kilometers, the South West is the largest region in England. The size and historical character necessitate structural differences that are also reflected in the region’s public transport. Easily accessible public transport (PT) in cities contrasts with very rural areas where transport services are correspondingly sparse.

The city of Bristol, as the most important economic zone, is one of nineteen transport authorities in the region for which the “South West Public Transport Information Ltd”, or SWPTI, is responsible for coordinating public transport data. Since 2010, the authorities, which are integrated into city- and county councils in England, use the multi-tenant capable DIVA system to maintain and process the stop- and timetable data for the Traveline South West regional journey planner (cf. mdv News II/2010). In order to be supplied with real-time information, automated vehicle monitoring systems (AVMs) are available at the authorities and the largest bus companies: Stagecoach, First and GoAhead. The systems supply both local monitors/displays (PIS) and a nationwide mobile service for real-time bus departures, the so-called Nextbus system. Ever since bus deregulation in 1985, operations have been transferred into private hands. There are also many smaller bus operators that do not maintain their own AVM or supply an external AVM. Many of these smaller companies have a GPS-based electronic ticketing system (Electronic Ticket Machine- ETM) that centrally collects and transfers bus locations. Due to the current budgetary policies it is necessary to consolidate and centralize the real-time data systems with their decentral organization at authorities and companies.

Although AVM systems are nearly comprehensive, an exchange of real-time data does not exist between authorities and companies and there is no supply to external systems, like EFA. The AVMs have put a focus on their own local areas, which results in cross border transport or other means of transport not being sufficiently covered. This situation should fundamentally change with the introduction of the DDIP. Real-time data should be centrally available in the future. During the concept phase, the following objectives were established between the SWPTI Ltd and MENTZ:

1. The dynamic data integration platform DDIP is to be centrally installed and operated at the SWPTI.
2. Via the DDIP an exchange of real-time data is enabled between the AVMs.
3. The entire real-time data exchange is based on the SIRI protocol.
4. A module is required to calculate real-time data from vehicle positions and make it available via interfaces that can be used by other systems.
5. The current number of 11 existing individual connections (per authority AVM) to the Nextbuses system are to run centrally over the DDIP. As a result, only one connection is required.
6. Local displays (PIS) will receive real-time via the DDIP and therefore also be able to display the departures of other AVMs or other means of transport.
7. The real-time data should flow into Traveline South West (EFA) to increase the acceptance of the journey planner among the public and to contribute to sustainable development in the region.

These defined goals required a detailed analysis of the data situation, which MENTZ performed in collaboration with the regional specialists at SWPTI. As one of the first steps the system architecture was developed that includes the data flow from the available AVMs to the DDIP and the consuming systems Nextbuses, EFA and the displays. MENTZ AVM Light also served as a supplying AVM, which generates trip-based real-time information from bus positions and transfers it via a SIRI interface to the DDIP (Fig. 1).

The installation of DDIP, of AVM Light and the components required to operate EFA took place at SWPTI after procuring the required hardware. When the first data sets were flowing into the system, it was quickly apparent that all the real-time data sources are useful in their own way.

The operator AVMs and AVM Light are the main sources for the journey planner data. Conversely, the authority AVMs are the optimal source for the Nextbuses system. The displays (PIS) rely on all data that is available via the DDIP. This complex orchestration of real-time data flows can be assured with the existing DDIP based on SIRI (see explanation of SIRI).
As such, the integration of real-time data into the journey planner represents a special challenge. All available real-time data sources in the region must be collected by DDIP to form a consistent flow of real-time data and be transferred to EFA using a fail-proof subscription process. To achieve this, DDIP supports the SIRI function service ‘estimated timetable’ (ET). As soon as real-time data are available, departure boards and journey plans can be calculated considering the current network status. The departure board displays stop-based real-time information to notify users about possible delays. This information is especially helpful when passengers are already en route and need to know when their bus will arrive. It substitutes for a digital passenger information system (PIS) at stops (Fig. 2).

A planned journey not only displays route information, but also integrates delays, cancellations and other related data into the routing of the trip. Arrival and departure times are adjusted accordingly and new journeys are provided in cases where unforeseen transfers are required. The use of real-time data from DDIP in EFA enables special services like displaying the current location of buses. Since the real-time positions of buses are regularly adjusted in the new Traveline South West layout, users can effectively plan when to leave their home/office to catch the bus.

Currently there are several authority and operator AVMs connected to DDIP at SWPTI and their data are integrated into EFA. Work is ongoing to connect other smaller companies using AVM Light to the remaining real-time data sources of the region. As soon as the region-wide supply is complete, the AVMs of the transport authority and companies can exchange real-time information with one another. Indeed, a guaranteed connection can be realized using a duty SIRI CM supported in DDIP.

The integration of real-time for trains is planned as a next stage to further expand the offering of more reliable information in the Traveline South West journey planner. The railways in England have their own system (Darwin) to transfer the train movements and predictions to DDIP. As a result, there are no longer any limitations to the variety of potential services, they range from guardian angel and companion functions to notification services and changes to the timetable.

The complete package of services promises to achieve cost savings and advantages through process optimization in the organization of real-time data, but most importantly through sustainable and efficient development of the journey planning system. The overall aim is to strengthen confidence in public transport.
We spoke to General Manager Ian Miller and Data Development Manager Andy Hole

Why do you consider real time information as important for your system and the South West region?

Since being set up in 2000, Traveline South West has provided a comprehensive, integrated and impartial journey planning and timetable database service for all public transport journeys across the south west of England. The local transport authorities and operators who run the service have always looked to improve what is offered, to keep pace with the demands of users across the region. Initially, 99% of enquiries were made by telephone to our call centre. But growth in the everyday use of technology and digital media since then has seen use grow and switch to 99% via internet, text and mobile apps and devices, with less than 1% now being made by telephone. However, the service is still largely based on scheduled, timetabled information. Research conducted locally by SWPTI, who provide the Traveline SW service, has shown that users not only want accurate information provided across a range of channels, but that their expectations is for journey plans to reflect actual conditions on the day and to take account of changes almost as they happen. This is mirrored by the results of national research in the UK, by user’s representative body Transport Focus, for example. When this is compared to the fact that around 50% of our enquiries are for journeys within the next hour or two, it was clear to SWPTI that we needed to switch to using Real Time Information wherever possible to keep up with our market demands and raise our service to the next level.

What challenges were you facing during the implementation phase?

The SWPTI Board had a one-off opportunity in 2016 to make an investment to improve the Traveline SW offering using reserve funds, but needed a payback on that investment over the next 3 years or so in order to justify the expenditure. So, a proven system was required. However, there were challenges both in the provision of data to the DDIP system and in ensuring that data from smaller operators, who provide around 20% of bus services in the region, could take part via AVL so that our dataset remained as comprehensive as possible. When the SWPTI Board approved the purchase of DDIP earlier in 2016, there were potentially two ways of providing data feeds into DDIP. Unlike in most of the rest of Europe, the responsibility for the planning and operation of services largely rests with private sector operators, with larger companies having invested in their own vehicle location systems to aid performance monitoring. This would mean fewer data feeds overall, and make good use of investment in the “Ticketer” ETM with AVL capability for smaller operators by South West Smart Solutions Ltd. But it was relatively untried as a method. Alternatively, feeds could be taken from existing RTI schemes founded on on-street signs and hoping that financial austerity for local authorities in the UK would not lead to the schemes ceasing and data drying up. In the end, the option to take data from operators where possible was taken, as this is judged to give longer term stability. There was also the challenge that SWPTI is a micro company without large resources to call on. But a combination of close working, input and advice from Mentz and wrapping our Data Manager, Andy Hole, in cotton wool to prevent damage during the project has meant that we have made progress! We are also in the process of updating our website and mobile apps to give a more modern platform on which to present the upgraded data.

What are the next steps the South West region plans to take based on the available real time information?

The initial task was to display RTI in journey plans and departures across our websites and apps. We will now move on to provide a single, combined feed for the GB wide “Next Buses” platform, then investigate providing feeds to on-street signs and to areas without good RTI coverage at present. We also need to take account of any demands in the forthcoming Bus Service Bill in the UK, for example by enabling even smaller operators to provide audio visual “next stop” and route details on-bus. This will need careful planning and roll out as well as taking in further feed types from operators. However, the aim is to be able to provide output of Real Time Information on a consistent, comprehensive basis across our region, at a competitive cost to our Local Transport Authority partners. The win-win situation will be for DDIP/AVL to help secure SWPTI’s funding and future, while providing an increased level of service to users and partners across the South West of England – but it will take more investment and hard work to achieve that goal.

Real Time for Traveline South West
Customer Project

On time in ‘die Hölle Süd’ (literally: hell of the south)
Side Facts: The ‘Filsländer’ (resident of Filsland)
Locations: Göppingen, Geislingen an der Steige
Passion: Handball
Team: FrischAuf! Göppingen
Previously, passenger information was based on static scheduled data which was centrally managed in Filsland Mobility Network’s DIVA system and then supplied to the VVS. In order to improve passenger information with real-time data the FMV evaluate different systems, among which was the existing Regio-AVM of the VVS. Due to technical and economic factors, a decision was made in the summer of 2015 to procure MENTZ’s AVM Light System. It was purchased in cooperation with the VVS, who also operates the system in its computing center.

During the first half of 2016, a second-generation AVM Light, which is composed of three components, was installed at the Filsland Mobility Network and at the VVS (see also MENTZ MAGAZIN 2/2015).

The vehicle component solely consists of a smartphone and an app. Because today’s smart phones have reliable GPS positioning, it was possible to do without the previously required external GPS antenna. This significantly reduces the effort involved in having to equip vehicles. In addition to transferring position data, the app is used for duty login and communication with the driver regarding trip status and planned or guaranteed connections.

The background system, with its new PostGreSQL database, collects the location information and continually calculates new predictions for all current trips and any subsequent trips in the vehicle block. This real-time information is forwarded to the control center component, and to the VVS data platform in VDV 454 AUS/REFAUS format and thus to the connected passenger information systems.

Similar to the entire AVM, the control center component is completely multi-tenant capable. Using the web layout, users of each individual transport company only have access to the precise data that was authorized for their use. Using function rights, each role in an operation can be optionally defined to fit the tasks of individual users. The new control center is an extension of the Event Management Systems (EMS), which was developed in the last few years. It can be seamlessly integrated into the system. In this way, employees in the control center can use the AVM and event management functions in one single layout. This greatly reduces the workload, especially in case of an incident or cancellation.

On the way to the handball stadium, to work or during leisure, a ‘Filsländer’ (resident of Filsland) with an affinity for public transport moves about using the Filsland Mobility Network (FMV). This network includes 7 bus operators with a total of 130 vehicles. The area of service in Filsland comprises the small towns of Göppingen, Geislingen an der Steige and the surrounding region. Passenger information can be found in the web portal and the app of the Stuttgart Transit and Tariff Authority (VVS).

Currently, AVM Light is in trial operation for the seven operators of the Filsland network. We fully expect this phase to be successfully completed in the near future. At that point, the ‘Filsländer’ will know when the bus will truly arrive on the web, using an app and even at the stop.

Prompt integration of other bus operators in the surrounding areas of the VVS is already in the planning stages.
Customer Project

EFA real-time with GTFS-R

Sydney, Australia

Customer
Transport for New South Wales (TfNSW)

Project Scope
Supply of journey planner
With real-time from GTFS-R
www.transportnsw.info

Key Figures
New South Wales (NSW)
7.5 Mil. inhabitants
800,642 sq km area
Capital Sydney
4.6 mil. inhabitants

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Within an open data framework, Transport for New South Wales (TfNSW) is making real-time information available for almost every transport authority in New South Wales (7.5 mil. inhabitants) using GTFS-R. The data comprise not only public transport in the metropolis of Sydney with a population of 4.5 mil., but also regional transport and a large amount of school transport.

In order to use the real-time information from GTFS-R in EFA when calculating journeys, the data has to be converted into SIRI ET. In addition to the peculiarities of GTFS-R, a number of so-called “polishing rules” were defined to detect inconsistencies and correctly process the supplied data.

In the last few years, TfNSW has put increased value on the supply of real-time data to external developers. Today there is a range of common apps that use this data. As part of the re-development of their internet presence, real-time data are used as well as a responsive web design (for mobile & desktop) and a number of new ideas for the presentation of timetable data.

**General Transit Feed Specification - GTFS/GTFS-R**

Using GTFS, the static scheduled timetable data are defined (routes, stops, timetables, calendar etc.). Real-time format GTFS-R is based on GTFS, which is why the content of the GTFS scheduled timetable data must match the GTFS-R data and vice versa.

There are three services in GTFS-R:

- **Trip Updates** – provide all changes of the scheduled timetable regarding delays and early arrivals, additional trips, skipped stops, and trips cancellations (comparable to SIRI ET)
- **Service Alerts** – provide all notifications regarding incidents in the network. (comparable to SIRI SX)
- **Vehicle Positions** – provide the current position of all vehicles in the network (comparable to SIRI VM)

**Data Flow with GTFS and GTFS-R in DIVA/EFA**

Processing of GTFS-R data occurs in two parallel processes: in one process, the scheduled data (GTFS) are imported daily to DIVA. The GTFS data contain the yearly timetable and the daily timetable of the next day, which is supplied by SIRI via the reference service SIRI PT.

Parallel to the aforementioned process, the GTFS-R data (incl. GTFS data) from the GTFSProxy module are polished (see below) and converted to a SIRI ET subscription by the GTFS2ET module.

Finally, the SIRI agent sends the SIRI ET data to the EFAPTKernel, which takes the available real-time information into account when routing.

**GTFS and GTFS-R in Sydney: ‘Polishing Rules’**

The GTFS(-R)-data in NSW have many features that are not covered by the GTFS(-R) specification. For example, there are trips that do not transport passengers, which also have to be accounted for in both the scheduled data stream and in the real-time data stream.

Another interesting example is the real-time data of Sydney’s light rail system. It travels from the Central Station to Dulwich Hill and back. For trips from Central Station, due to technical reasons the AVM system of light rail can only generate real-time data starting from the fourth stop. This is not optimal from a customer’s perspective because Central Station and the subsequent stops are the most important boarding stops of the light rail system. The GTFSProxy generates real-time data for these trips by extrapolating the previous trip in the vehicle block.

As these two examples have demonstrated, in addition to converting from GTFS-R to SIRI ET (process: GTFS2ET) it is important to implement a process that modifies the GTFS-R data according to specified rules (GTFSProxy). In NSW, there are approx. 15 rules in the project that have been labelled ‘polishing rules’.

**Experience during Implementation**

A decisive factor to successfully implementing this project is the technical exchange with the data suppliers. GTFS and especially GTFS-R are formats that leave a few questions unanswered.
For example, in GTFS-R there is not one single required field, all fields are optional. Accordingly, there are a number of ways in which the specification can be interpreted. As a consequence, individual use cases or standard scenarios, and how they should be depicted, are not discussed.

On the other hand, the GTFS-R format, especially compared to SIRI ET, is kept quite simple. Practically every AVM system manufacturer can supply real-time data as GTFS-R. In this way, NSW is able to provide most of their data in real-time. The simplicity of the format also enables fast and uncomplicated adjustments of the supplied data.

In sum, the assessment is quite positive: in just a few months, integration of what is a nearly comprehensive supply of real-time to the EFA system was realized at TfNSW. Today there are 49 real-time feeds using GTFS-R with up to 6,000 simultaneously real-time monitored trips in EFA. In contrast to other large real-time systems, the supply of real-time in NSW was not built in steps, but rather was switched on all at once by all operators. This was only made possible through the standardization of data flows for target and real-time data. Another positive aspect is the possibility to harmonize non-compliant GTFS-R data and to transform it into meaningful real-time data.

Finally, it is important to note that the conversion of GTFS-R data to SIRI ET creates benefits: SIRI ET and the German equivalent VDV 454 AUS have existed for years as well known real-time standards for journey planners. MENTZ is very actively involved in the development and continuity of both VDV and CEN standards. Due to the great deal of experience gained in the last few years, the conversion of GTFS-R into SIRI ET was made just a bit smoother.

TfNSW’s journey planner can be accessed at transportnsw.info. The new website with integrated real-time data will be launched at the end of 2016 / beginning of 2017.
Yarra Tram is the tram operator in Melbourne (4.5 mil. inhabitants). On behalf of Google, real-time requests are made to a freely-accessible proprietary interface by Yarra Tram. This interface can be requested by HTTP and provides the target and actual departure time for each individual stop in JSON format for any selected route for any tram operated by Yarra Tram. These requests are made each minute with the MENTZ program YARRA2GTFS-R for all stops and routes. The responses received from this ongoing process are changed into GTFS-R format and subsequently retrieved by Google to make real-time information accessible to the public in Google Maps.

The GTFS data (scheduled data) are available free of charge on the PTV (Public Transport Victoria) Homepage, are downloaded there weekly and supplied to Google. In addition, YARRA2GTFS-R requires GTFS data to successfully depict trips using the route number and route option. To display real-time data on the GTFS data, a translation table of stop numbers and individual directions must be maintained because the two are not consistent with one another.

Figure 1: Overview of the dataflow to supply Google Maps with real-time information
Customer Project
Electronic Journey Planner for Mannheim

Mannheim, Germany

Customer
Rhein-Neckar Transport Authority (VRN GmbH)

Project Scope
Installation of a mobility platform

Key Figures 2015
Passenger: 310 mil.
Area size: 9,970 sq km

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The Rhein-Neckar Transport Authority (VRN) developed an electronic mobility platform and has set new standards as a mobility service provider. The 6th of October was a special day; the new web presence for the VRN in Mannheim was publicly launched using the same address www.vrn.de. It was the highlight of a long journey that spanned from an idea in 2015, to implementation during 2016, and then to the live launch. The fact that everything was done in time for the important timetable change and also before Christmas was not by chance. During these times, clear and easily accessible transport information is especially important. Clarity is the focus of the new and responsive internet page, with which the VRN is strengthening its position as a mobility service provider in the region.

The most important part of the new web appearance is the journey planner (EFA), which will be replaced in the first quarter of 2017 by the electronic mobility platform (EMA) as a marketing- and information tool. The multimodal system based on EFA, which is currently available to a limited circle of test users, includes new means of transport in addition to bus & rail such as car- and bike sharing. Sustainable modes of transport that complement the existing offering and are represented in Mannheim by providers like VRNnextbike, stadtmobil, Joecar and the ride-sharing company flinc, are becoming more important for VRN users and customers. In times in which even personal details are shared over social media about peoples' private lives, shared means of transport are viewed as modern mobility options, especially in fast-paced cities.

Both the VRNnextbike and car sharing options have background systems that provide the locations of available bikes and vehicle for the access from the mobility platform. The locations are used as origins and destinations for journeys. As
such, account is taken of which combination possibilities are possible so that no unnecessary journeys are calculated. This allows the system to create rules to allow variations that could contain the following sequences:

- Footpath → VRNnextbike → PT → VRNnextbike → Footpath

Another typical rule defines the following sequence:

- Footpath → PT → Car-Share (floating or station-bound) → Footpath

Monomodal journeys can also be defined using rules:

- Footpath → Car-Share (floating or station-bound) → Footpath

- Footpath → VRNnextbike → Footpath

The list of modes of transport and combination options can be arranged in any way. The most important thing is that the set of rules can be easily expanded and set by VRN. The system that keeps the connection to the sharing background systems is a part of the MENTZ EFA service platform. The ‘EFA Mode Sharing Server’ requests the used shared services with corresponding plugins. The interfaces to the background systems are partly proprietary, but also partly based on quasi-standards like the IXSI interface, which is fully supported by the MENTZ EFA service platform.

In the first quarter of 2017, the multimodal part with bike- and car sharing (see figures to the right) will be made accessible to the public.

The EMA layout, which runs optimally on desktops, tablets and smart phones, is based on templates that are provided by the VRN. The installation and connection to the mobility platform (EMA) was conducted by MENTZ in iterative steps and in close collaboration with the VRN digital mobility team. The MENTZ development team implemented the EMA layout as a “single-page application” and used the JSON interface of EFA. Using the alternative interface to XML, depending on the request, 30-40% of the response size can be saved, which has a lot of advantages, especially in the area of mobile phones. The page works as a single page using AngularJS performant and is of optimal usability to keep the interaction of a customer relatively simple and, at the same time, to ensure high information transfer rates.

Try it out: www.vrn.de
New Planning Latitude in Switzerland
1.12.2016 was the day that the “Open Data Platform öV Schweiz” was officially launched. It provides all public transport-focussed application developers and service providers with a platform with which the timetable data can be requested for the entire country, including real-time data, over a standardized VDV 431 TRIAS interface.

In addition, the ‘Open Data Platform öV Schweiz’ allows users to download the timetable in GTFS format (General Transit Feed Specification).

The scheduled data of the platform are supplied via data imports to DIVA. The GTFS data are exported from DIVA and the requests over the TRIAS interface are processed and responded to by our EFA programs.

As a result, new options are available in Switzerland to easily access nationwide timetable data on the basis of real-time and display important information in apps.

In the upcoming months, GTFS-R data will also be made available.

https://opentransportdata.swiss/en/

UG in Düsseldorf
The 59th user group with a focus on operators took place this year from 6 – 7. October in Düsseldorf. Talks focused on block and duty optimization, connection optimization and map-based planning. One presentation highlighted the plethora of new possibilities for driver communication via smart phone. The VRR reported on the challenges that accompany the EU-wide implementation of accessibility by 2022. In addition to the talks, active discussions were pursued during into the breaks. Participants rounded off the discussions by taking a stroll through the old city together. The evening schedule included a visit to the brewery and a hearty dinner from the Rhineland.

Innotrans Berlin:
The world’s largest trade fair for transport technology took place on 20-23 September in Berlin. Dubbed “The Future of Mobility”, this year’s theme helped attract almost 3,000 exhibitors, who presented their products over 112,000 square meters to the approx. 140,000 trade visitors from all over the world. MENTZ presented multimodal routing, fully-accessible indoor routing and the latest developments in the operational planning software DIVA 4. The main focus of interest was on drivers that praised the use of MENTZ apps in their job. Many customers and other interested parties used the opportunity to visit the new stand.

News in Brief
UG in Düsseldorf
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https://opentransportdata.swiss/en/
Events

2. DEFLI-Konferenz
25 - 26 January 2017, Berlin

ÖPNV-Innovationskongress,
14 - 16 March 2017, Freiburg

60. DIVA/EFA User Group
30 - 31 March 2017, Nürnberg, GVN

61. DIVA/EFA User Group,
28 - 29 September 2017, Paderborn,
Padersprinter

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