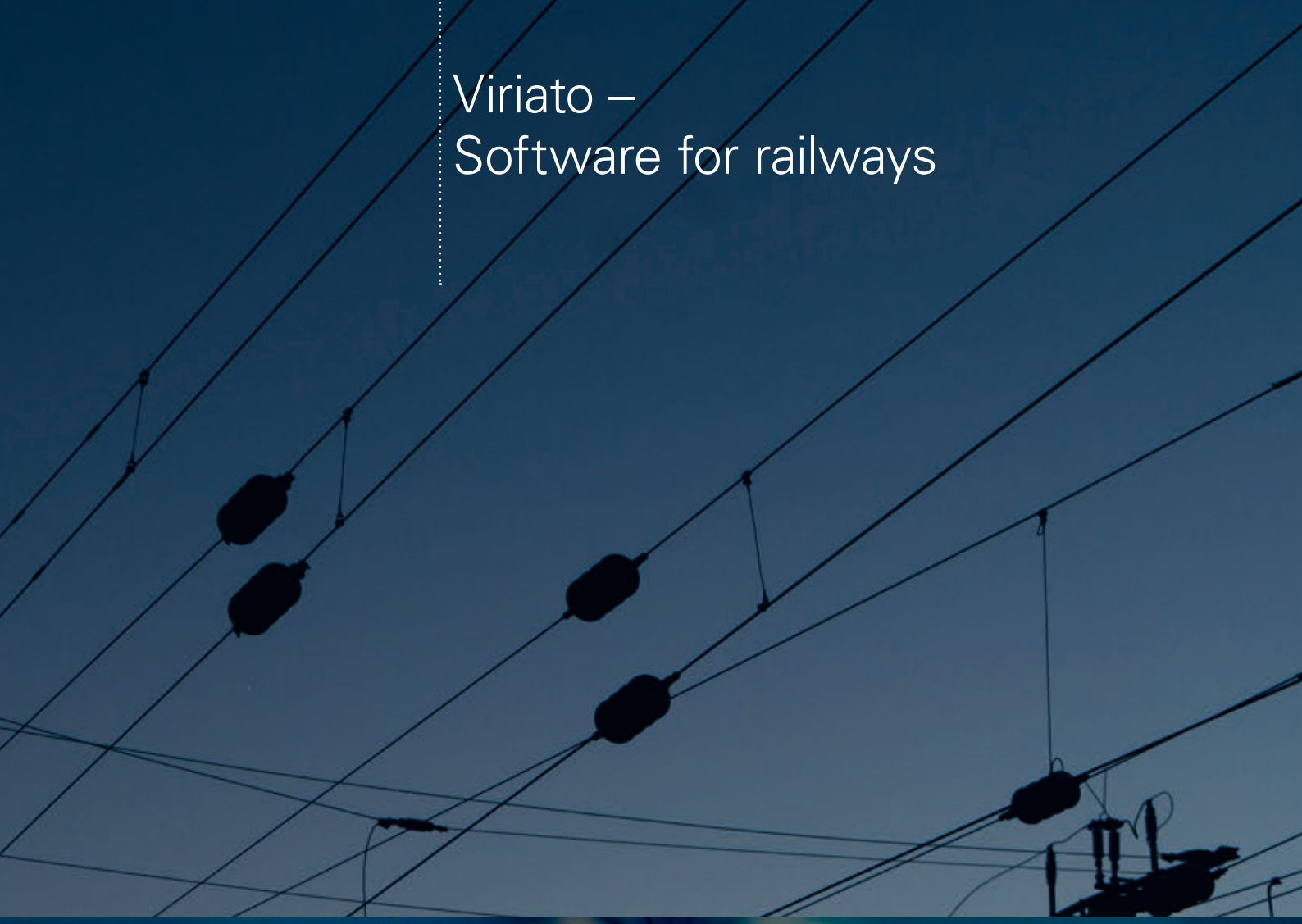
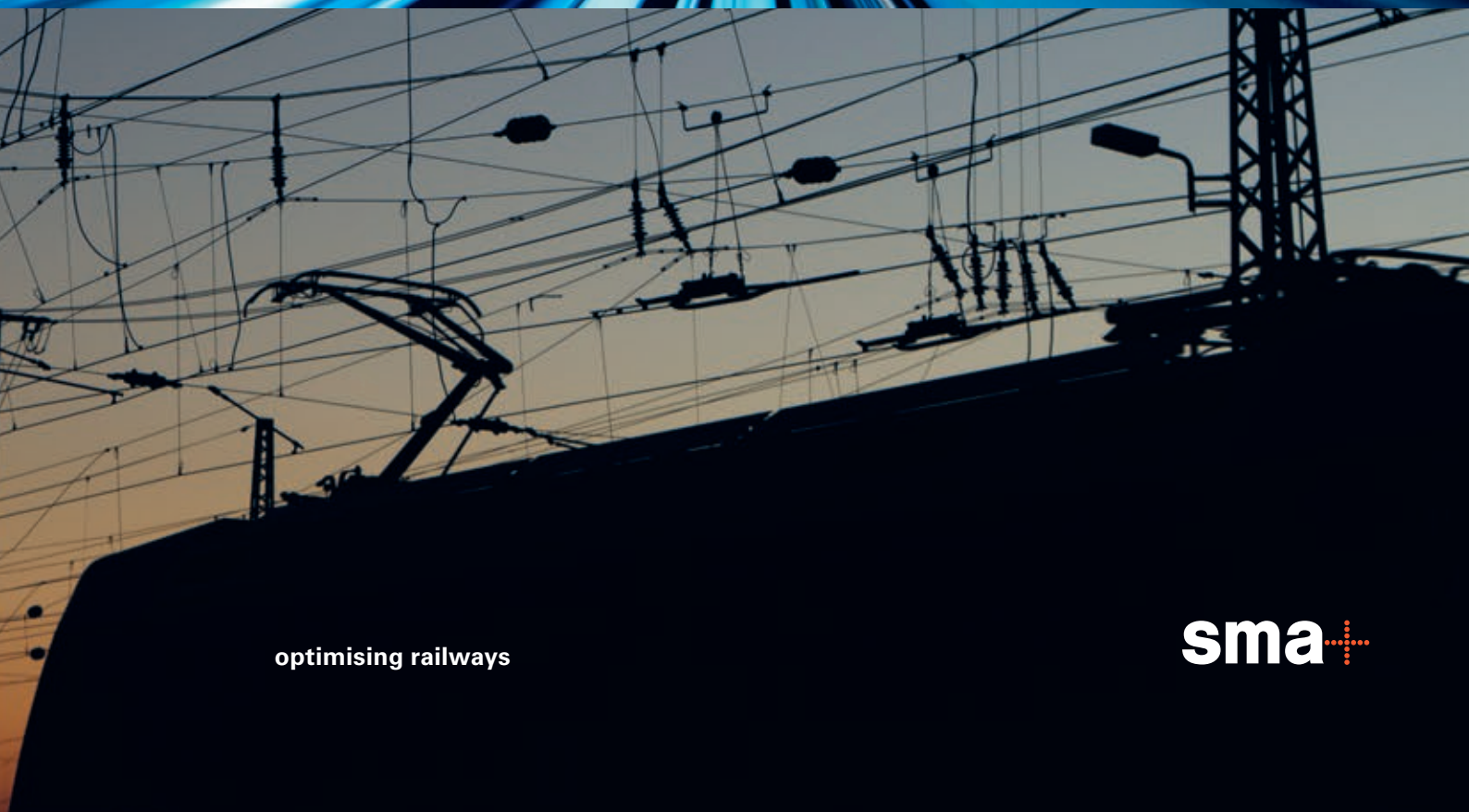
Viriato –
Software for railways





optimising railways

sma

Timetable planning at your fingertips

Viriato is a powerful integrated timetable planning tool that allows users to optimise the railway planning process.

Originally focussing on strategic timetabling, its functionality has now expanded to cover the entire planning process, from very long-term timetables through to short-term operational plans.

Viriato integrates into the entire planning process:

- **Strategic**
  Using high-level data to develop initial travel time estimates, rough timetables and rostering plans that optimise vehicle utilisation. Viriato helps planners identify optimal timetables by allowing them to easily compare alternatives.
- **Capacity**
  As timetable implementation approaches, Viriato can work with detailed data to refine and share timetables between stakeholders.
- **Operations**
  Daily timetables can be prepared for use by train operators and infrastructure managers.

Viriato provides timetable planners with a full suite of applications addressing all aspects of the timetable planning process including works planning and vehicle rostering. The Viriato interface consists of the graphic timetable, trip time analysis, conflict detection, netgraphs, platform occupation diagrams and customer timetables in addition to data manipulation features.

To allow the optimal feature coverage, Viriato has been developed into two parallel products, Viriato Standard for timetables with a high degree of regularity, and Viriato Enterprise allowing greater flexibility as the operational requirements emerge.

Reflecting the requirements of the stakeholders in the railway industry, we continue to develop the capabilities of Viriato.

Viriato allows the user to work with timetable concepts varying in size from aspirational schemes through to fully populated national databases, allowing the creation of efficient plans maximising the usage of network capacity and rolling stock assets, while providing high quality services to customers.

Viriato forms a complete timetable planning suite that helps timetable planners to develop optimal timetables for all levels of operations quickly, accurately and transparently. Thanks to its unique features, it has established itself as an integral part of the timetabling process at more than 60 companies in 15 countries.

The right precision

Viriato is the planning tool that covers the full planning process from the strategic through to the operational level. It achieves this through the use of a top-down or "service-centric" methodology where you can freely think about the train services that you want to run before aligning them with the constraints of the network.

Unlike other planning tools, in Viriato you work at a level of data granularity appropriate for the task. A feature-orientated data model lets you concentrate on planning trains and then adding more detailed information later in the process.

Having the appropriate level of infrastructure data for the current task relieves the train planner from maintaining an overly detailed infrastructure model where unnecessary information has to be entered and managed.
As the timetable implementation date approaches, Viriato can work with increasingly detailed data to refine the plan. This prevents the planner from being constrained by having to create an unnecessarily detailed model for the task they are working on.

Timetables based on the concept of coordinated interval services provide passengers with excellent services but are very complicated to develop and evaluate by hand. Viriato was created explicitly for regular-interval timetables and integrates this concept fully throughout the application, in both Viriato Standard and Enterprise versions.

Viriato Enterprise extends this conceptual model further to allow the train planner to make the changes to a highly structured timetable that are needed when faced with commercial variations, engineering works and other sources of modifications to the plan. Trains can have their service patterns altered, be rerouted or use different infrastructure features while retaining their link to the original train.

Viriato consistently follows these principles to enable train planners to develop their plans and understand any constraints on their services at an earlier stage than would otherwise be possible. This ensures that Viriato provides the maximum possible information to the train planner at each stage in the process, from conceptual design through to production-ready timetables.

Planners can design efficient timetables, allowing them to easily compare alternative scenarios and identify where changes have been made.


Hackerbrücke

Modern timetabling

Viriato offers the user an efficient working environment in which to create timetables and evaluate their effectiveness.

The program is developed using state-of-the-art software engineering tools and techniques, and using object-oriented architecture offers significantly higher performance and better scalability for very large railway networks. This architecture allows the integration of user-specific functionality and interfaces in a consistent manner.

The latest version of Viriato includes a range of features that significantly increase the efficiency of the timetable planning process:

- The user interface is consistent throughout the entire program, with an efficient workflow with the information required on each screen made directly available to the user.
- The addition or modification of data on any screen is reflected in all views, allowing the planner to visualise and manage at a glance the timetable development process.
- The undo feature allows the planner to experiment with alternatives, and to quickly correct any non-optimal changes made.
- Bulk update functionality speeds up repetitive data entry tasks.
- The train validity model allows each train to have its own individual validity, while user defined templates and update functionality helps to maintain complex patterns easily.
- The graphic timetable can be edited directly, and the user may retime whole or partial trains simply through selecting the relevant portion of a service.
- Conflict detection enables the user to eliminate conflicts dynamically simply by dragging trains on the graphic timetable or platform occupation view.
- User-defined reports allow detailed queries of timetable data to be produced.
- Configurable keyboard shortcuts allowing direct access to features.
- The extensible architecture allows the development of bespoke interface to capacity ordering and management systems.

Viriato can be used with a range of database management systems allowing system installations ranging in size from single users to many hundreds with controlled access rights to data by name and roles. To give users the maximum flexibility, Viriato can be used as either a desktop application or as part of a cloud-based installation.


Sortie Exit Uscita
Correspondance
Alarme

Modular design to meet your needs

Viriato has been designed with a modular architecture allowing the user to work with the features that are required for the planning task that they are undertaking. As more detail outputs become necessary, additional modules can be seamlessly integrated into the program.

Viriato Standard features:

- Netgraph – service-centric view of timetable showing service frequencies and routes
- Graphic timetable – visualisation of train service and interaction between trains
- Customer timetable – tabular presentation of timetable
- Calendar – set running day patterns to allow timetable variants by day
- Connection clock – visualisation of arrivals and departures at stations
- Running time calculation – calculate precise technical running times
- Platform occupation – view station utilisation and resolve capacity constraints
- Network visualisation map
- railML timetable import/export and GTFS export
- Job management – schedule the execution of long running tasks such as railML exports to run automatically in the background

Viriato Enterprise additional features:

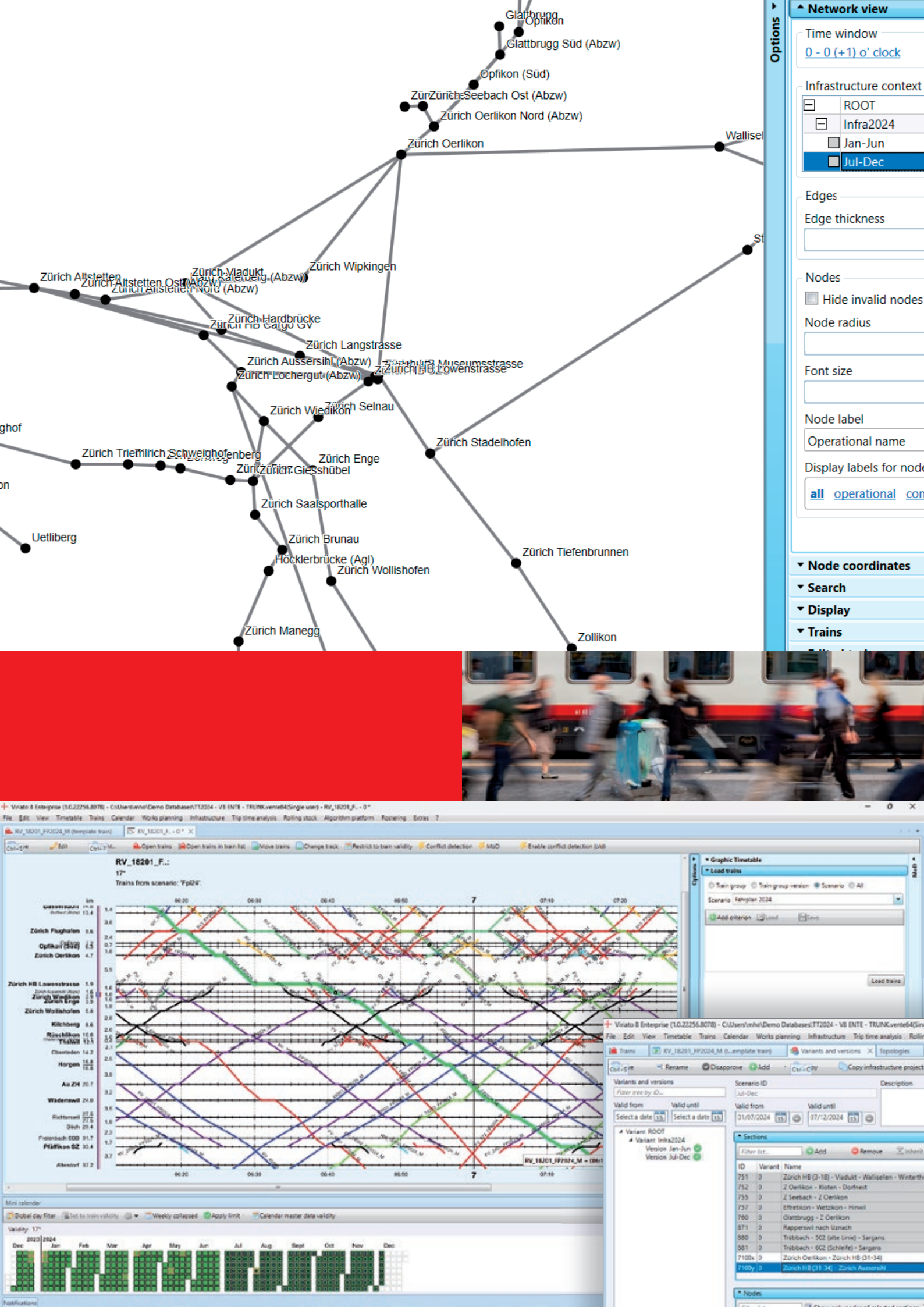
- Infrastructure variants – dated changes to the infrastructure during a timetable period projected onto timetable
- Flexible train model – Different timings, stop patterns and routing possible within trains on specific dates

Optional features (available in both Viriato Standard and Enterprise):

- Vehicle rostering – prepare detailed plans of fleet utilisation and maintenance tasks
- Conflict detection – verify compliance of the timetable with infrastructure constraints
- Robustness analysis – verify the resilience of the timetable to perturbations caused by operational incidents
- Trip time analysis – display in tables and graphics the journey time between locations including change times, and export data for deeper analysis
- Passenger assignment – algorithms to assign passengers to specific trains based on journey attractiveness
- Engineering works planning – manage the consequences of engineering works on the timetable and plan mitigations
- Microscopy on Demand (MoD) – use a microscopic infrastructure to perform running time calculation and conflict detection via a third-party application
- Path Search – find free capacity to add a new train

Sometimes the planning workflow process will have specific additional requirements not covered by the standard features of Viriato. For these cases SMA has extensive experience in developing interfaces to other information-management systems.

Built-in outputs with standard file formats such as railML offer instant compatibility with a wide range of third-party applications.


Glattbrugg
Opfikon
Glattbrugg Süd (Abzw)
Opfikon (Süd)
Zürich Seebach Ost (Abzw)
Zürich Oerlikon Nord (Abzw)
Zürich Oerlikon
Wallisel
Zürich Wipkingen
Zürich Viadukt
Zürich Kalkbreite (Abzw)
Zürich Altstetten
Zürich Altstetten Ost (Abzw)
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Zürich Hardbrücke
Zürich HB Cargo GV
Zürich Langstrasse
Zürich Aussersihl (Abzw)
Zürich HB Museumsstrasse
Zürich Lochergut (Abzw)
Zürich HB Löwenstrasse
Zürich Selnau
Zürich Wiedikon
Zürich Stadelhofen
Zürich Enge
Zürich Gieshübel
Zürich Saalsporthalle
Zürich Brunau
Hocklerbrücke (Agl)
Zürich Wollishofen
Zürich Tiefenbrunnen
Zollikon
Zürich Manegg
Uetliberg
Options
Network view
Time window
0 - 0 (+1) o' clock
Infrastructure context
ROOT
Infra2024
Jan-Jun
Jul-Dec
Edges
Edge thickness
Nodes
Hide invalid nodes
Node radius
Font size
Node label
Operational name
Display labels for node
all
operational
Node coordinates
Search
Display
Trains

Greater operational flexibility

Viriato Enterprise extends the functionality of Viriato Standard to meet the requirements for short term and ad-hoc planning to cover all the phases of the timetabling process. This extension means that the base model and workflow of Viriato Standard is retained, while enabling greater flexibility with regards to the validity of train activities and infrastructure configurations.

A migration path from Viriato Standard to Viriato Enterprise is available, allowing the investment made in preparing existing data to be preserved.

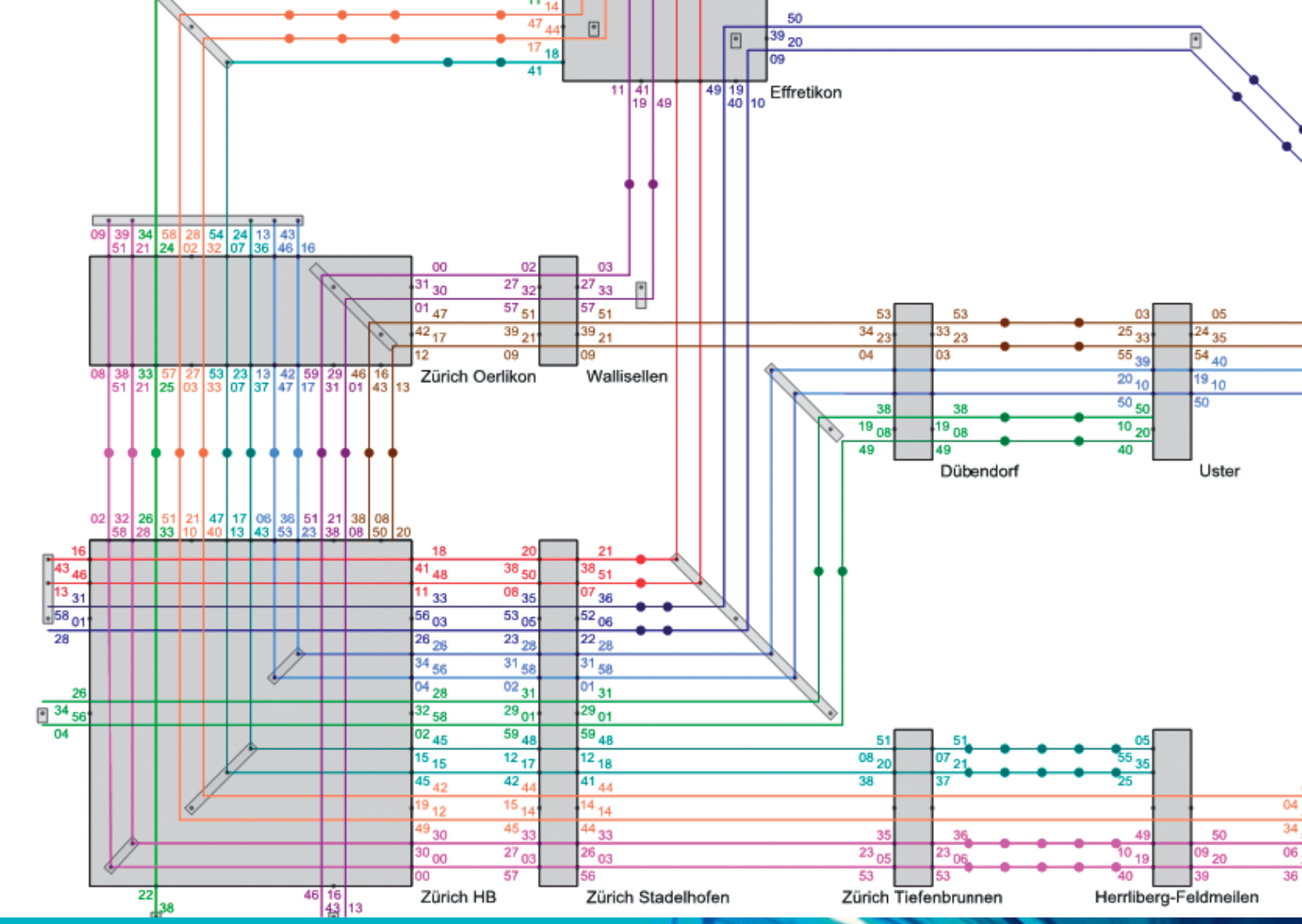
Viriato Enterprise is both a product and a platform that enables the custom integration of a complete solution for the design and optimisation of timetables and is often connected to the external systems of customers, including the import or connection to infrastructure data sources, data exchange with resource planning systems and interfaces or links to portals for train path applications.

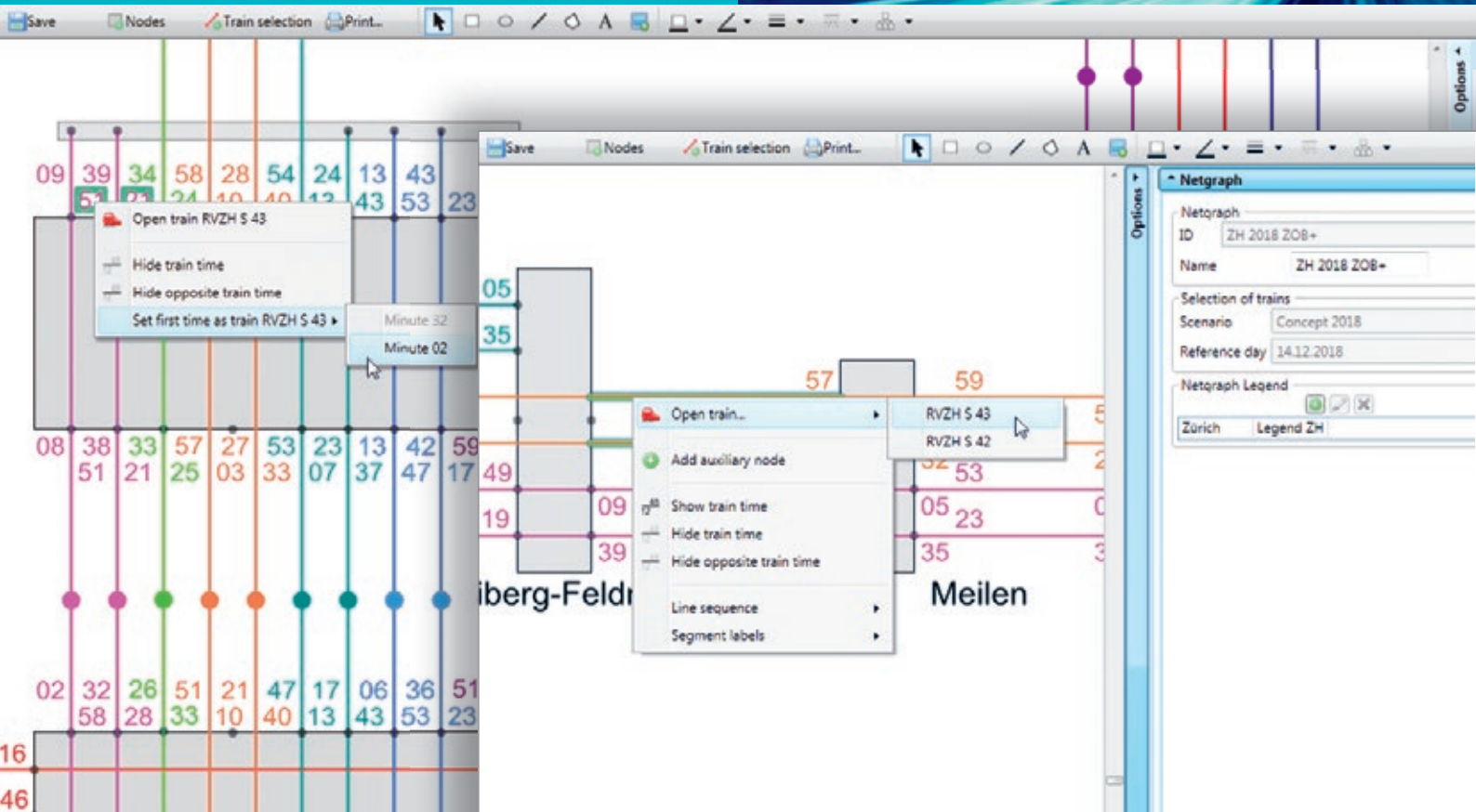
Viriato Enterprise is characterised by the following features:

- The infrastructure can be differentiated into different states used by the trains (project variants as well as versions) over a time period
- The trains can run over different infrastructure states within their validity without having to create a new train
- The train families are more flexible and trains with different times and/or routes can be created within a train family
- With the help of the mini calendar changes within a train can also be modified for any selected validity without having to create a new train
- Trains can be compared with other trains and properties transferred between them

In addition to the operational point of view Viriato Enterprise also provides additional functionality for managing the planning of trains:

- Order management: collaborative framework for distributing and tracking changes to trains
- Connection management: search, management and output of connection relationships between trains
- Related trains: linking the train families of different train group versions within a train group with each other by labels
- Daily variation transfer: batch function to extend the timetable and characteristics of the selected trains on a given reference day to a selected target validity


Effretikon
Zürich Oerlikon
Wallisellen
Dübendorf
Uster
Zürich HB
Zürich Stadelhofen
Zürich Tiefenbrunnen
Herrliberg-Feldmeilen


Save
Nodes
Train selection
Print...
Options
Open train RVZH S 43
Hide train time
Hide opposite train time
Set first time as train RVZH S 43
Minute 32
Minute 02
Open train...
RVZH S 43
RVZH S 42
Add auxiliary node
Show train time
Hide train time
Hide opposite train time
Line sequence
Segment labels
Meilen
Netgraph
Netgraph
ID
ZH 2018 ZOB+
Name
ZH 2018 ZOB+
Selection of trains
Scenario
Concept 2018
Reference day
14.12.2018
Netgraph Legend
Zürich
Legend ZH

Focusing on service

The introduction of coordinated ("interval") timetables has led to the ability to represent timetables in a way that shows both the geographical network and the train times in an efficient manner on a "netgraph".

A single line represents each service (and the corresponding journey in the reverse direction) connecting the stations it passes through on its trip, with the arrival and departure times for each station indicated. The cyclical aspect of the timetable means that a whole repeating family of trains can be covered by one line on the diagram.

The connection times between services at a station can be seen at a glance, giving a powerful method for improving the coordination between services for the train planner.

Viriato was the first planning tool to successfully combine this netgraph with graphic and tabular timetables to produce a single integrated planning tool.

Functionality

- Fully integrated with the timetable database – change train data in one location and it changes in all Viriato views
- Step-by-step undo function (to last saved version)
- Powerful snap-to-grid mechanism supports the user in the efficient drawing of netgraphs with a visually compelling layout
- Advanced drawing functions for legends, comments, etc. allow the production of ready-to-print netgraphs
- Grouping of multiple trains on common sections (e.g. to display an hourly service of several different trains with two-hourly frequency over the same route) to maintain visual clarity

Display/output

- Directly work with trains in the netgraph
- Select trains for analysis and illustration using specific day filters
- Create easy-to-read line maps
- Import and export data between different Viriato databases
- Separation of views for display on screen and for printing
- Copy netgraph to clipboard or export it directly to a graphics file (including PDF and SVG)

Speichern | Neue Ansicht öffnen | Bearbeiten | Drucken... | Ausgewählten Zug öffnen | Konflikterkennung | Konflikte entfernen

FV IC 1932: (Gotthard -) Oberrieden Dorf - Zürich HB

Täglich 10.12.2017-09.12.2018

Szenario 2019.

Konzept 2019 - Concept 2019

Optionen | Konflikte

km 6 | 6:10 | 6:20 | 6:30 | 6:40 | 6:50 | 7

Sihlbrugg 15.91

Horgen Oberdorf 16.52

Oberrieden Dorf 14.52

Auswahl | Entfernen | Vorne anfügen | Abfahrtszeiten eingeben | Ankunftszeit fixieren | Bhf. Gleis

Hinzufügen | Anfügen | Umleiten | Konstante Gesamtfahrzeit | Abfahrtszeit fixieren | Gleisbelegung öffnen

Strecke	Str. Gleis	Betriebsstelle	Bhf. Gleis	Gleis-info	HA	Ankunft	Abfahrt	Fz	% FzR	FzR	zFzR	tot% FzR	mHz	bHz	sHz	Bemerkung	km	v
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48110	530	Schwäbis					06:40.6	0.2	7								1.090	66
48110	530	Steffisburg			11	06:41.9	06:4						0.4		0.1		2.310	56
48110	330	Lädeli			14	06:44.1	06:4						0.2		0.1		3.570	44
48110	330	Heimberg			11X	06:46.4	06:4						0.4	0.5	0.1	KB 45	4.440	26
48110	327	Brenzikofen					06:5										7.740	64
48110	324	Oberdiessbach			11X	06:52.2	06:5						0.4		0.1		10.170	86
48110	321	Stalden im Emmental					06:5										13.860	65
48110	319	Konolfingen			11X	06:58.0	07:0						0.9	1.1	0.1		15.080	39
48105	518	Grosshöchstetten			11	07:04.1	07:0						0.4		0.1		19.150	61
48105	515	Biglen			11X	07:07.3	07:0						0.4		0.1		21.730	57
48105	512	Walkringen			11	07:11.0	07:1						0.4		0.1		24.930	60
48105	509	Bigenthal					07:1										26.990	65
48105	506	Schafhausen im Emmental					07:1										31.260	80
48105	503	Hasle-Rüegsau			11X	07:19.2	07:2						0.4	0.4	0.1		33.820	59

Hinzufügen...
Anfügen...
Vorne anfügen...
Umleiten...
Entfernen
Ankunftszeit fixieren
Abfahrtszeit fixieren
Bhf. Gleis...
Gleisbelegung öffnen

Visualise capacity

Graphic timetables represent train operations and are pivotal when determining the interactions between trains at a network-wide level. Graphic timetables can also be used to identify the likely rolling stock requirements for a line and produce initial utilisation plans.

An experienced timetable planner can assess the feasibility of a timetable and the plan, such as insufficient headways between services or conflicting movements over a single track section simply by looking at a graphic timetable.

Viriato's highly configurable graphic timetable functionality allows users to represent the trains according to their needs. For example, colours may indicate different train types (e.g. by service group or line), while line thickness may reflect express or regional service. Such customisation gives timetable planners the power to produce highly descriptive graphical timetables, and to identify timetable improvements.

Functionality

- Fully integrated with the main planning database – change something in one location and it changes in all Viriato views
- Create graphic timetables for selected line segments
- Directly open a graphic timetable from the train window (for the entire trip or part of a trip)
- Shift a train (or a part of train) in the graphic timetable
- Directly edit a train within a graphic timetable using drag-and-drop
- Undo function (to last saved version) for specific train from list of edited trains
- Compare alternatives by overlaying different scenarios
- Select trains using filters for operating days and validity periods

Display/output

- Display trains for selected time periods of up to 48 hours
- Use colour to distinguish between train type or status
- Configurable timetable orientation (time axis vertical or horizontal)
- Dynamic zooming of timetable view using mouse
- Free selection of display layout, colours, fonts, etc.
- Highlighting of the tracks used in line diagram
- Advanced tooltip to instantly display train details
- Train number of each train always visible in the displayed view
- Headway time display allowing visual check of available capacity
- Selectively display time information (arrival, departure, passing) and train characteristics
- Separation of user and default views, allowing the user to work in a view configured to their needs while maintaining corporate layout rules for outputs
- Copy graphic timetable to clipboard or export it to a graphics file (including PDF and SVG)

S (1)	IR	IR	S (1)	S (1)	S (21)	IR	S (1)	S (1)	S (1)	S (21)	IR	ICN	S (1)	S (1)
22123	2305	2257	21119	21123	20115	2307	21123	22125	22129	20119	2309	10013	21125	21129
15	17	17	17	15	15	17		16	16	15	17	17	17	16
	6:04	6:09			6:20	6:35				6:50	7:04	7:09		
	|	|			6:27	|				6:57	|	|		
	6:13	|			6:34	6:43				7:04	7:13	|		
	6:14	|			6:35	6:45				7:05 [1]	7:14	|		
6:15	|	|	6:31	6:47	6:50	6:57		7:01	7:15	7:20	|	|	7:31	7:47
6:16	|	|	6:32	6:48	|	|		7:02	7:16	|	|	|	7:32	7:48
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6:20	6:29		6:36	6:52 [2]		7:02		7:06	7:20		7:29		7:36	7:52
6:21	|		6:37	6:54		|		7:07	7:21		|		7:37	7:54
6:23	|		6:39	6:56		|		7:09	7:23		|		7:39	7:56
6:25	|		6:41	6:57		|		7:11	7:25		|		7:41	7:57
6:27	|		6:43	6:59		|		7:13	7:27		|		7:43	7:59
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6:30	|		|	7:02		|		|	7:30		|		|	8:02
6:34	|		6:49	7:07		7:09	⇁	7:19	7:34		|		7:49	8:07
	|		6:50	↳		7:11	7:16				|		7:50	↳
	|		6:53			|	7:19				|		7:53	
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		Locarno										Lugano		
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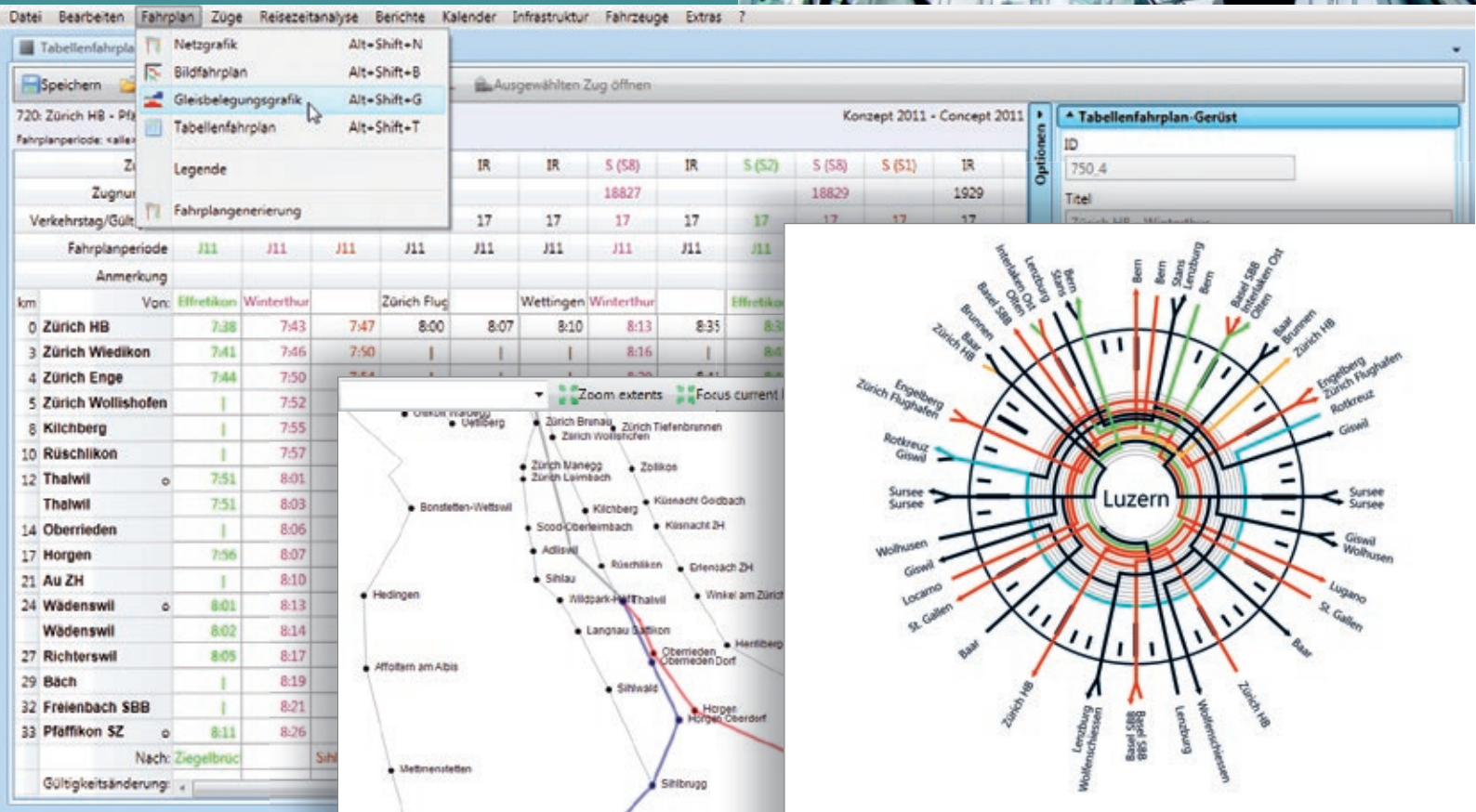


Production facts and figures

Timetables form a clear description of the service in terms of product type, coverage, frequency and/ or station calling pattern policy, and are thus indispensable.

The customer timetable is the traditional method for presenting the schedule of trains along a route. The functional requirements for a customer timetable vary depending on how it will be used. Used in conjunction with the operational modules, such as the graphic timetable, it provides further insights into aspects of the timetable on rail traffic.

Viriato provides flexible filter possibilities and layout settings that permit users to easily display the desired information. Viriato also provides an interface that allows customer timetable data to be analysed and/or displayed using MS Excel.

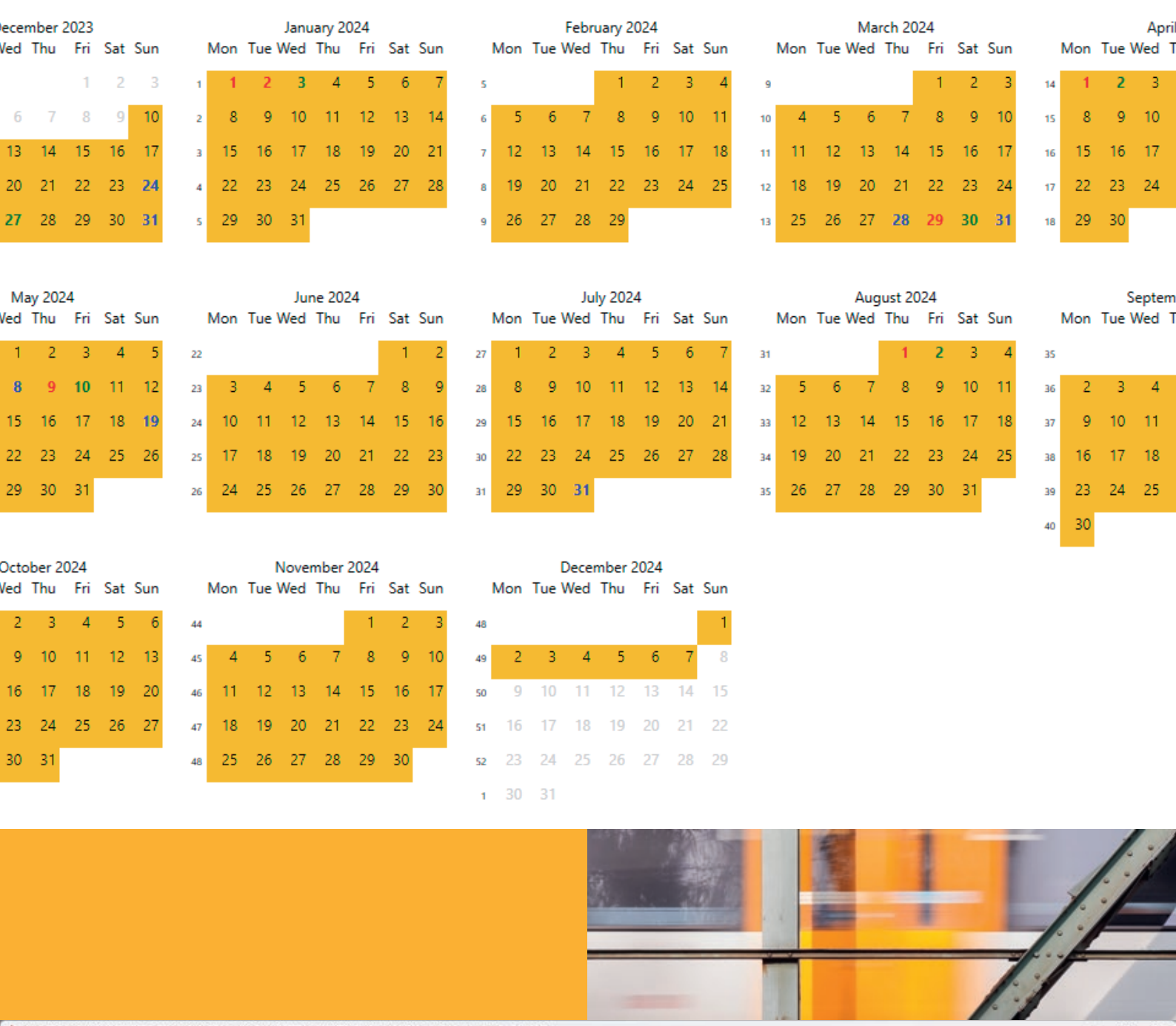
The connection clock shows graphically the relationship between arriving and departing services at a station so that the timetable planner can efficiently manage the arrival and departure times. This maximises the connection possibilities for customers so that as many potential journey combinations as possible become practical for travellers. The arrival and departure times of services are shown in the form of a clock arranged around the node allowing this information to be absorbed in a glance. The user can also display the usage of specific platforms during the hour.

Functionality

- Prepare customer timetables for selected line segments or combinations with branches
- Directly open trains from the customer timetable
- Select trains using filters for operating days and validity periods
- Show the overtaking of trains in the timetable
- Indicate validity changes in a train's operation in the timetable
- Show arrival/departure times for trains at a node in the connection clock
- Display platform usage in the connection clock

Display/output

- Display timetables for selected time periods of up to 24 hours
- Select display of arrival, departure and passing times
- Individually show/hide trains in the timetable
- Use colour to distinguish between train type or status
- Freely select display layout, colours, fonts, etc.
- Export timetables to MS Excel
- High quality PDF printed outputs of timetables and connection clocks


December 2023
Mon Tue Wed Thu Fri Sat Sun
January 2024
Mon Tue Wed Thu Fri Sat Sun
February 2024
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March 2024
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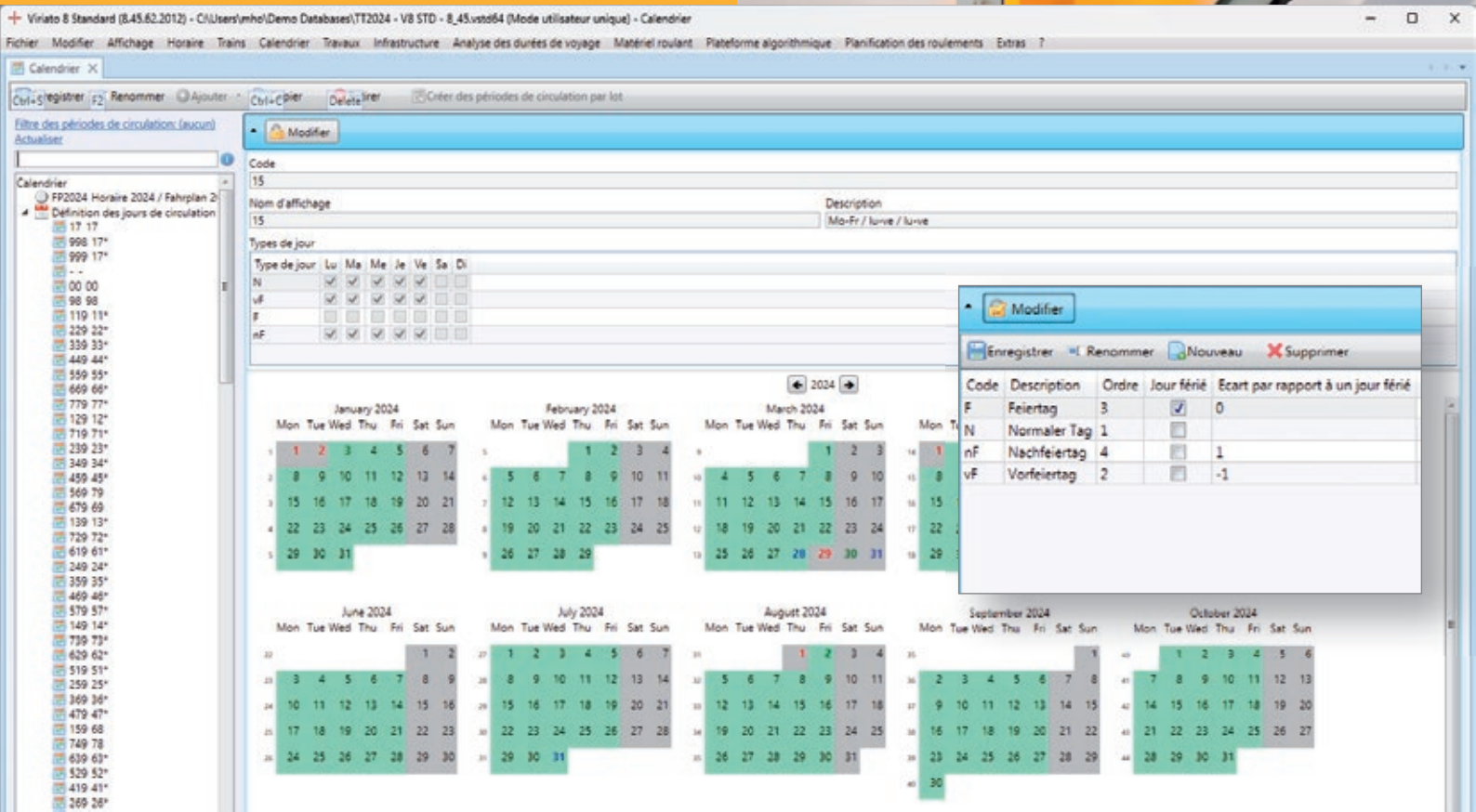
Fichier Modifier Affichage Horaire Trains Calendrier Travaux Infrastructure Analyse des durées de voyage Matériel roulant Plateforme algorithmique Planification des roulements Extras
Calendrier
Modifier
Code
Nom d'affichage
Description
Types de jour
Enregistrer
Renommer
Nouveau
Supprimer
Code
Description
Ordre
Jour férié
Ecart par rapport à un jour férié
F
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1
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Vorfeiertag
2
-1

Every day is not like Sunday

At the conceptual planning level a nominal day can be used to develop and evaluate timetables; however, as the date of timetable introduction draws near, planners must define the timetable in greater detail to include weekend variations, holidays and other service pattern alterations. Actual operations require day-specific timetables to allow responses to short-term changes, such as additional or cancelled trains, to be incorporated in the working plan.

To incorporate this flexibility, Viriato has a train specific validity model allowing the timetable planner to assign any operating pattern to a chosen train, even allowing different validities to trains within a train family. To help manage this process, Viriato allows the definition of template validities that can be assigned to trains. Naturally these can be modified later on a train-specific basis. Viriato generates validity descriptions allowing the user to see at a glance when a train operates.

For the efficient management of train validities within a timetable, the user can modify the running days of multiple selected trains using a bulk update option.

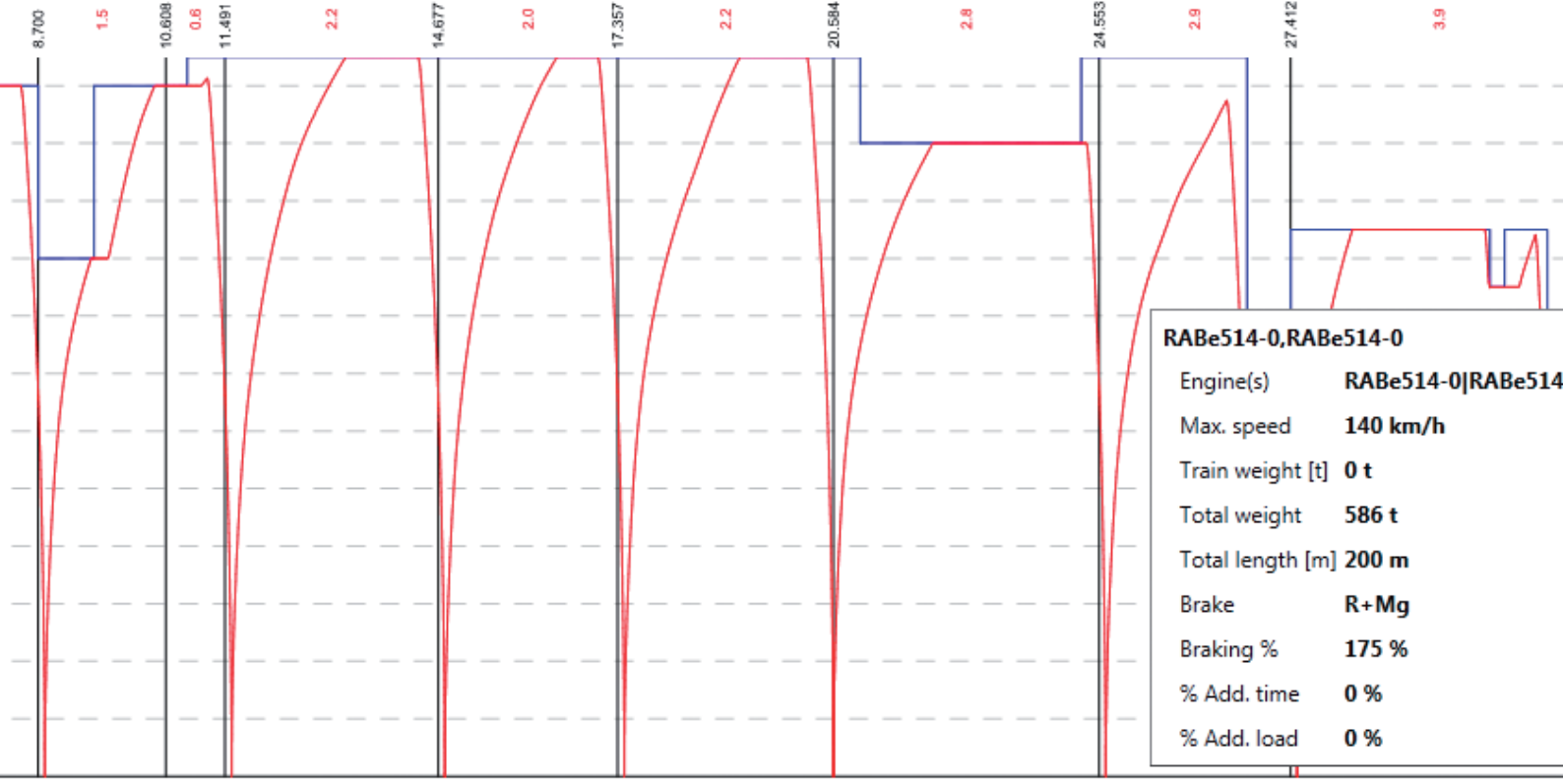
All output views allow the user to filter by days and dates which trains are displayed.

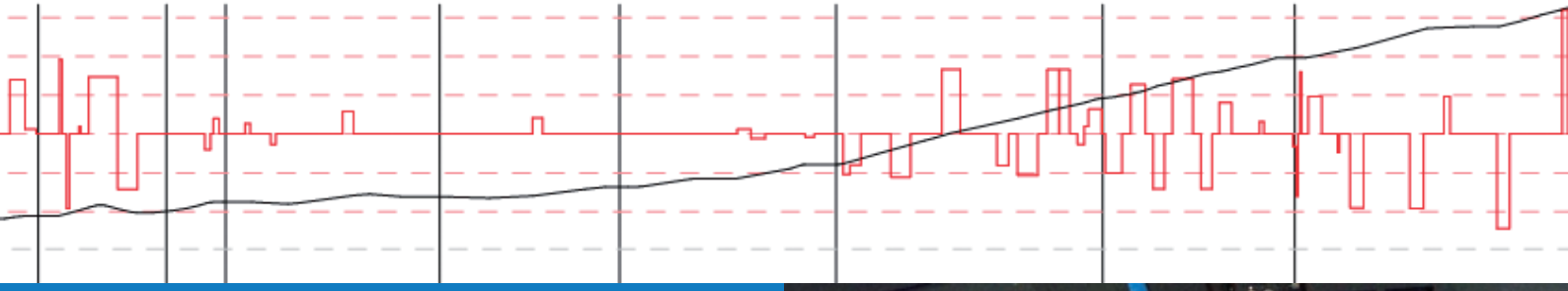
Functionality

- Individual validity information stored at the train level allowing full operational flexibility in the planning process
- Efficient creation and reuse of common operating patterns through the user of saved templates
- Creation and matching of named validities
- Quickly update train validities through batch operations
- Display and analyse operations for any individual calendar date or selection of dates in the netgraph, graphic timetable, customer timetable, station track occupancy plan and arrival/departure tables
- Accurately calculate performance figures based on the calendar-based schedule (e.g. train kilometres, number of departures from a station, etc.)
- Use Viriato's perpetual calendar to define holidays that change dates every year (e.g. Easter)

Display/output

- Use calendar view to easily define operating/ non-operating days by clicking on the required days using the mouse
- From within any train view edit the days that this service operates
- Automatically generate validity descriptions for footnotes in schedules
- Powerful mini-calendar to display effective timings and routing of a train (in Viriato Enterprise version only)





Save Rename Copy Delete Add speed profile Remove speed profile

- Definition
- Attributes
- Section tracks
- Headway Tables
- Speed limits
  - 001
    - A
    - D
- Elevation profile
- Curves
- Tunnels

ID: ZZ201203 | Name: Paris to Brest | Status: | Remarks: Case 47.2012

Valid from: 01.01.2000 | Valid until: 01.01.2020 | Last change: 30.03.2012 10:34:15

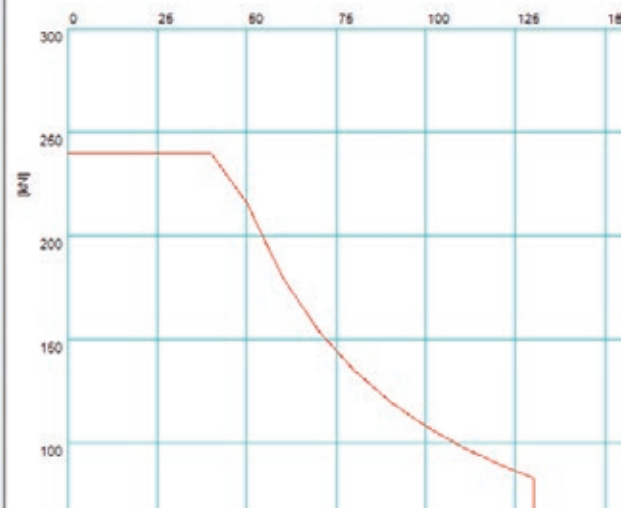
Add Remove Copy Reverse

Node ID	Node name	km 1	km 2	km from start	Interm. dist	Max. speed
87RGPMON	PARIS-MON					
87RGMASS	MASSY-TGV					
87RNMSME	MONTFORT-					
87NTLMAN	LE MANS					
87NTSLGU	SILLE-LE-GU					
87NTVOUT	VOUTRE					
87NTEVRO	EVRON					
87NTNPRS	NEAU PRS					

Model: RE450 | Series: 1 | VMax: 130 | UIC-Number: 85 - SBB

General | Characteristics | tractive effort chart | double heading | push mode | electric brake

Speed [km/h]	Traction [kN]	Function segmen
0.00	240.00	Linear
10.00	240.00	Linear
20.00	240.00	Linear
30.00	240.00	Linear
40.00	240.00	Linear
50.00	216.00	Linear
60.00	180.00	Linear
70.00	154.29	Linear
80.00	135.00	Linear
90.00	120.00	Linear
100.00	108.00	Linear
110.00	98.18	Linear
120.00	90.00	Linear
130.00	83.08	Linear
131.00	0.00	Linear
132.00	0.00	Linear



Switzerland's official running times supplier

Accurate train planning requires a detailed knowledge of a train's technically feasible running time. The ability to dynamically recalculate the running time during the planning process is essential. This allows changes in rolling stock and infrastructure, such as temporary speed restrictions for engineering works, to be included in the timetable. Viriato makes it possible to calculate precise running times based on a wide range of technical and operational parameters.

The running time calculator in Viriato includes the algorithm used by Swiss Federal Railways (SBB) and by Infrabel to calculate all their running times in Switzerland and Belgium. This calculator allows an unlimited combination of rolling stock types, traction values, dynamic resistances and braking curves to produce highly accurate running times which have been validated by SBB during their daily operations.

The civil engineering characteristics of the infrastructure such as gradients, curvature and speed restrictions are entered to produce a highly detailed model of the railway.

The Viriato running time calculator allows users to easily define their own rolling stock types with associated performance characteristics.

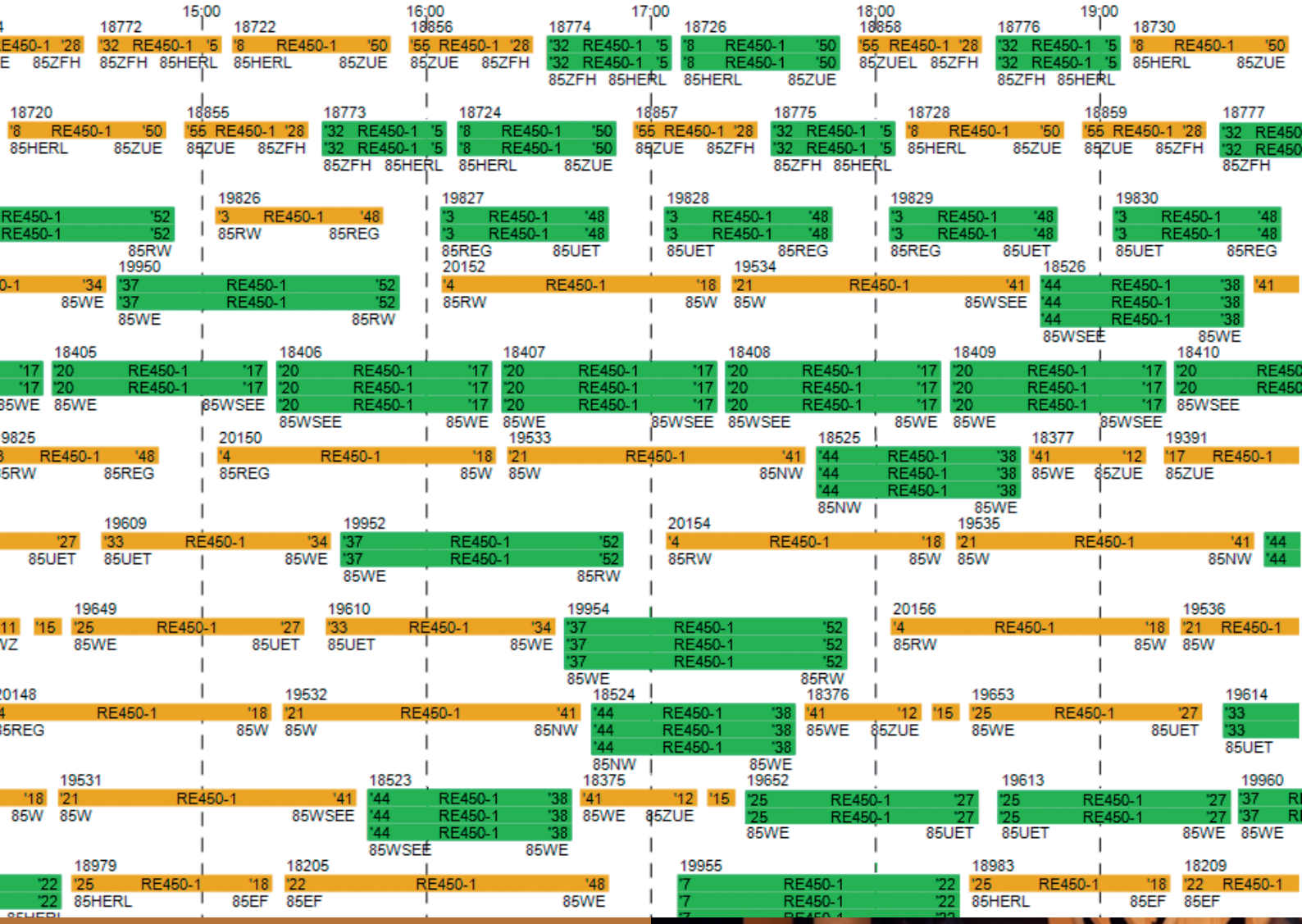
The Viriato running time calculator integrates fully into the train planning process, and the results are instantly reflected in a train's running times.

Functionality

- Validated industry standard running time calculation engine
- Fully integrated into Viriato
- Gradients, tunnel and curvature information
- Detailed traction and braking system characteristics definition
- Multiple infrastructure speed profiles for different vehicle types
- User-defined station-specific entry and exit speeds
- Train configuration changes during train run (e.g. adding or removing vehicles to the consist)
- User-defined parameters for energy-saving operating techniques
- Significantly increased performance combined with additional calculation parameters

Display/output

- Diagram illustrating line speed and train speed with optional display of gradients and curve profile
- Train line in diagram showing head, middle or rear of train or both head and rear
- Log file recording all calculated parameters including energy consumption with MS Excel export
- Running time data can be directly transferred to Viriato's train definition


15:00
16:00
17:00
18:00
19:00
18772
18722
18856
18774
18726
18858
18776
18730
18720
18855
18773
18724
18857
18775
18728
18859
18777
19826
19827
19828
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19830
19950
20152
19534
18526
18405
18406
18407
18408
18409
18410
19825
20150
19533
18525
18377
19391
19609
19952
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19649
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19954
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20148
19532
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19614
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18375
19652
19613
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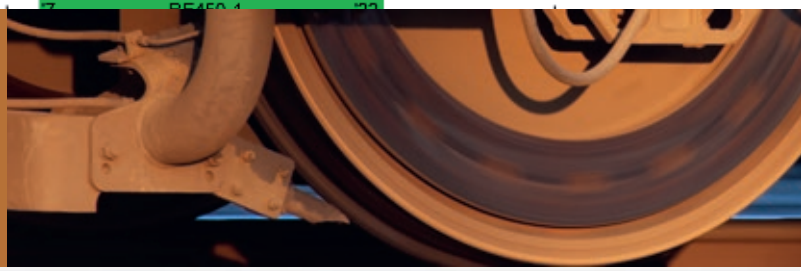
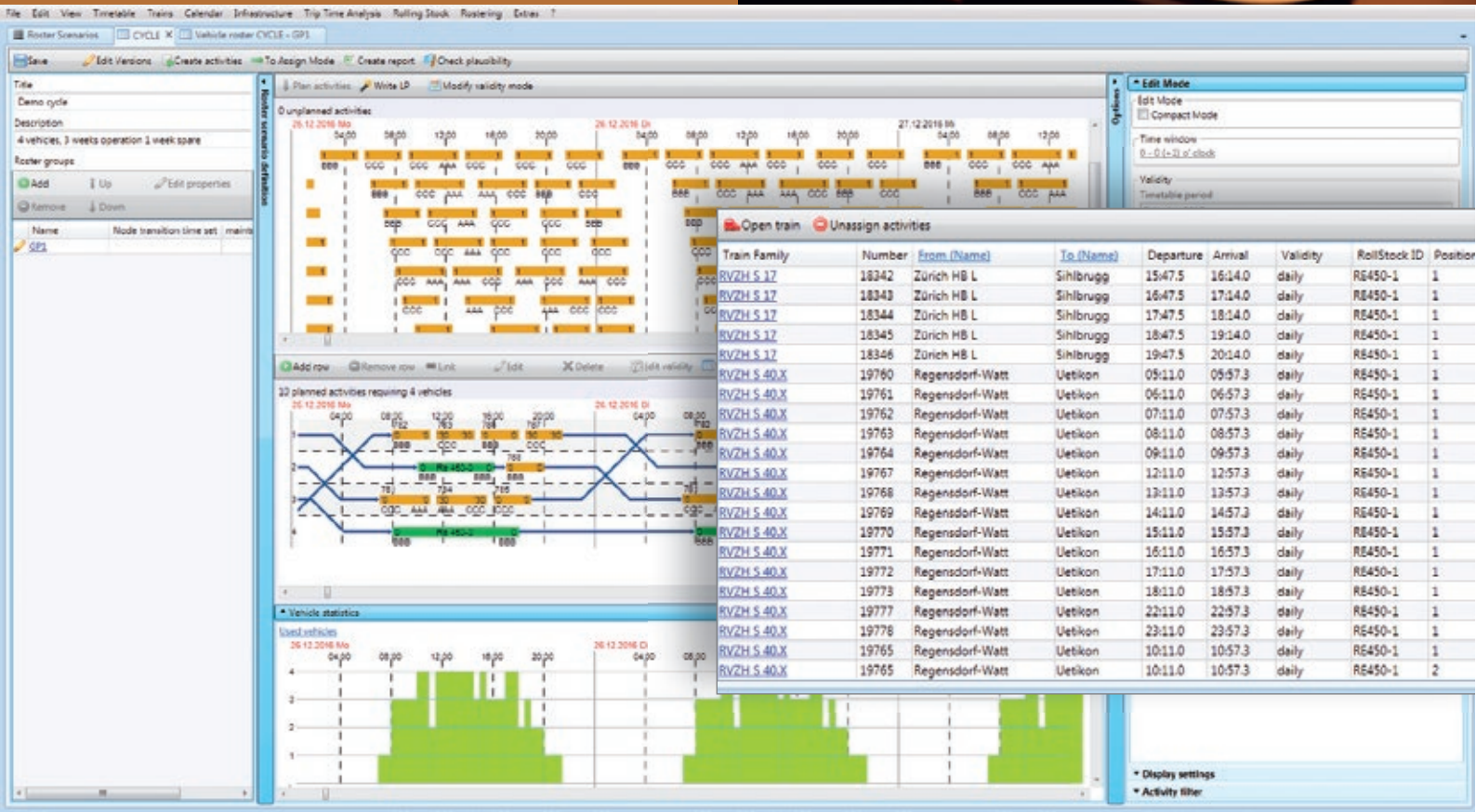
18979
18205
19955
18983
18209




Open train
Unassign activities
Train Family
Number
From (Name)
To (Name)
Departure
Arrival
Validity
RollStock ID
Position
RVZH S 17
18342 Zürich HB L Sihlbrugg 15:47.5 16:14.0 daily RE450-1 1
18343 Zürich HB L Sihlbrugg 16:47.5 17:14.0 daily RE450-1 1
18344 Zürich HB L Sihlbrugg 17:47.5 18:14.0 daily RE450-1 1
18345 Zürich HB L Sihlbrugg 18:47.5 19:14.0 daily RE450-1 1
18346 Zürich HB L Sihlbrugg 19:47.5 20:14.0 daily RE450-1 1
RVZH S 40.X
19760 Regensdorf-Watt Uetikon 05:11.0 05:57.3 daily RE450-1 1
19761 Regensdorf-Watt Uetikon 06:11.0 06:57.3 daily RE450-1 1
19762 Regensdorf-Watt Uetikon 07:11.0 07:57.3 daily RE450-1 1
19763 Regensdorf-Watt Uetikon 08:11.0 08:57.3 daily RE450-1 1
19764 Regensdorf-Watt Uetikon 09:11.0 09:57.3 daily RE450-1 1
19767 Regensdorf-Watt Uetikon 12:11.0 12:57.3 daily RE450-1 1
19768 Regensdorf-Watt Uetikon 13:11.0 13:57.3 daily RE450-1 1
19769 Regensdorf-Watt Uetikon 14:11.0 14:57.3 daily RE450-1 1
19770 Regensdorf-Watt Uetikon 15:11.0 15:57.3 daily RE450-1 1
19771 Regensdorf-Watt Uetikon 16:11.0 16:57.3 daily RE450-1 1
19772 Regensdorf-Watt Uetikon 17:11.0 17:57.3 daily RE450-1 1
19773 Regensdorf-Watt Uetikon 18:11.0 18:57.3 daily RE450-1 1
19777 Regensdorf-Watt Uetikon 22:11.0 22:57.3 daily RE450-1 1
19778 Regensdorf-Watt Uetikon 23:11.0 23:57.3 daily RE450-1 1
19765 Regensdorf-Watt Uetikon 10:11.0 10:57.3 daily RE450-1 1
19765 Regensdorf-Watt Uetikon 10:11.0 10:57.3 daily RE450-1 2

Maximising asset utilisation

The planning of efficient vehicle rosters is a key activity affecting the economic performance of a railway. The capital cost of rolling stock is high, and the challenges of meeting the service commitment to passengers and customers, while retaining sufficient margin for maintenance activities requires a coordinated planning approach.

The Viriato Vehicle Rostering module is designed to be fully integrated with the timetabling functionality of Viriato, allowing the creation of vehicle rosters during the planning process.

Throughout the life cycle of a timetable there are different requirements for vehicle rostering, and the Viriato Vehicle Rostering module provides the functionality for this entire process.

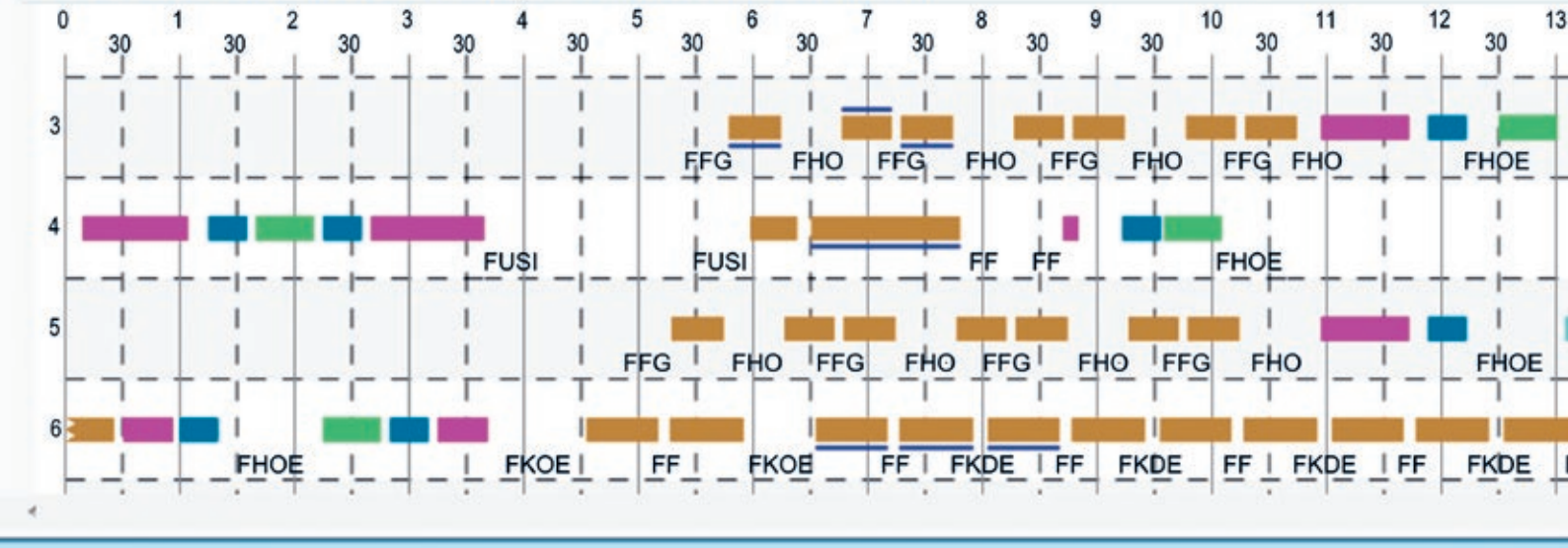
During the initial long term strategic planning process the user can concentrate on determining the size of the required rolling stock fleet to deliver the service pattern. As more detail becomes available the vehicle rosters can be refined to include detailed rolling stock information, maintenance activities and empty runs.

The Viriato Vehicle Rostering module includes the following features:

- The vehicle rostering process is fully integrated with the timetable. If running times or routes are changed, this is reflected in the vehicle roster too. User definable tolerances allow the planner to decide what level of change is allowed before a revised roster is required.
- The rostering process is undertaken in a graphical environment. The user can drag unplanned trips to a roster. This trip is then automatically linked with the previous trips and suggestions are made for the next trips to link.
- Vehicles to roster can be split by any user defined criterion. This allows plans to be prepared by a range of rules including by rolling stock type, assigned business group, base depot, or other parameters.
- The vehicle rosters can be created and managed in several different types of Gantt-chart type views. The compact view compresses a time period into a single day allowing the planner to quickly see which activities link consistently and which occur less frequently. A rolled-out view shows the roster in a continuous day-by-day format allowing the links to be traced through the plan. Finally, a vehicle-specific view is available allowing the sequence of work for a single unit to be examined.

Mo-Fr | Sa | So

Statistics
Train runs: 86320 Vehicle runs: 96460 Vehicles: 24
Productive vehicles: 1'832'227 km / 41'308 h Unproductive vehicles: 176'218 km / 4'273 h
Productive trains: 1'486'247 km / 33'290 h Unproductive trains: 176'218 km / 4'273 h

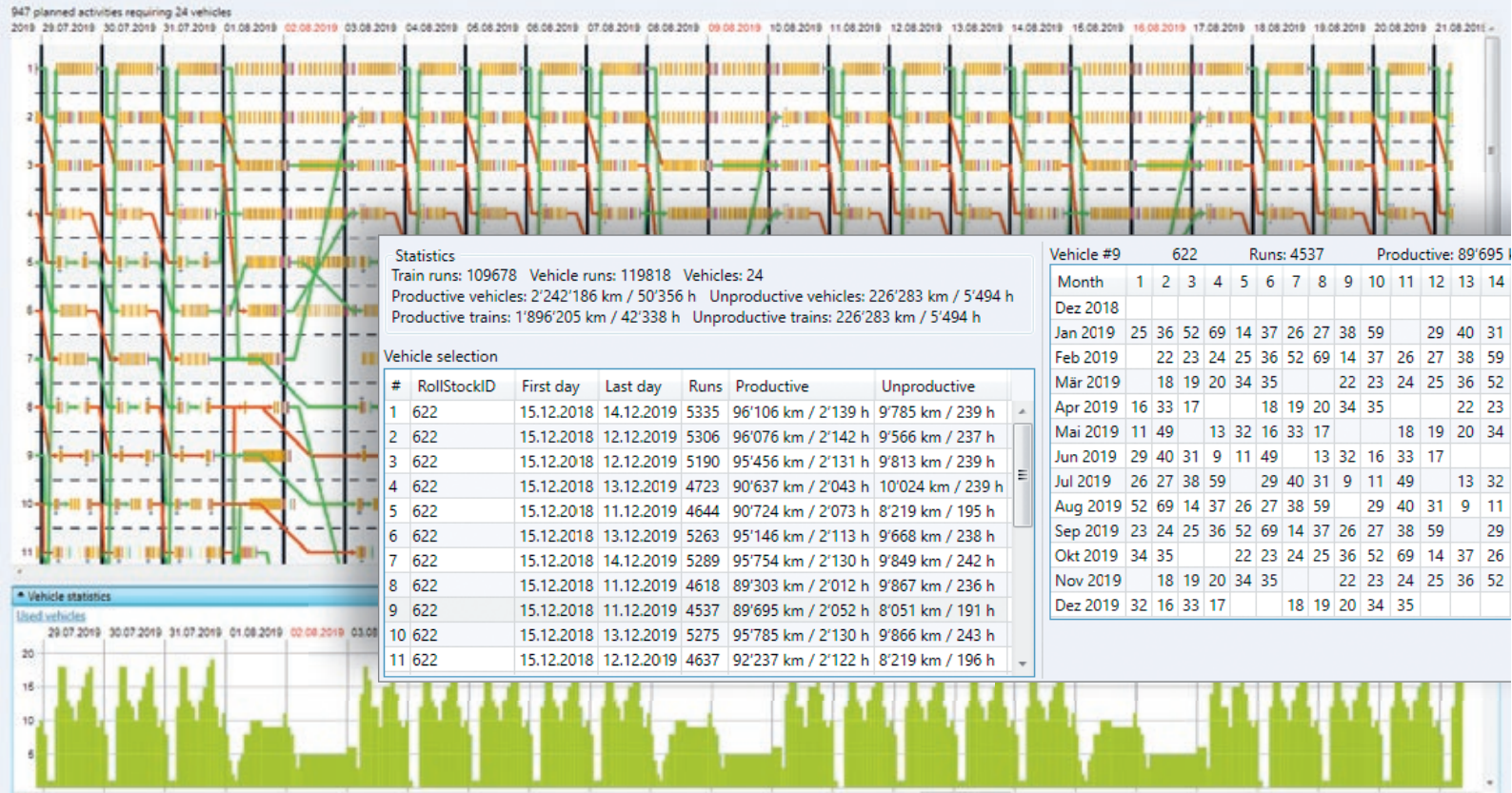


Row details

Row	Validity	Occurence count	Productive	Unproductive	Shift Length
7	Mo-Do	208	224 km / 4:39	23 km / 0:36	10:11
8	Mo	52	485 km / 12:14	64 km / 1:44	23:56
9	Mo	52	427 km / 8:51	50 km / 2:07	21:55
10	Mo-Fr	260	231 km / 4:55	0 km / 0:00	10:36
11	Mo-Fr	260	122 km / 2:39	18 km / 0:29	12:56
12	Mo-Do	260	142 km / 2:55	19 km / 0:25	13:25
13	Mo-Fr	260	251 km / 5:12	38 km / 0:44	14:52

Next day information for row 10

Validity	Next row
Mo-Do	27
Fr	42



Statistics
Train runs: 109678 Vehicle runs: 119818 Vehicles: 24
Productive vehicles: 2'242'186 km / 50'356 h Unproductive vehicles: 226'283 km / 5'494 h
Productive trains: 1'896'205 km / 42'338 h Unproductive trains: 226'283 km / 5'494 h

Vehicle selection

#	RollStockID	First day	Last day	Runs	Productive	Unproductive
1	622	15.12.2018	14.12.2019	5335	96'106 km / 2'139 h	9'785 km / 239 h
2	622	15.12.2018	12.12.2019	5306	96'076 km / 2'142 h	9'566 km / 237 h
3	622	15.12.2018	12.12.2019	5190	95'456 km / 2'131 h	9'813 km / 239 h
4	622	15.12.2018	13.12.2019	4723	90'637 km / 2'043 h	10'024 km / 239 h
5	622	15.12.2018	11.12.2019	4644	90'724 km / 2'073 h	8'219 km / 195 h
6	622	15.12.2018	13.12.2019	5263	95'146 km / 2'113 h	9'668 km / 238 h
7	622	15.12.2018	14.12.2019	5289	95'754 km / 2'130 h	9'849 km / 242 h
8	622	15.12.2018	11.12.2019	4618	89'303 km / 2'012 h	9'867 km / 236 h
9	622	15.12.2018	11.12.2019	4537	89'695 km / 2'052 h	8'051 km / 191 h
10	622	15.12.2018	13.12.2019	5275	95'785 km / 2'130 h	9'866 km / 243 h
11	622	15.12.2018	12.12.2019	4637	92'237 km / 2'122 h	8'219 km / 196 h

Vehicle #9 622 Runs: 4537 Productive: 89'695

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dez 2018														
Jan 2019	25	36	52	69	14	37	26	27	38	59		29	40	31
Feb 2019		22	23	24	25	36	52	69	14	37	26	27	38	59
Mär 2019		18	19	20	34	35			22	23	24	25	36	52
Apr 2019	16	33	17			18	19	20	34	35			22	23
Mai 2019	11	49		13	32	16	33	17			18	19	20	34
Jun 2019	29	40	31	9	11	49		13	32	16	33	17		
Jul 2019	26	27	38	59		29	40	31	9	11	49		13	32
Aug 2019	52	69	14	37	26	27	38	59		29	40	31	9	11
Sep 2019	23	24	25	36	52	69	14	37	26	27	38	59		29
Okt 2019	34	35			22	23	24	25	36	52	69	14	37	26
Nov 2019		18	19	20	34	35			22	23	24	25	36	52
Dez 2019	32	16	33	17			18	19	20	34	35			

VEHICLE ROSTERING

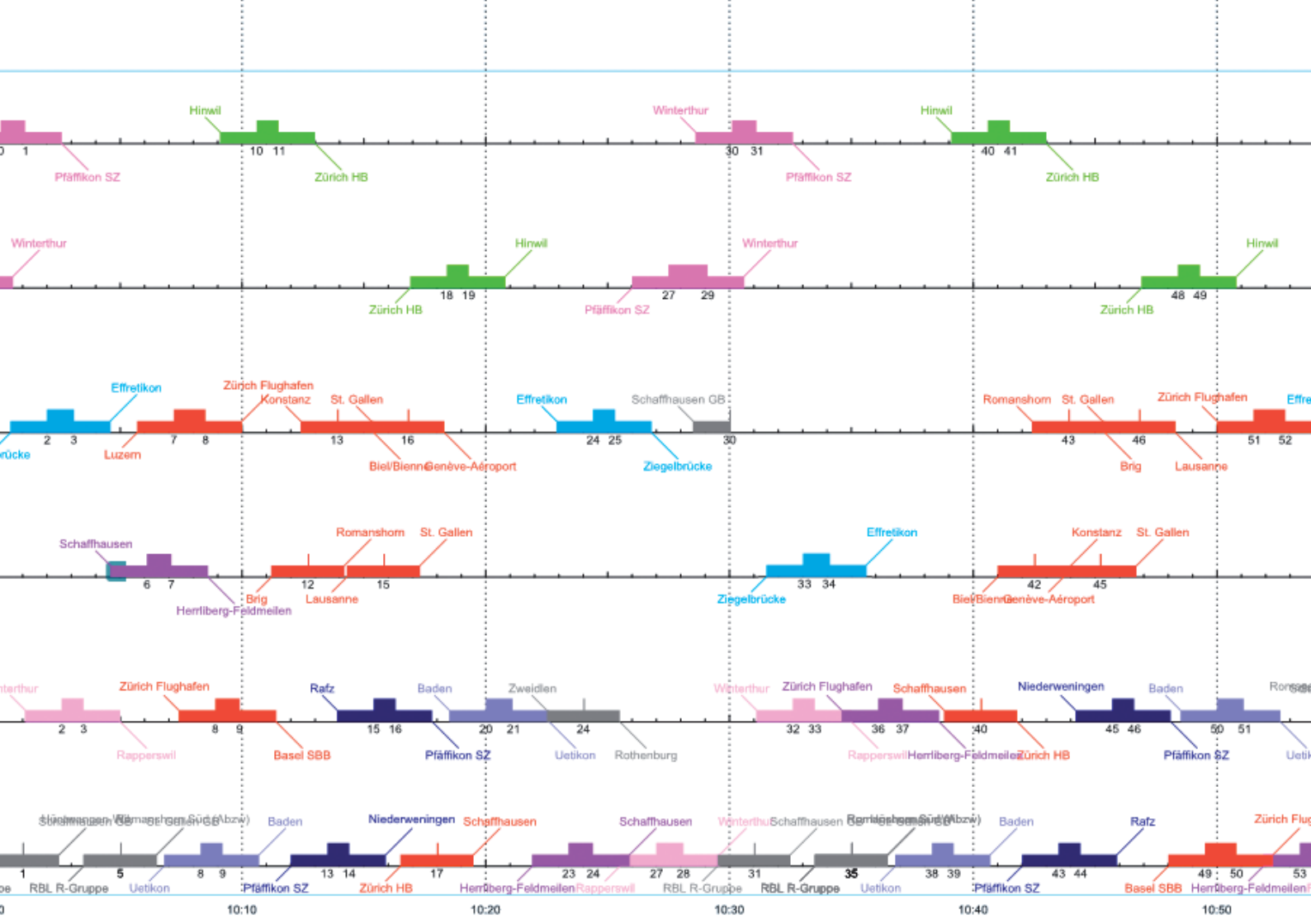
- Unique to Viriato vehicle rostering is the concept for laying out rosters. The user is free to plan the vehicle rosters using the rosters as a form of sketching tool. Once the roster is finalised the program will convert this to a publication ready format based on the vehicle work pattern.
- Automation and optimisation to speed up the process of generating and improving rosters. Automation is included to allow the user to quickly find a valid roster plan, or to complete an unfinished one. An optional interface is available allowing an external optimisation tool to control all aspects of a vehicle roster so that an optimal solution is found respecting vehicle movements, empty runs, maintenance activities and any user specific business rules that must be respected.
- The vehicle rosters can be viewed directly on a graphic timetable allowing clear visualisation of the work undertaken by vehicles within the timetable environment.
- The sequence of vehicles within a multiple unit is automatically managed in Viriato. Thus the rostering tool determines when a vehicle has changed direction, and alerts the user if a roster plan contains planned activities which are not possible because a vehicle is trapped by another unit.
- Built in plausibility checks ensure that the rosters created by the user contain links for all dates within the timetable period ensuring the creation of valid rosters.
- Reports showing utilisation of vehicles during each day and vehicles waiting at nodes allowing the planner to manage times of peak demand for rolling stock and storage locations.
- Empty runs for stock balancing purposes can be created as rostering activities. This allows the planner to see the effects on capacity consumption of the vehicle roster to make the roster more reliable.
- Maintenance activities can be planned in the roster, with validation rules based on time interval between activities (e.g. a cleaning activity every four hours) or distance between activity (e.g. refuelling at least every 1000km). Rule sets can be defined specifying which types of activities can occur at each location, allowing flexible planning of vehicle specific tasks.

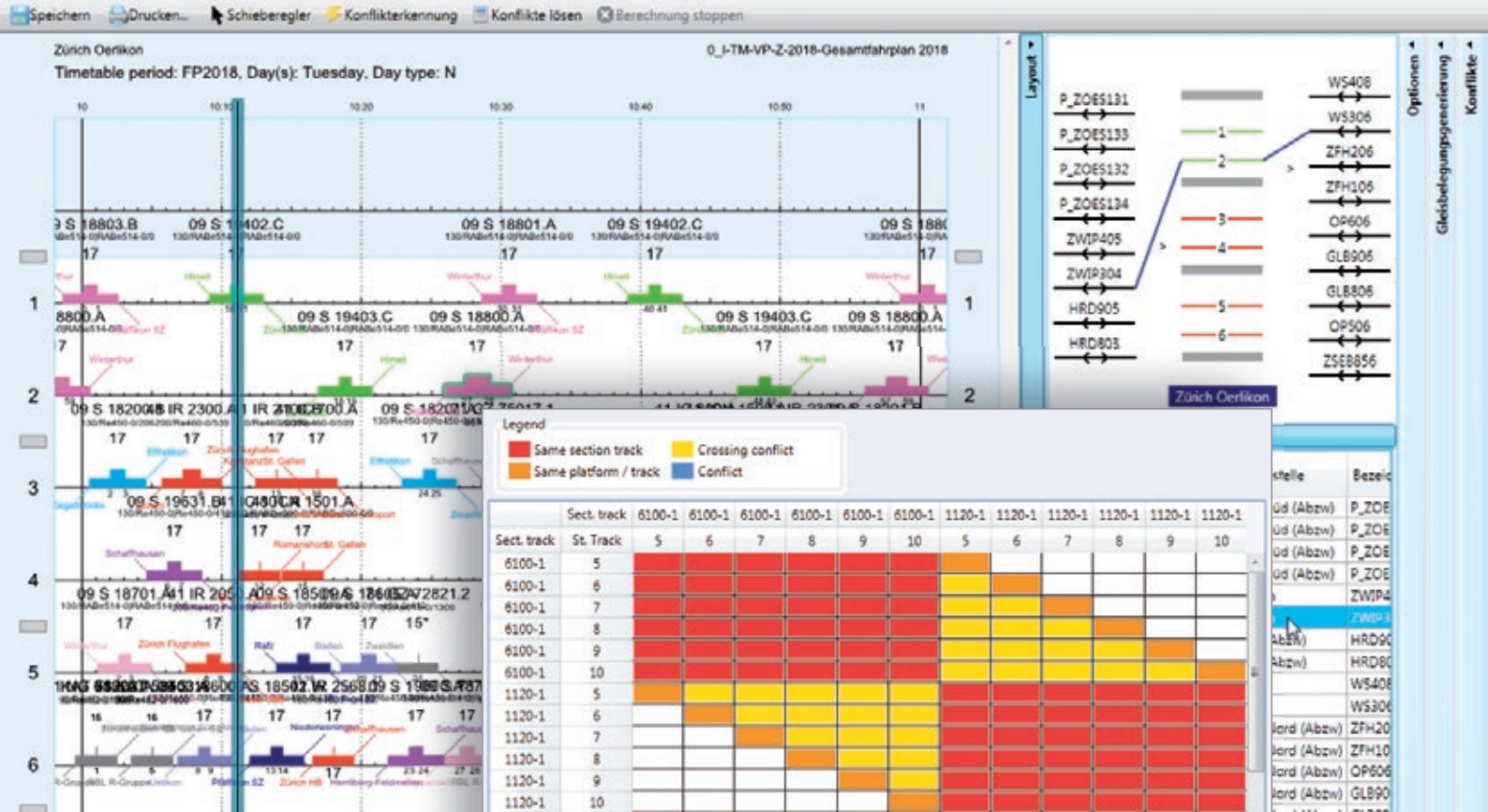
Functionality

- Create vehicle rosters through drag-and-drop
- Automatically generate rosters efficiently using built-in optimisation engine
- Complete existing partial rosters through automation
- Define empty vehicle movements
- Define maintenance tasks and frequencies
- Integrated within timetabling functionality allowing opening of trains from within roster
- Work with vehicles operating in multiple combinations
- Partition timetable data into efficient and logical sets for rostering
- Manage changes of vehicle direction during journey
- Optimisation interface available for third party systems

Display/output

- Prepare vehicle rosters as Gantt charts
- Display validation rules violations
- Print high quality vehicle rosters in detailed and compact formats
- Output summary statistics and reports


Hinwil
Pfäffikon SZ
Zürich HB
Winterthur
Effretikon
Zürich Flughafen
Konstanz
St. Gallen
Luzern
Biel/Bienne
Genève-Aéroport
Schaffhausen
Romanshorn
Brig
Herrliberg-Feldmeilen
Lausanne
Ziegelbrücke
Schaffhausen GB
Rapperswil
Basel SBB
Rafz
Baden
Zweidlen
Uetikon
Rothenburg
Niederweningen
RBL R-Gruppe
10:10
10:20
10:30
10:40
10:50


Speichern
Drucken...
Schieberegler
Konflikterkennung
Konflikte lösen
Berechnung stoppen
Zürich Oerlikon
0_I-TM-VP-Z-2018-Gesamtfahrplan 2018
Timetable period: FP2018, Day(s): Tuesday, Day type: N
Layout
Optionen
Gleisbelegungsgeeierung
Konflikte
Legend
Same section track
Same platform / track
Crossing conflict
Conflict
Sect. track
St. Track
6100-1
1120-1

Keeping track

Stations are at the heart of railway operations. Here lines converge, trains arrive and depart, passengers come and go and change trains, and trains are taken out of service, cleaned and maintained. As train operators introduce regular interval timetables and develop major connection points, the operational functions and capacity requirements placed on stations increase significantly.

Given these conditions, every step must be planned in detail. Therefore the analysis of arrival/departure times, the allocation of platforms and their occupancy is a core part of the timetable production process. The questions that are addressed in this analysis include: Are there sufficient platforms available for the proposed service concept? And what additional tracks or switches are needed to increase the service?

Viriato's platform occupancy module provides timetable planners with a simple and powerful tool for planning, evaluating and producing platform occupation charts. The planner can drag and drop trains between platforms and review conflicting moves instantly.

Viriato can help the timetable planner to create conflict-free platform workings with the optional conflict detection module displaying planning rule violations and conflicts between services on a given track or between arriving and departing trains from different tracks within the station area.

Functionality

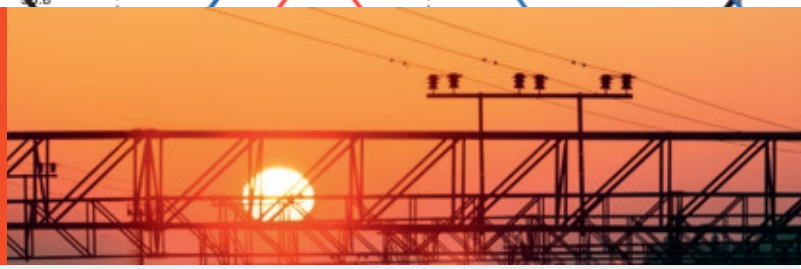
- Define track-specific occupancy and duration
- Set line-specific standard defaults and individual restriction rules for track allocation
- Set track-specific stopping points and arrival/departure speeds (for use in travel time calculation)
- Interactively allocate track using drag-and-drop within the allocation diagram
- Working area allowing trains without platforms to be kept in a separate pool until graphically assigned a platform
- Step-by-step undo function (to last saved version)
- Use filters for operating day, date range and validity
- Work directly with a train from the allocation diagram

Display/output

- Display/print station diagrams with tracks, platforms and lines
- Display the operating sequence in the station with slide control
- Adjust display based on operating day, train number, times, directions
- Freely select colours for displaying trains
- Copy platform occupation charts to clipboard or export it to a graphics file format (including PDF and SVG)

Conflict: Headway conflict in Rolle, Needed 2.0min, Actual value 1.7min

Train ID	From	Time	Track	To	Time
41 RE 2600.A	Rolle	12:12.5	319	Gilly-Bursinel	12:14.5
41 IR 1700.A	Rolle	12:10.8	319	Gilly-Bursinel	12:12.2



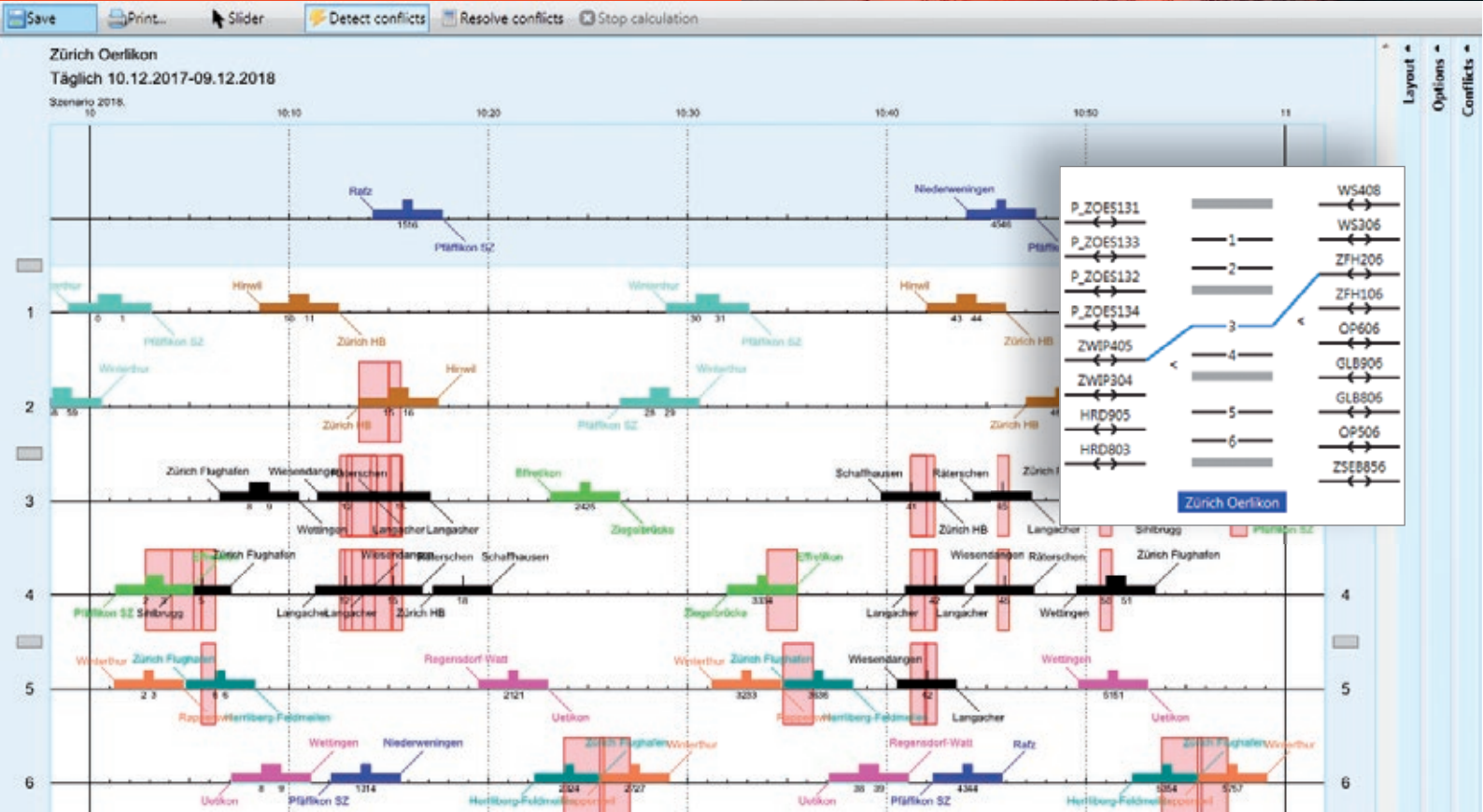
Save | Print... | Slider | Detect conflicts | Resolve conflicts | Stop calculation

Zürich Oerlikon

Täglich 10.12.2017-09.12.2018

Szenario 2018

Layout | Options | Conflicts



The dark side of capacity

A railway timetable is subject to numerous constraints, including those due to infrastructure (line headways, interlocking systems, etc.), vehicles (performance, train type, etc.) and the service pattern (intermediate stops, connections, etc.). The higher the railway system's degree of complexity, and the closer to operating at design capacity, the more these constraints must be considered in timetable planning.

In complex cases it can be very difficult to verify that all the constraints on operation have been considered and that the proposed timetable remains conflict-free.

Viriato's conflict detection module rapidly determines and visualises all conflicts on the graphic timetable. The user can alter a planned train by dragging the path on the graphic timetable, and any remaining conflicts are instantly shown. Viriato produces a tabular summary of conflicts and durations to enable the planner to resolve them quickly.

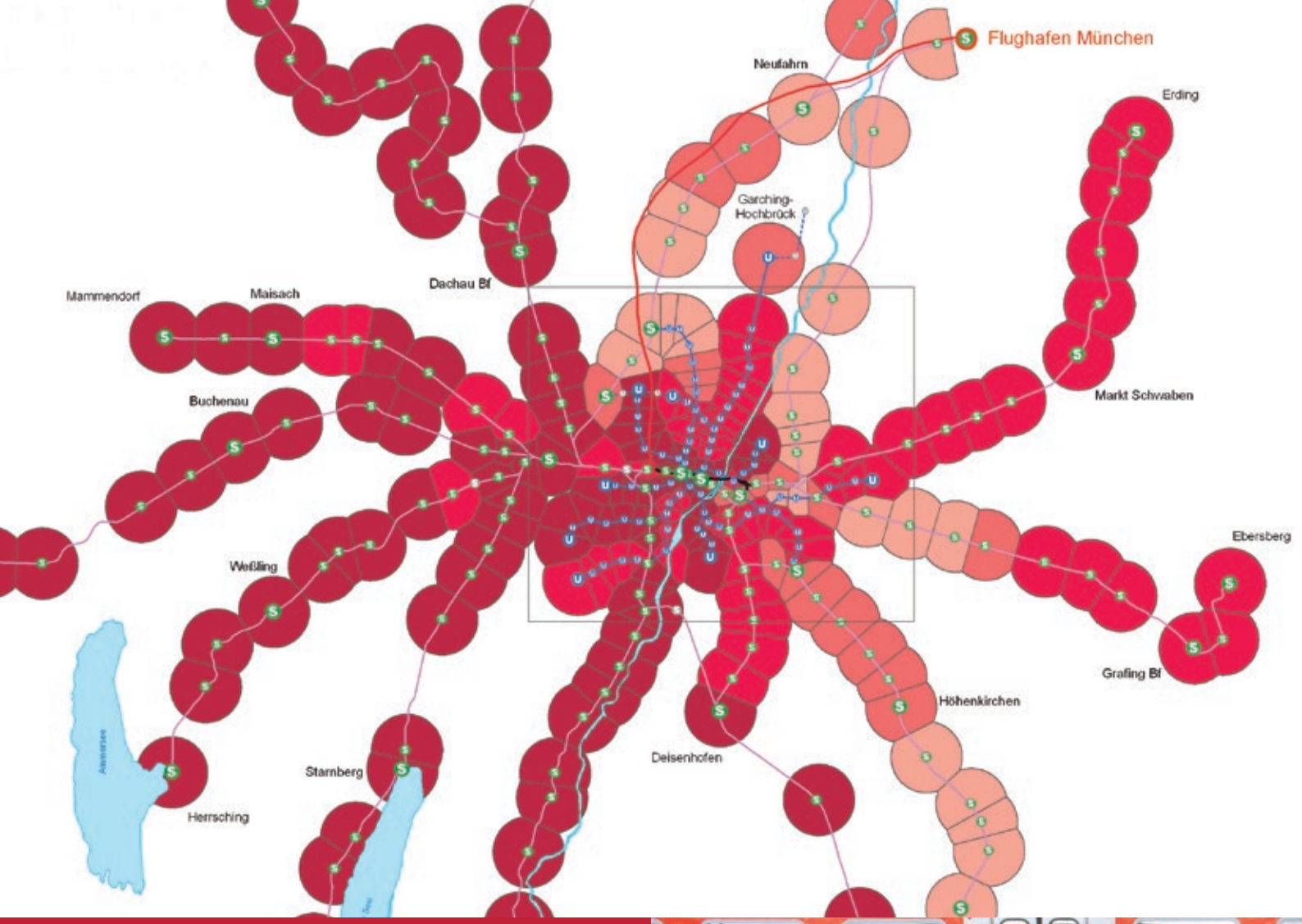
The Viriato conflict detection module also detects platform allocation issues. Our rigorous mathematical algorithm detects conflicts within a platform occupation plan, and alerts the user if the proposed service pattern is infeasible, providing a valuable early warning to the train planner.

Functionality

- Distinguish between single direction and bi-directional service on a line
- Detect crossings on single track lines
- Detect itinerary conflicts in station gridirons
- Detect insufficient headway times based on user-defined headway standards
- Set station-specific separation times for conflicting routes and overlap distances
- Examine simultaneous track allocations, platform lengths and prohibited routes
- Dynamic drag-and-drop conflict resolution

Display/output

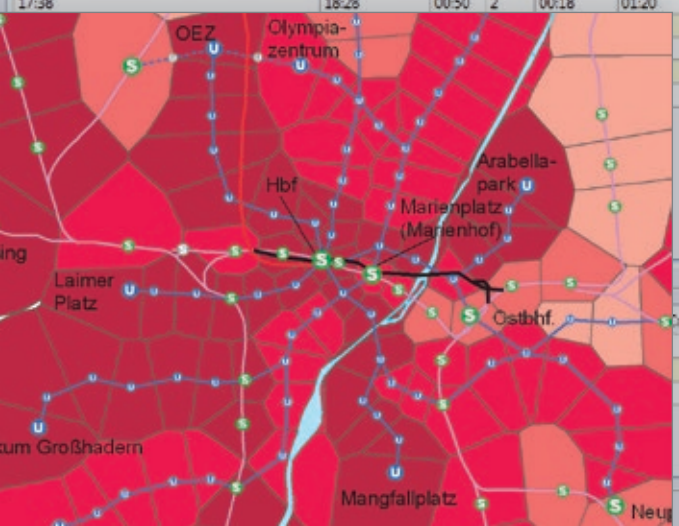
- Graphic display of conflicts on the track occupancy diagram and graphic timetable
- Tabular conflicts listing including conflict duration and affected trains



Save Open Calculate Filter active

85AN - Andelfingen | 85FET - Fehraltorf

Departure time	Arrival Time	Durati	Chan	Changes d	Penalised trip	Distance	F	C	B
07:38	08:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
08:38	09:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
09:38	10:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
10:38	11:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
11:38	12:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
12:38	13:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
13:38	14:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
14:38	15:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
15:38	16:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
16:38	17:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
17:38	18:28	00:50	2	00:18	01:20	29.4	✓	✓	✓
						29.4	✓	✓	✓
						29.4	✓	✓	✓
						29.4	✓	✓	✓
						29.4	✓	✓	✓



Summary

Data source

Scenario: Konzept 2018 - Concept 2018

Total trip possibilities:	15
Fastest trip duration:	00:50
Average trip duration:	00:50
Minimum changes:	2
Best overall trip duration:	**00:50**

Extras

- Train selection
- Node selection
- Penalty per change [min]
- Results filter

Filter enabled

Time window

Departure 5:00 22:00

Arrival 23:00 23:00

Quality criterion

Relative to fastest connection

2 Max minutes slower

0 Max percentage slower

Absolute criterion

0 Max number of changes

0 Max time per change [min]

Connection categories

Filter by connection criterion

Fastest connection

Fewest changes

Best connection

Getting there

Timetable production is an interactive process involving many constraints and conflicting goals. Operational constraints often have impacts that are not initially obvious. Furthermore, the system-wide impacts of local timetable changes are not directly evident in large railway networks.

Viriato's trip time analysis module enables timetable planners to compare alternative timetables and analyse timetable and service quality. It starts by identifying all meaningful connections based on the timetable data, trip times and user-defined transfer times. Once the connections have been identified, Viriato calculates the alternative's most important customer and operational qualities.

The trip time analysis module provides many different analysis tools enabling timetable planners to thoroughly evaluate alternative timetables, and permitting the attractive presentation of this data in a variety of graphical formats. This allows the travel opportunities offered by the new timetable to the railway and its customers to be communicated effectively.

Functionality

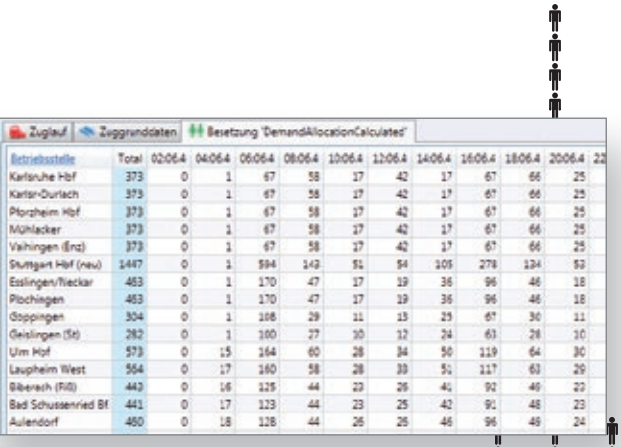
- Determine all possible connections with: shortest trip time, fewest transfers and shortest weighted trip time, for any selection of origin/destination pairs
- Compare summary and specific origin/destination pair journey time data between timetables
- Set user-defined transfer weighting values

Display/output

- Display connection data in a tabular format for a large set of criteria (including trip time, waiting time, total distance travelled, speed, etc.)
- Use filters to display selected data
- Aggregate data based on various criteria
- Graphically view results in the SMA geovisualisation tool

Demand Assignment

Passengers per train



Betriebsstelle	Total	02:00-4	04:00-6	06:00-8	08:00-10	10:00-12	12:00-14	14:00-16	16:00-18	18:00-20	20:00-22	22
Karlsruhe Hbf	373	0	1	67	58	17	42	17	67	66	25	
Karlsr-Durlach	373	0	1	67	58	17	42	17	67	66	25	
Pforzheim Hbf	373	0	1	67	58	17	42	17	67	66	25	
Mühlacker	373	0	1	67	58	17	42	17	67	66	25	
Vaihingen (Enz)	373	0	1	67	58	17	42	17	67	66	25	
Stuttgart Hbf (neu)	1447	0	1	594	143	51	54	105	278	134	53	
Esslingen/Neckar	463	0	1	170	47	17	19	36	96	46	18	
Plochingen	463	0	1	170	47	17	19	36	96	46	18	
Göppingen	304	0	1	168	29	11	13	25	67	30	11	
Geislingen (St)	282	0	1	100	27	10	12	24	63	28	10	
Ulm Hbf	573	0	15	164	60	28	34	50	119	64	30	
Laupheim West	564	0	17	160	58	28	33	51	117	63	29	
Biberach (Riß)	443	0	16	125	44	22	26	41	92	49	22	
Bad Schussenried Bf	441	0	17	123	44	23	25	42	91	48	23	
Aulendorf	460	0	18	128	44	26	26	46	96	49	24	

Understanding passenger flows

The creation of a new timetable and service often influences the choice of route taken by passengers. The Viriato add-on module trip time analysis calculates the routes that can be taken by passengers, including changing trains and indicates any change of service quality between timetables. The Demand Assignment module goes one step further, as it incorporates the passenger demand into trip time analysis and thus allows the determination of the number of passengers travelling on each train in the timetable.

An iterative process is carried out within Viriato which makes transparent to the user the interaction between new timetable service concepts and the associated changes in passenger routing and flows. Within this process occurs the timetable concept creation itself, calculation of the possible connections available, apportionment of the passenger demand on the new routes and thus the loading of trains. As the user modifies the timetable concept this process repeats. This analysis is all undertaken within Viriato using the Trip Time Analysis and Demand Assignment add-on modules.

The algorithm for passenger assignment uses a relative attractiveness model for each potential journey. The demand from every origin-destination pair is simultaneously distributed to trains based on both the weighted time spent travelling and the waiting time between options for each choice, i.e. the passengers wishing to travel during a time period select their train connections based on the relative quality of the journeys available to them.

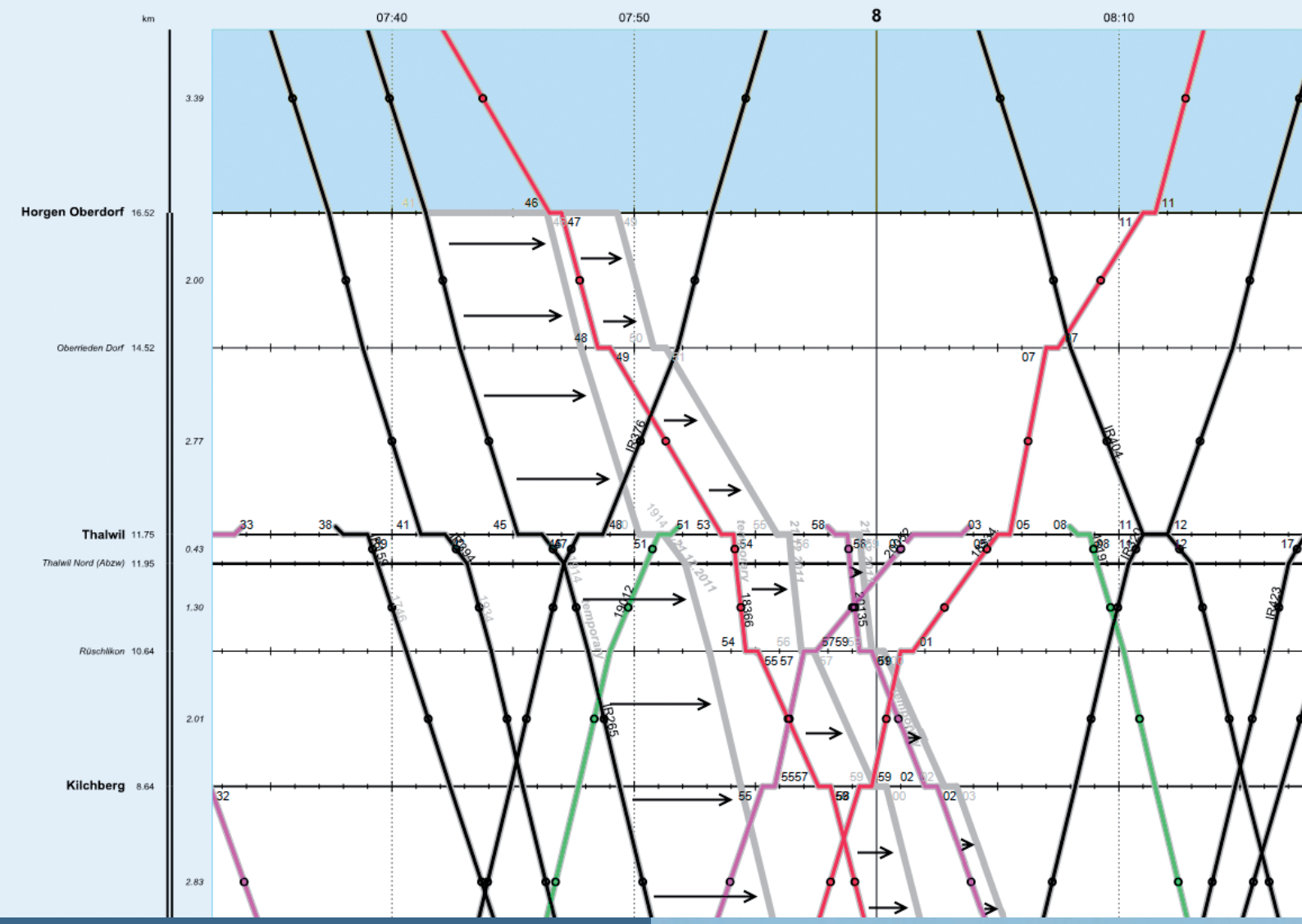
Viriato also calculates the distribution curves containing the fraction of passengers who wish to travel each hour used by the module based on known travel patterns between locations, allowing the modelling of morning and evening peaks, flows into major conurbations, etc.

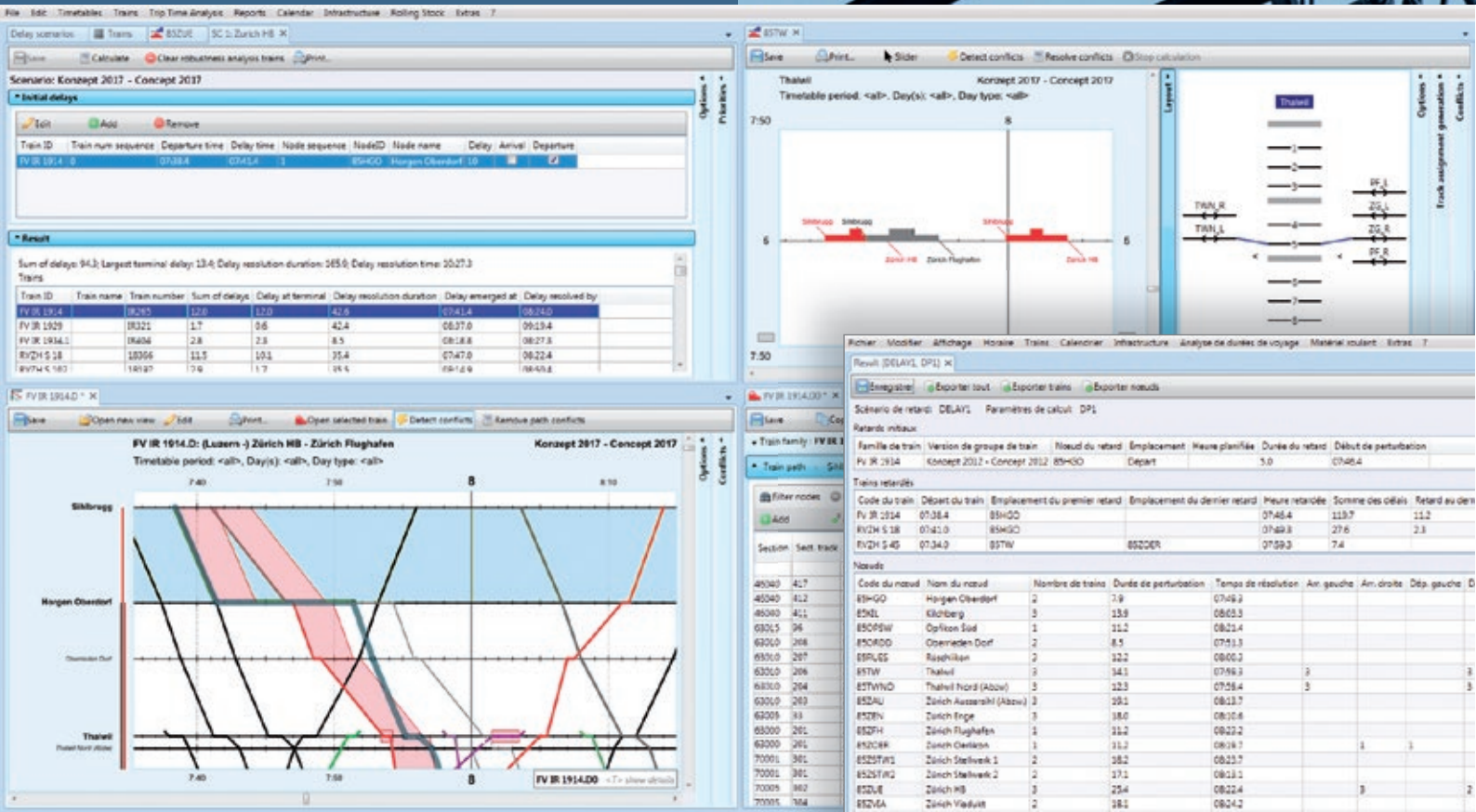
Functionality

- Import demand matrix
- Import base daily utilisation curves
- Calculation of node pair specific curves by direction
- Import connection data (results from Viriato Trip Time Analysis)
- Adjustable resistance exponent in algorithm
- Calculation of part trips
- Calculation of trips parts

Display/output

- Additional tab showing passenger loading per train journey segment
- Detailed export to MS Excel of demand assignment data


km
07:40
07:50
8
08:10
Horgen Oberdorf 16.52
Oberrieden Dorf 14.52
Thalwil 11.75
Thalwil Nord (Abzw) 11.95
Rüschlikon 10.64
Kilchberg 8.64
3.39
2.00
2.77
0.43
1.30
2.01
2.83
IR376
IR404
IR423
IR265
1914
1912
Temporary


Scenario: Konzept 2017 - Concept 2017
FV IR 1914.D: (Luzern -) Zürich HB - Zürich Flughafen
Konzept 2017 - Concept 2017
Timetable period: <all>, Day(s): <all>, Day type: <all>
Sihlbrugg
Horgen Oberdorf
Thalwil

Dealing with uncertainty

In the iterative process of timetable production, evaluation of plans plays an important role. One aspect which is usually especially hard to quantify and assess is the operational robustness of a timetable variant. The determination of the impact of local infrastructure or timetable changes on the robustness of the whole system is a difficult task even for experienced planners when working with large networks.

The robustness analysis module allows the validation of the stability of a timetable and the comparison of the performance of alternative timetables. The user develops delay scenarios containing a set of pre-defined incidents that they wish to test a timetable against or using delays generated from statistical distributions. This is then processed by Viriato using the infrastructure data, with the original delays propagated through the timetable until the service pattern returns to normal. Once the calculation is done Viriato produces statistics and the perturbed timetable can be saved as a regular Viriato scenario.

Using a Monte Carlo simulation, where the analysis is performed multiple times with different initial delays, the robustness of a timetable can be assessed and compared against a realistic range of input perturbations.

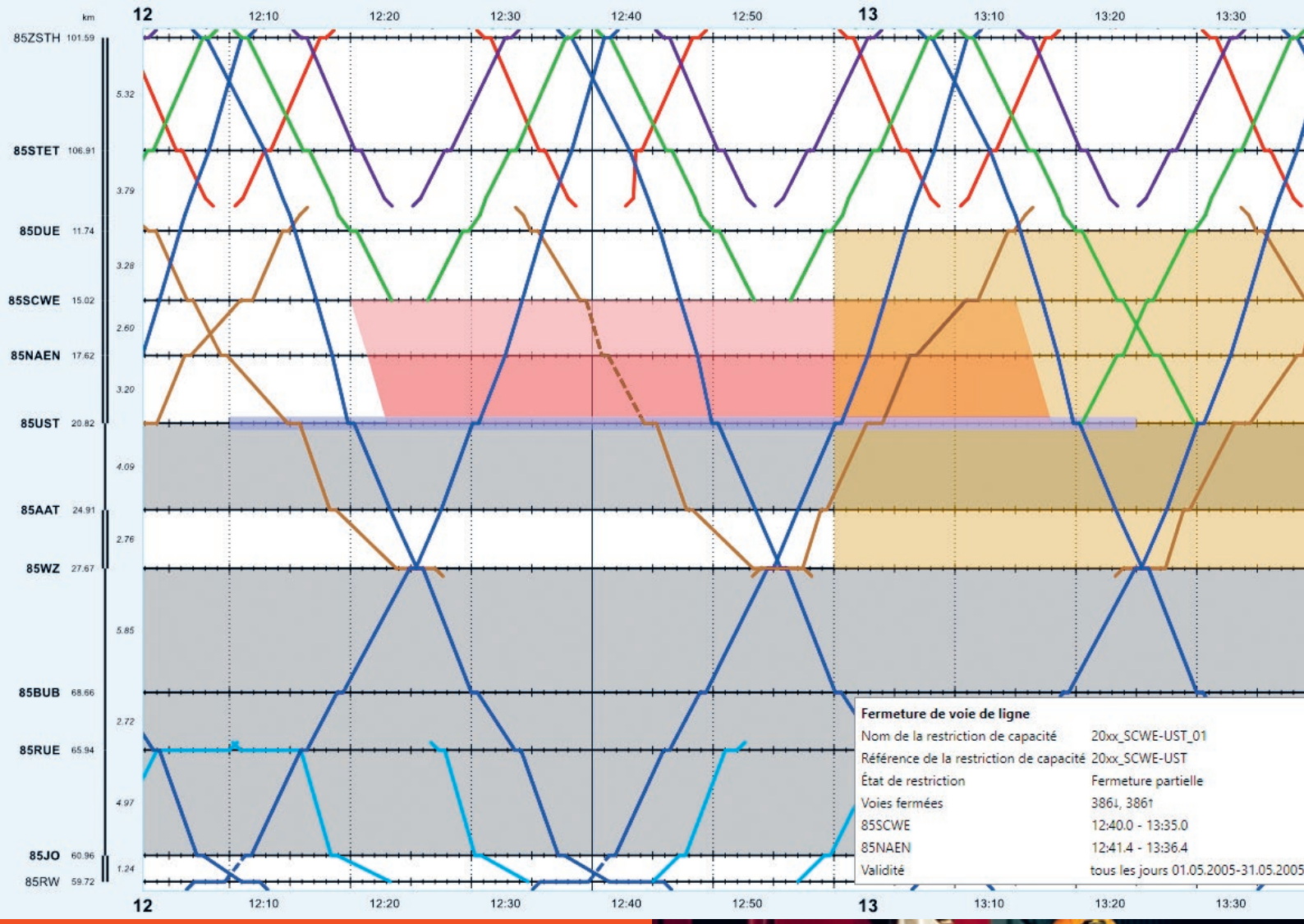
The result of the delay propagation may be reviewed using Viriato, and includes statistics such as the duration for recovery and the total delay minutes due to the original perturbation. These statistics can be exported and used for further analysis and for the presentation of results. Results saved in a new timetable scenario can be displayed and analysed using all the standard Viriato functions. This allows the robustness of any new timetable to be effectively analysed and easily communicated.

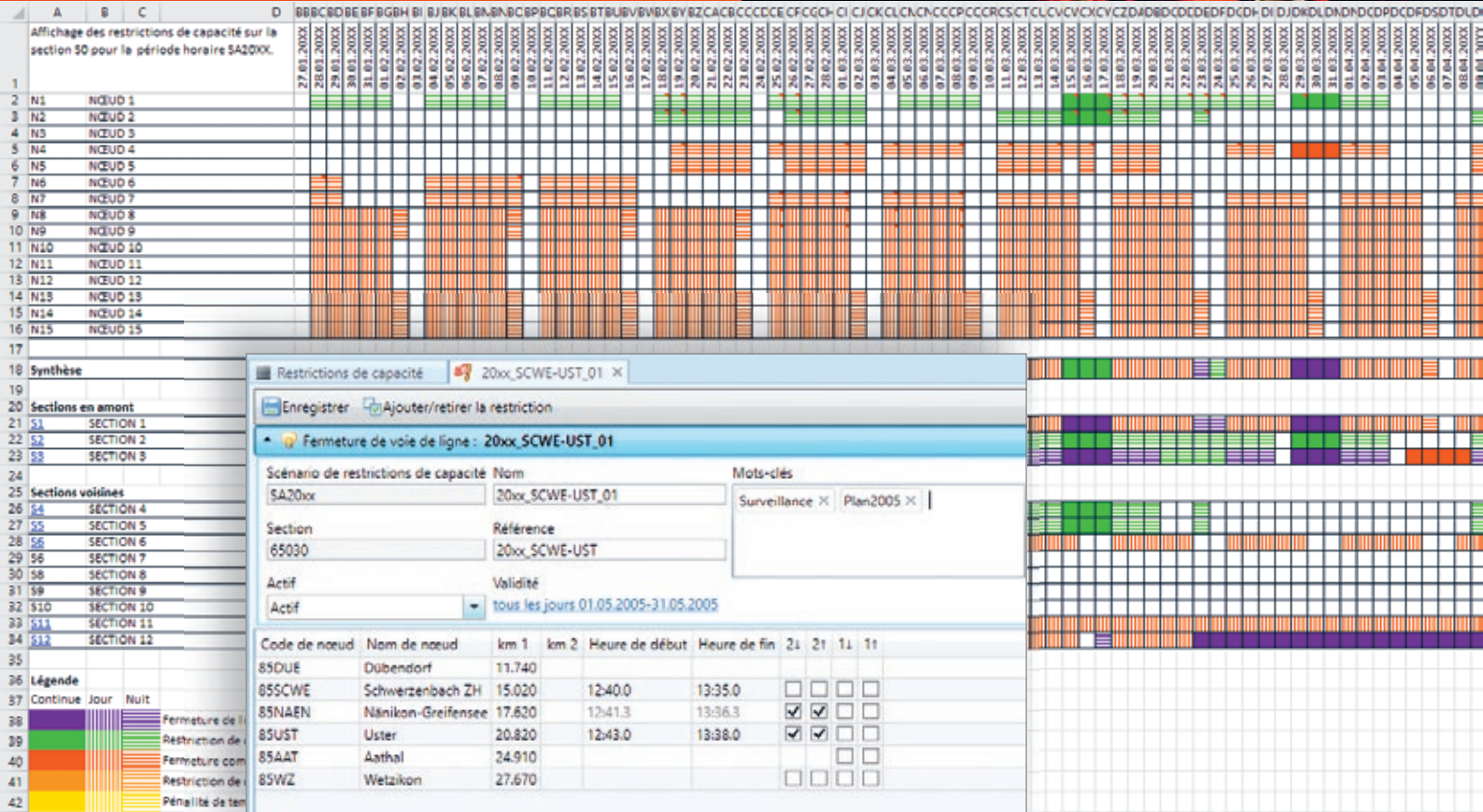
Functionality

- Define delay scenarios by injecting delays to trains into a timetable
- Determine the behaviour of trains by defining which kind of planned time reserves can be used to catch up delays
- Uses the Viriato conflict detection to model infrastructure capability
- Simulate the propagation of delays in the timetable through a railway network
- Analysis of results and production of aggregated statistics
- Perform multiple runs with a Monte Carlo simulation based on statistically generated delays

Display/output

- Export the statistics as .csv files for further analysis
- Save the perturbed timetable as a new Viriato scenario
- Display the results using the graphical timetable comparison and all other standard Viriato views


km
12
12:10
12:20
12:30
12:40
12:50
13
13:10
13:20
13:30
85ZSTH 101.59
5.32
85STET 106.91
3.79
85DUE 11.74
3.28
85SCWE 15.02
2.60
85NAEN 17.62
3.20
85UST 20.82
4.09
85AAT 24.91
2.76
85WZ 27.67
5.85
85BUB 68.66
2.72
85RUE 65.94
4.97
85JO 60.96
1.24
85RW 59.72
Fermeture de voie de ligne
Nom de la restriction de capacité 20xx_SCWE-UST_01
Référence de la restriction de capacité 20xx_SCWE-UST
État de restriction Fermeture partielle
Voies fermées 386↓, 386↑
85SCWE 12:40.0 - 13:35.0
85NAEN 12:41.4 - 13:36.4
Validité tous les jours 01.05.2005-31.05.2005


Affichage des restrictions de capacité sur la section 30 pour la période horaire SA20XX.
N1 NŒUD 1
N2 NŒUD 2
N3 NŒUD 3
N4 NŒUD 4
N5 NŒUD 5
N6 NŒUD 6
N7 NŒUD 7
N8 NŒUD 8
N9 NŒUD 9
N10 NŒUD 10
N11 NŒUD 11
N12 NŒUD 12
N13 NŒUD 13
N14 NŒUD 14
N15 NŒUD 15
Synthèse
Sections en amont
S1 SECTION 1
S2 SECTION 2
S3 SECTION 3
Sections voisines
S4 SECTION 4
S5 SECTION 5
S6 SECTION 6
S6 SECTION 7
S8 SECTION 8
S9 SECTION 9
S10 SECTION 10
S11 SECTION 11
S12 SECTION 12
Légende
Continue Jour Nuit
Restrictions de capacité
20xx_SCWE-UST_01
Enregistrer
Ajouter/retirer la restriction
Fermeture de voie de ligne : 20xx_SCWE-UST_01
Scénario de restrictions de capacité
SA20xx
Nom
20xx_SCWE-UST_01
Mots-clés
Surveillance
Plan2005
Section
65030
Référence
20xx_SCWE-UST
Actif
Actif
Validité
tous les jours 01.05.2005-31.05.2005
Code de noeud
Nom de noeud
km 1
km 2
Heure de début
Heure de fin
2↓
2↑
1↓
1↑
85DUE Dübendorf 11.740
85SCWE Schwerzenbach ZH 15.020 12:40.0 13:35.0
85NAEN Nänikon-Greifensee 17.620 12:41.3 13:36.3
85UST Uster 20.820 12:43.0 13:38.0
85AAT Aathal 24.910
85WZ Wetzikon 27.670

Keeping the railway running

Although the key reason for running a railway is moving passengers and goods, it should not be forgotten that there is the requirement to maintain and upgrade the infrastructure to allow operations to continue and grow. Without maintenance work, the condition of railway assets soon begins to degrade.

While Infrastructure Managers try to minimise the effects of these engineering works on their customers,

they often have consequences to planned trains which may require modification to allow them to run on days with works. Train operators need to know which tracks are available between stations, within stations themselves, and will there be any additional running time due to speed restrictions?

The works planning module allows the creation of the engineering works, and the display of the interactions with planned trains. The engineering works can be collected together through the use of scenarios, allowing the user to group and filter subsets of the works based on their own criterion.

The engineering works can be visualised in the graphic timetable within Viriato, allowing an immediate overview of trains which are planned to run through track sections which are closed, or have a speed restriction planned. A report can be created that shows in detail exactly which trains are affected on each date during the timetable period, allowing them to be identified and replanned for the affected dates.

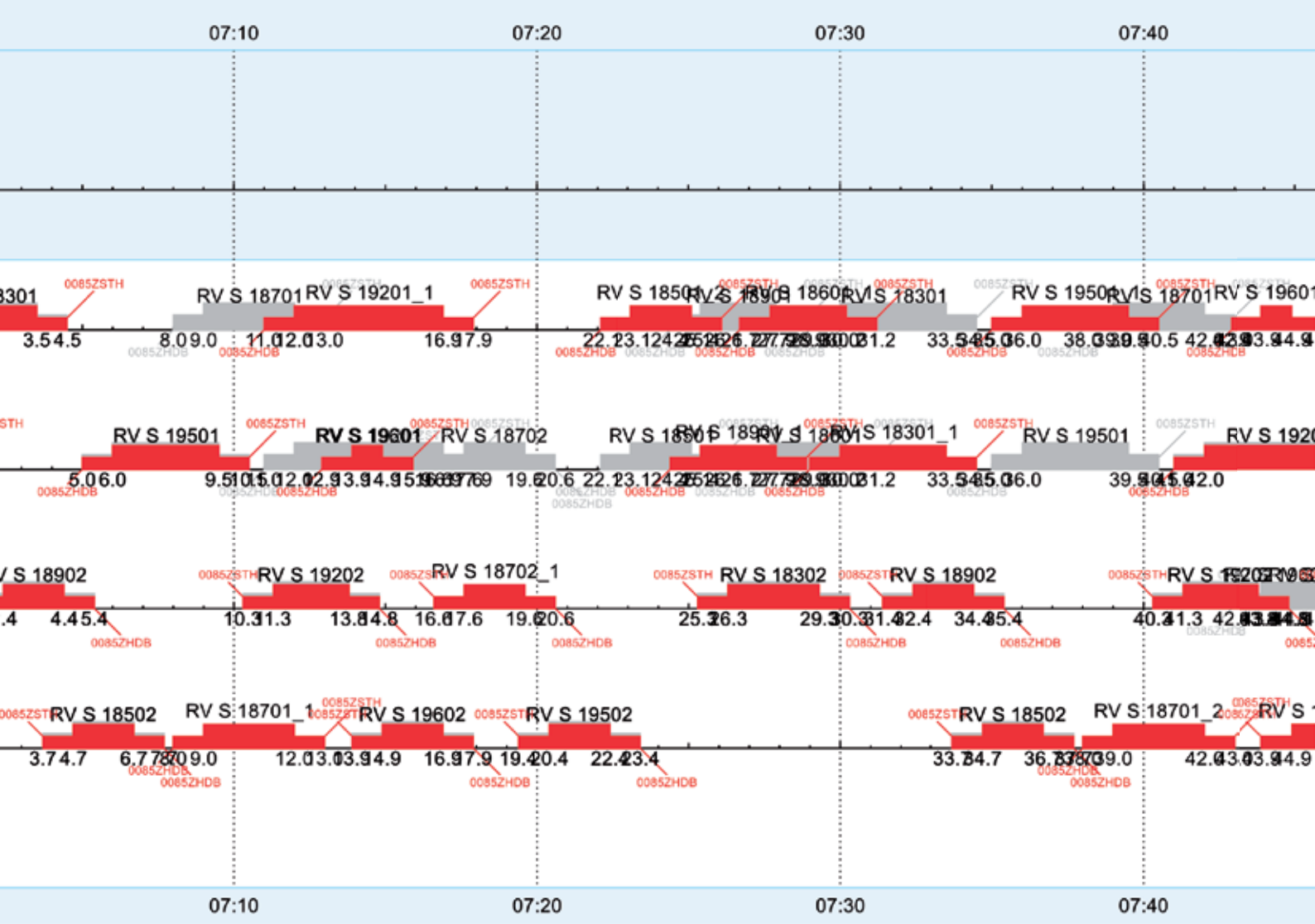
To allow the user to take a more strategic view of the engineering works, a second visualisation of the data in Viriato has also been developed which shows a summarised view of the works on a day-by-day basis. For each section in the network, the restriction is summarised as being full or partial and day and/or night. This view allows the user to quickly identify the pattern of restrictions, to check whether alternative routes are available and to make decisions regarding their train timetable.

Functionality

- Line sections closures can be full or partial by individual track
- Node closures of individual tracks
- Speed restrictions including the time penalty received by a train running through the works
- All restrictions may affect a section or node for any combination of dates and times within a timetable period

Display/output

- Graphical display of conflicts between trains and works on the graphic timetable
- Report of interaction between planned trains and engineering works



Viriato 8 Standard (1.0.24332.8067) - C:\Workspace\brochure\BeispieldatenbankZürich-1.00.vstd64(Single user) - tolnsert

File Edit View Timetable Trains Calendar Works planning Infrastructure Trip time analysis Rolling stock Algorithm platform Rostering Extras ?

Graphic Timetables | tolnsert | Nodes | Trains | RV_9999_2_FP2012 | Algorithm platform | Settings | Train attributes | Train types | RV_9999_2_FP2012_1

Save | Edit | Print... | Open trains | Open trains in train list | Move trains | Change track | Restrict to train validity | Conflict detection | MoD | Enable conflict detection (old)

tolnsert:
1/18/2012
Trains from scenario: 'solution'.

km
Zürich Oerlikon 4.7
Hard Käferberg (Above) 1.2
Zürich Hardbrücke 0.2
Zürich Langstrasse 1.9
Zürich HB Museumsstrasse 0.9 99.1 99.8
Zürich Stadelhofen 101.6 5.7
Zürich Tiefenbrunnen 7.9
Zollikon 9.5
Küsnacht Goldbach 10.8
Küsnacht ZH 11.7
Erlenbach ZH 13.5
Winkel am Zürichsee 14.6
Herrliberg-Feldmeilen 16.6
Meilen 19.5

Platform assignment finder - 1.0.1288.8034

Base timetable
Scenario: Fahrplan 2012
From: 1/18/2012 07:00.0
To: 1/18/2012 08:00.0

Stations
All stations relevant in the selected scenario
Restrict to station: 0085ZMUS - Zürich HB

Track assignment
Preserve planned tracks

Saving options
Target scenario: solZMUS2
Save back all trains

Finding capacity in a congested network

The goal of searching for conflict free paths in an existing timetable is a complex one. Although capacity may remain, the nature of potential remaining paths may be hard to find manually due to conflicts with trains already planned. A typical case for this is to add additional freight trains into an existing plan as the timetable moves from the long-term through to medium- and short-term versions.

In the Past Search Module, the user creates a model train for inserting into the timetable, typically based on an existing service identifying the rolling stock type and stopping locations. Other parameters are defined such as the time window in which this new service must run, and where the times can be flexed or modified to successfully integrate it into the planned service pattern. Other rules such as whether existing trains can be moved to alternative platforms to create space on the infrastructure without altering existing plans may also be specified. The module then creates a mathematical model of the inputs, and passes it to a high-performance external mathematical solver developed by Gurobi, which computes the optimal solution for the new path given the requirements and constraints. Viriato then re-inserts this resulting train into the timetable as a conflict-free train path.

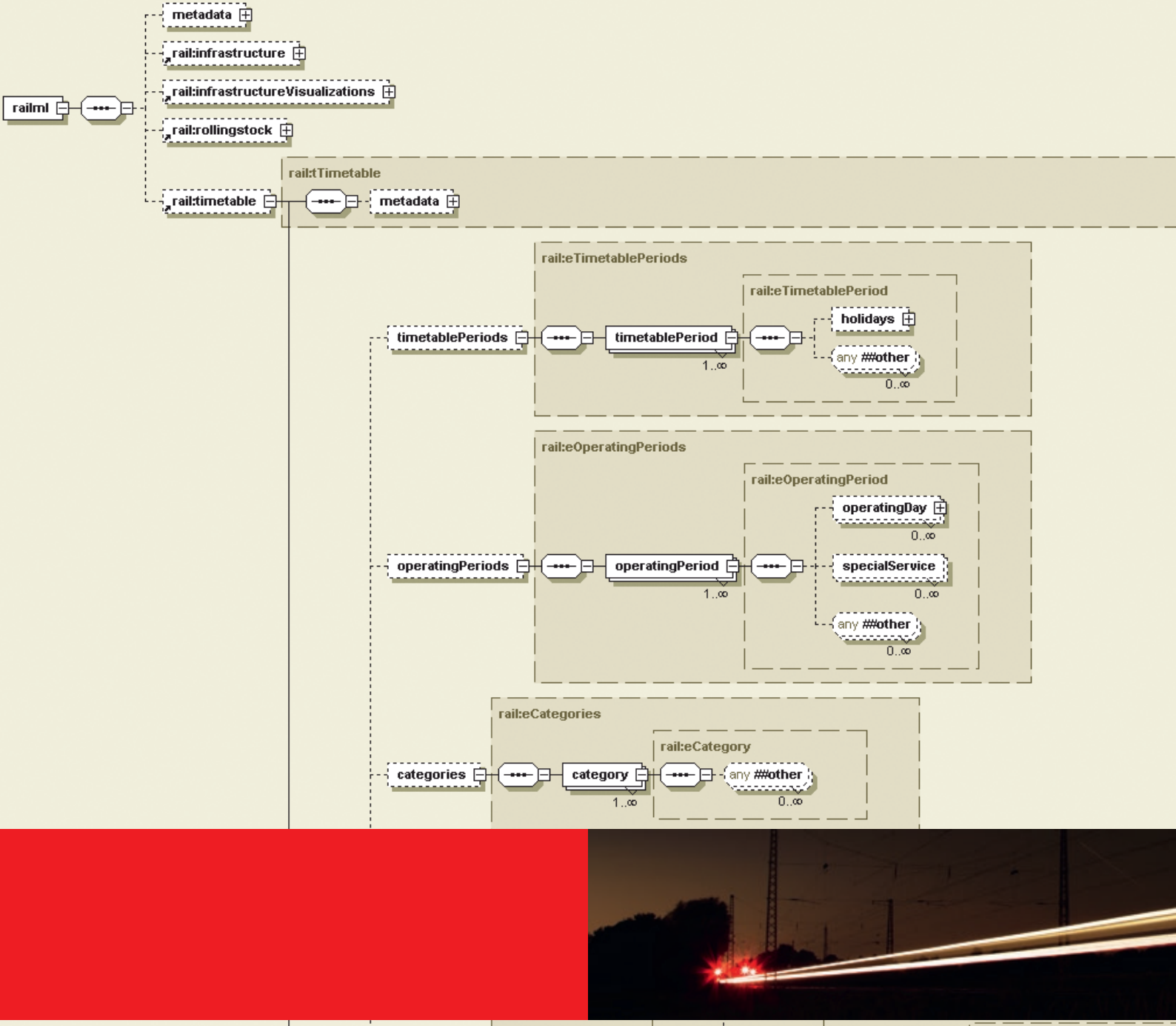
This workflow enables users to rapidly find conflict free paths in congested timetables, and to progressively build up the required service pattern. Additionally, the platforms used by existing trains can be adjusted at anytime to ensure conflict station operations.

Functionality

- Any existing train (or set of trains) used as template for new path(s)
- Path(s) inserted into a time window on a single day
- Deceleration, minimum stop and acceleration times added to unplanned stops
- Platforms used by existing trains may optionally be adjusted to enable a conflict free path to be found
- Maximum allowable path duration for both overall path and per section can be specified
- The user can specify nodes to ignore (i.e. assume capacity is always available) in the analysis
- Reserve times from the template trains can be preserved
- If a solution is not found due to lack of capacity a report is produced showing congested nodes
- Automatic platform occupation resolution can re-platform existing trains to make them conflict free without invoking the path search

Display/output

- Train scenario containing either only the conflict free path(s) found or all train paths, both existing and additional conflict free ones
- Results can be viewed in existing Viriato displays, e.g. graphic timetable, etc.


railml
metadata
rail:infrastructure
rail:infrastructureVisualizations
rail:rollingstock
rail:timetable
rail:tTimetable
metadata
rail:eTimetablePeriods
timetablePeriods
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operatingPeriods
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any ##other
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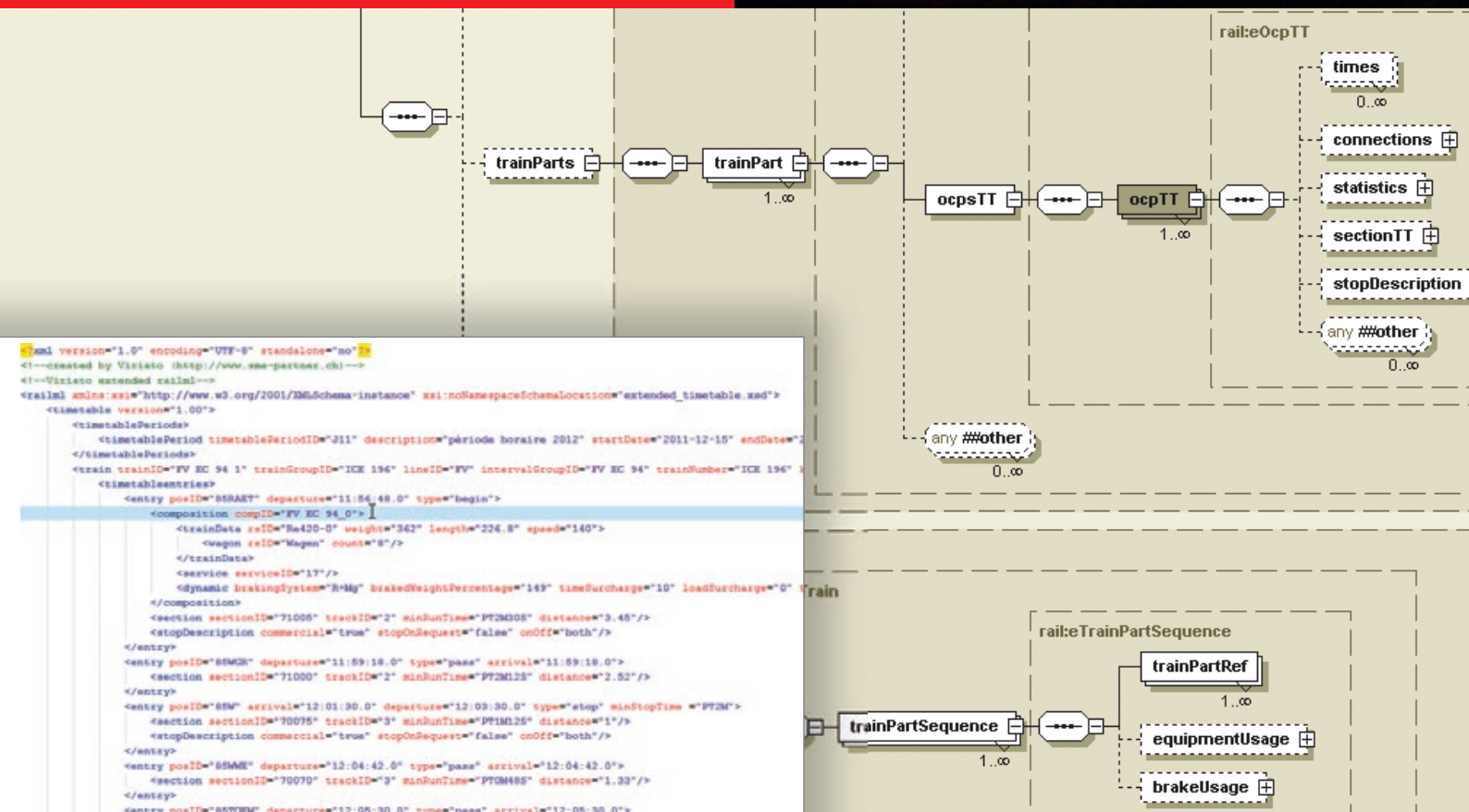
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ocpsTT
ocpTT
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rail:eOcpTT
times
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connections
statistics
sectionTT
stopDescription
any ##other
0..∞
any ##other
0..∞
rail:eTrainPartSequence
trainPartRef
1..∞
equipmentUsage
brakeUsage
trainPartSequence
1..∞

Taking platform thinking further

A train timetable goes through many planning stages over its long period of development. The process starts with the preparation of a draft service plan. This is constantly refined until operations of the train commence. Finally, after the introduction of the timetable system performance is analysed. Finding the timetable that best balances the railway's operational and economic needs requires much iteration.

Viriato's versatility enables it to support timetable planners at all stages of the development process. Nevertheless, data will almost certainly need to be exchanged with other applications at some point in the process, and used either in parallel or sequentially. A central element in the data exchange process is insuring efficient data flow without wasteful and error-prone re-collection of data. The challenge consists of linking different applications over intelligent and standardised interfaces.

The railML initiative was created to improve the data exchange process between railway information technology applications (www.railML.org) through the development of agreed standards. SMA und Partner AG was a founding member of the railML initiative and continues to actively participate in railML development. The goal of railML is to link different applications through the creation of defined interfaces between diverse rail service planning and operations IT applications, and to simplify information exchange with the definition of standardised XML-based schemas.

Proprietary interfaces

- TPN (DB InfraGo path portal for ordering train paths)
- TAF/TAP-TSI (EU standard data model for ordering train paths)
- SIPH (timetable system of SNCF-Réseau)
- BookIN (Infrabel slot portal for SNCB to order train paths)
- LIIKE (slot portal of Fintraffic)
- KSS (DB InfraGo timetable format for various systems)
- IVU.rail (Timetable export to resource planning system)

Other interfaces

- Direct exchange of data between Viriato databases
- Support of the railML standards for timetable import and export
- Direct export to MS Excel
- Reporting export for processing in business analytics tools

Application Server

- Citrix and AppStream-compatible for operation on an application server
- Windows Terminal Server compatible

User authorisation concept

- Role based multi-level authorisation for Viriato functions (administrator, super-user, user, guest…), user-group based authorisation for timetable data access (write, read, no access)

vDatabase system recommendations

Local file-based

- Recommended for stand-alone installations and small work groups
- Provides flexibility and simple administration

Oracle/MS SQL

- Recommended for multi-user work groups
- Provides high level of data security and performance
- Network-compatible
- Create file-based database extracts for local work on mobile clients

Editorial services
SMA und Partner AG, Zurich
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Eggmann-Design, Grüningen

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