HaCon – The Timetable Company

HaCon
Traffic • Software • Service

Real-time information & ETA

Workshop on Best Practice and Ongoing Developments

HaCon Ingenieurgesellschaft mbH

Hannover, Paris, London, Berlin, Brüssel, New York

Content:

1. Real-time & ETA
History ➞ Future

2. Background information
Overview of relevant systems
and data sources

3. Outlook (medium & long term)

1. Real-time & ETA History ⟹ Future

Intermediate steps

before 2000 | 2005 | 2010 | 2015 | 2020 | 2025

Real-time and **delay display** for passenger trains

LIVE MAPS based on real-time and delay display for passenger trains

HAFAS Real-time hub Standard tool

HIM Information Manager

Smart VMS based on real-time information from numerous sources incl. GPS…

Standard tool in productive use for large fleets of trains & buses

Train Monitor System based on real-time information from LEIDIS, USE-IT, GPS, …

Including ETA calculation

Productive tool incl. HIM used by Kombiverkehr

Train Monitor since 2017 with additional interface to TIS

TPS online ENNE

TPS BFB Operational timetable management

TPS Traffic Management 4.0 with cross sector integration layer incl. CTA calculation

Case sensitive **push notifications** in case of delay

BRAVO

CREAM

In2Rail Intelligent Mobility Management

Shift2Rail

Shift2Rail – IP2/IP5/CCA

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HaCon Business Segments

HaCon

Traffic • Software • Service

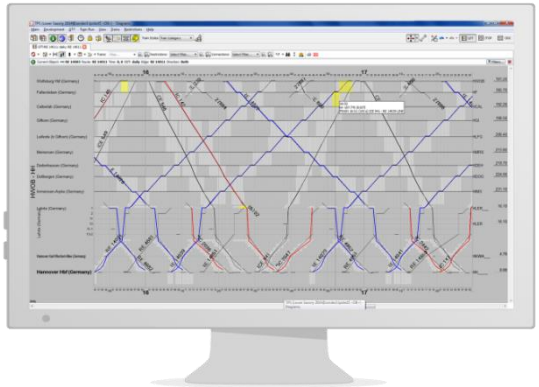
Consulting	Software for timetables and mobility			Ticketing
IT and Projects Transport and Traffic	Train Planning System TPS	Timetable Management TPS Integrator, HIM, Smart VMS, RT Hub, xModeServer	Timetable Information HAFAS	EOS UPTRADE Bytemark
Intermodal Systems	Network Capacity and Construction Management	Integration and Maintenance Management	Information Management	Ticketing Management

Since 2017 part of the Siemens Mobility Management family ….

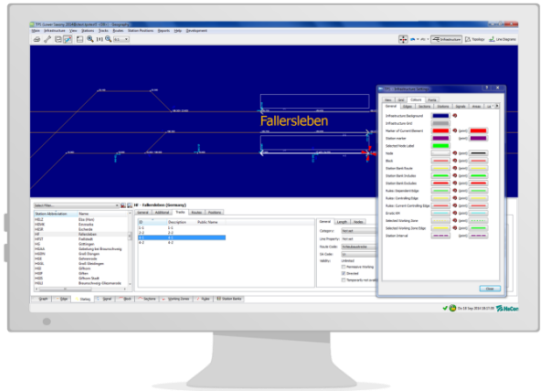
…. leading the Business Division “Innovative Mobility Solutions”

Train Planning System TPS

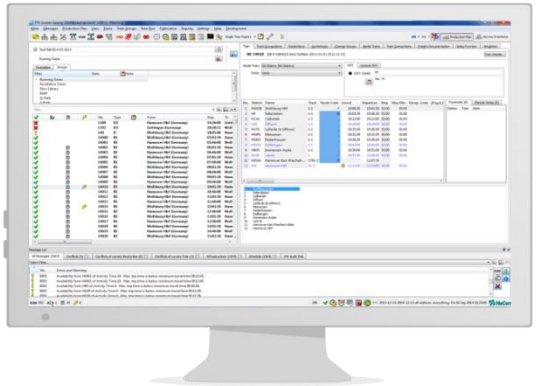
Graphical Editor



Infrastructure Editor



Timetable Editor



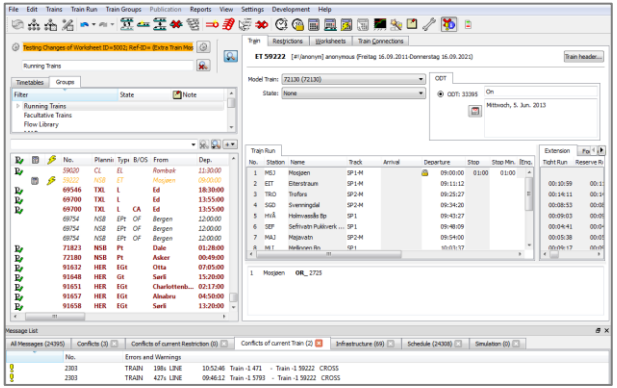
Customers

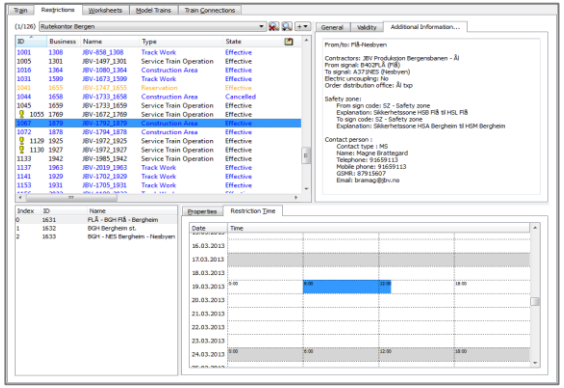
new:

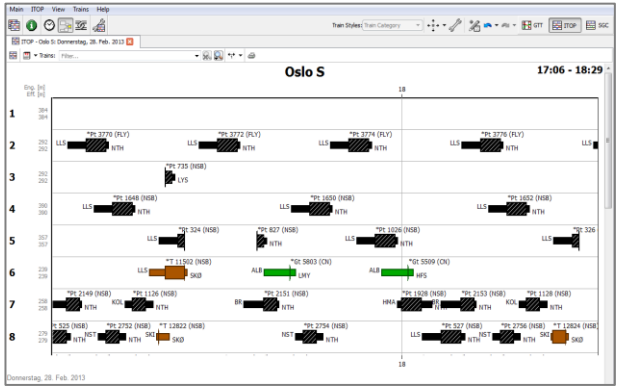
Features

- Multi-user system focused on train and capacity planning for railway networks
- Multi-screen support
- Oracle database for data management
- Suite of specialized applications and services
- Mature COTS product with high degree of integration and customization capabilities

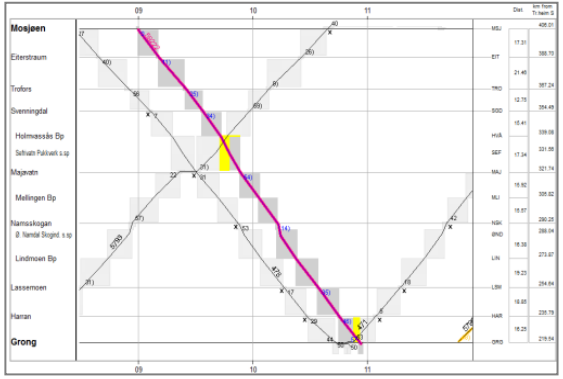
TPS Functional Areas

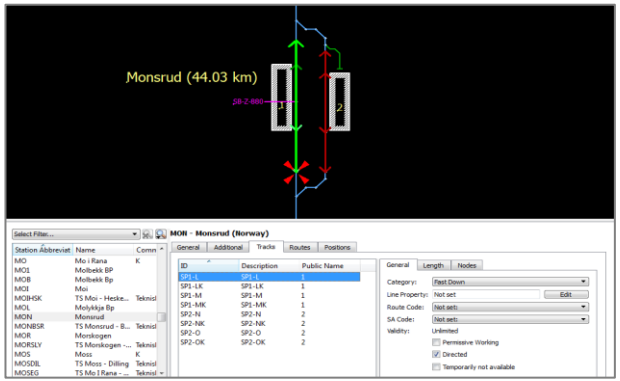




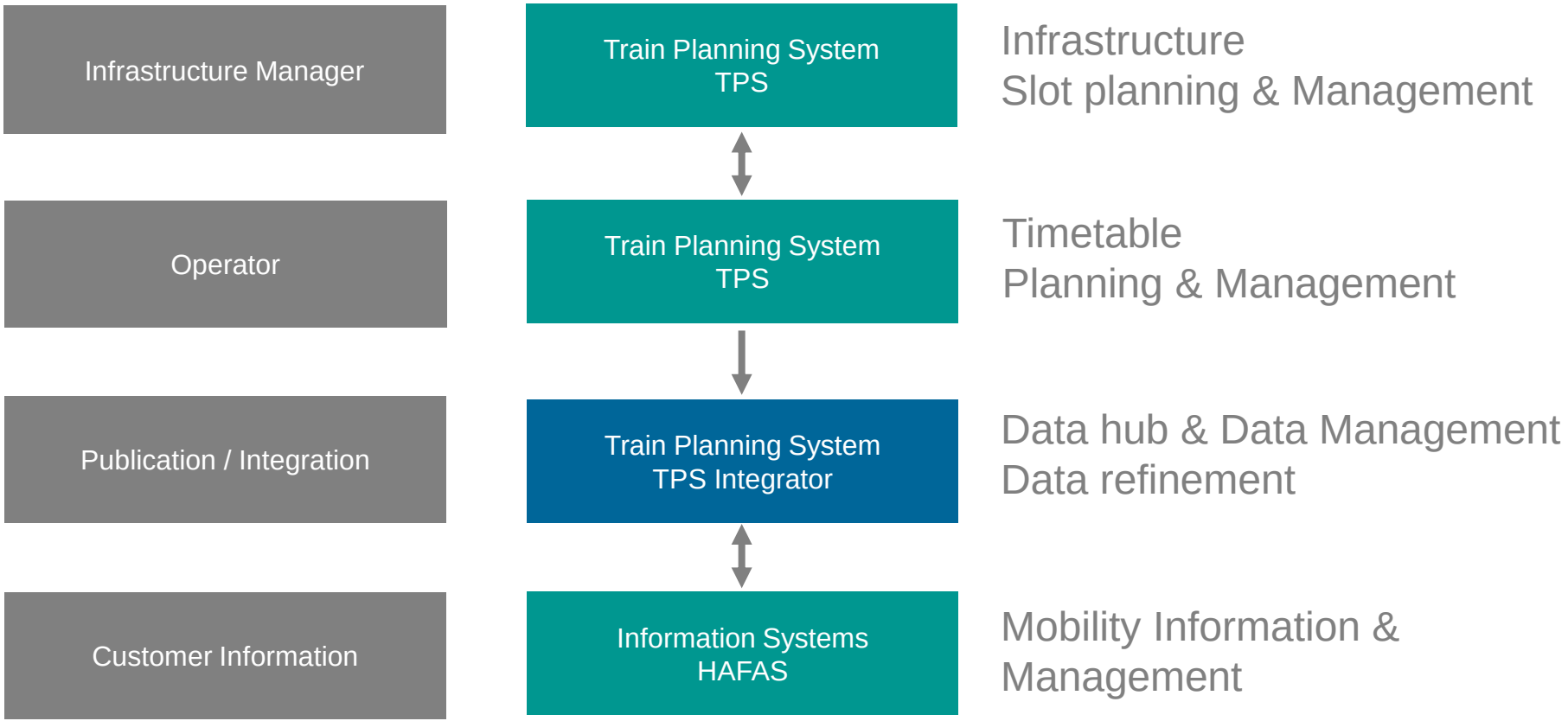


- Runtime calculation
- Conflict detection and resolution
- Planning parameters
- Simulation
- Tabular and graphic editing
- Reports and analysis





From Construction to Information



Continuous Information Flow

Planned Information

up to once a day/week

long-term

TPS Integrator

Disruption Information

mid-term

HAFAS Information Manager HIM

Real-time Information

up to 120 minutes

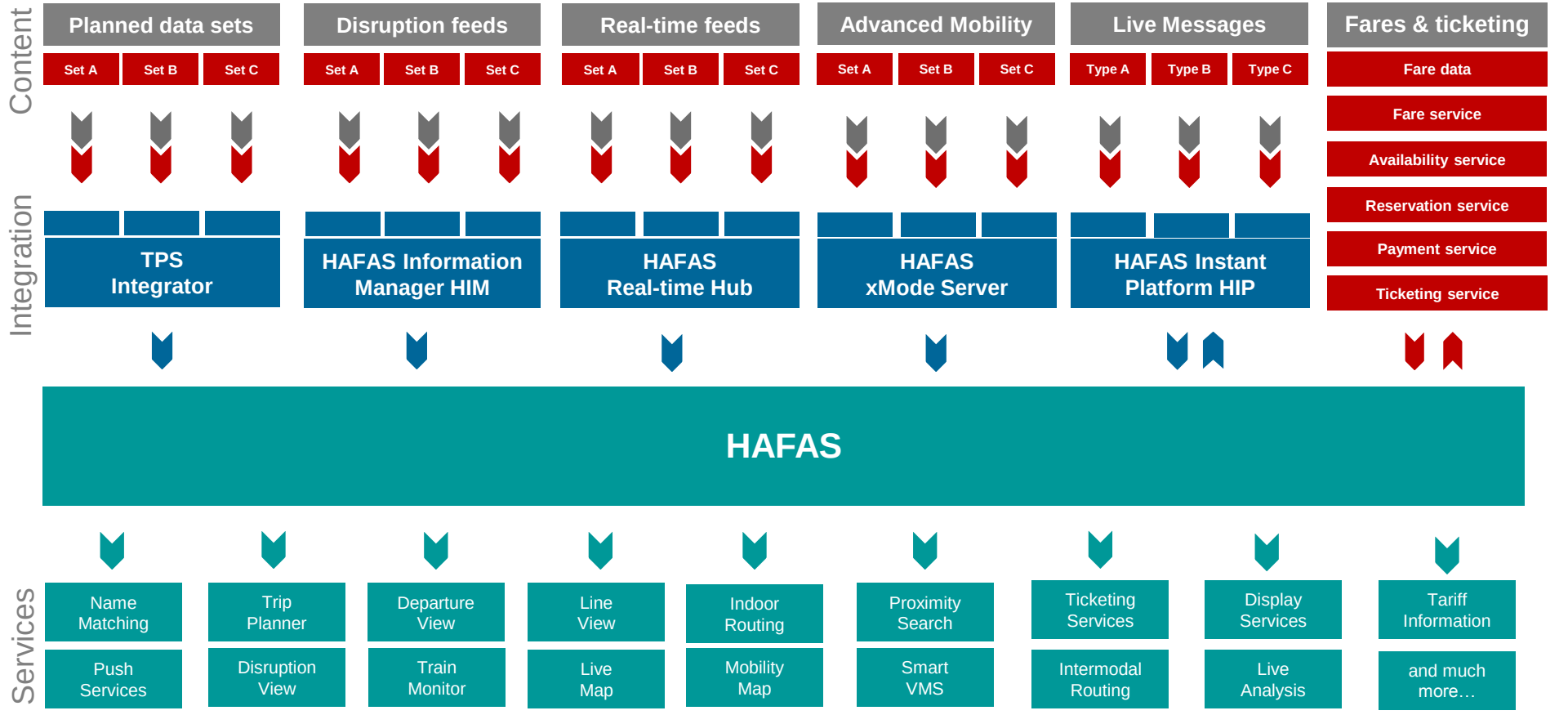
short-term

HAFAS Real-time Hub

Manage

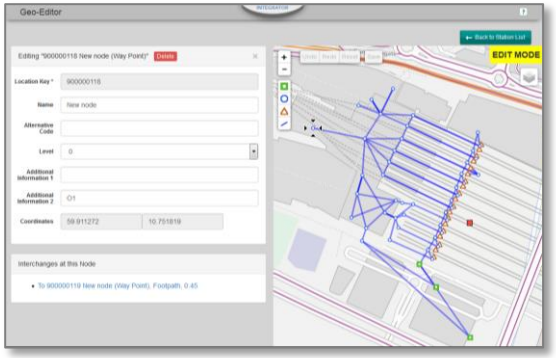
Data needs to be integrated and managed…

Modular HAFAS Architecture



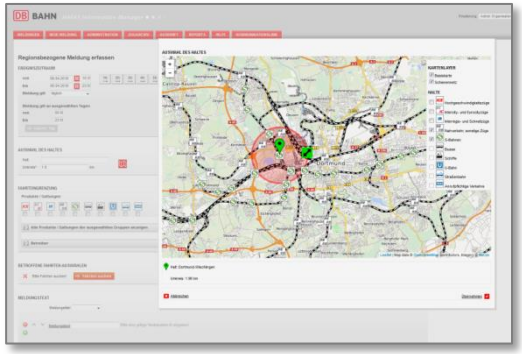
HAFAS Business Products for Managing Mobility Content

TPS Integrator



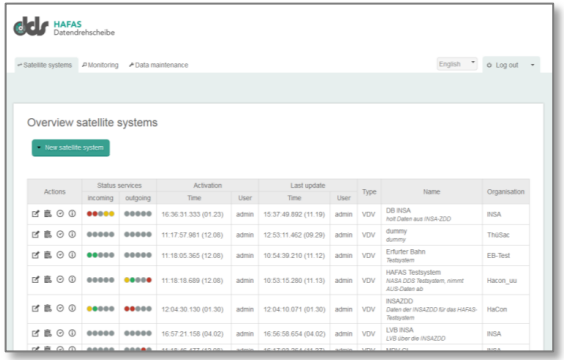
- Integration and harmonization
- Content from multiple sources
- Washing of “planned” timetables
- Adding data

HAFAS Information Manager HIM



- Editing disruption messages
- Rule-based service alerts
- Customer information
- Adding real-time content

HAFAS Real-time Hub



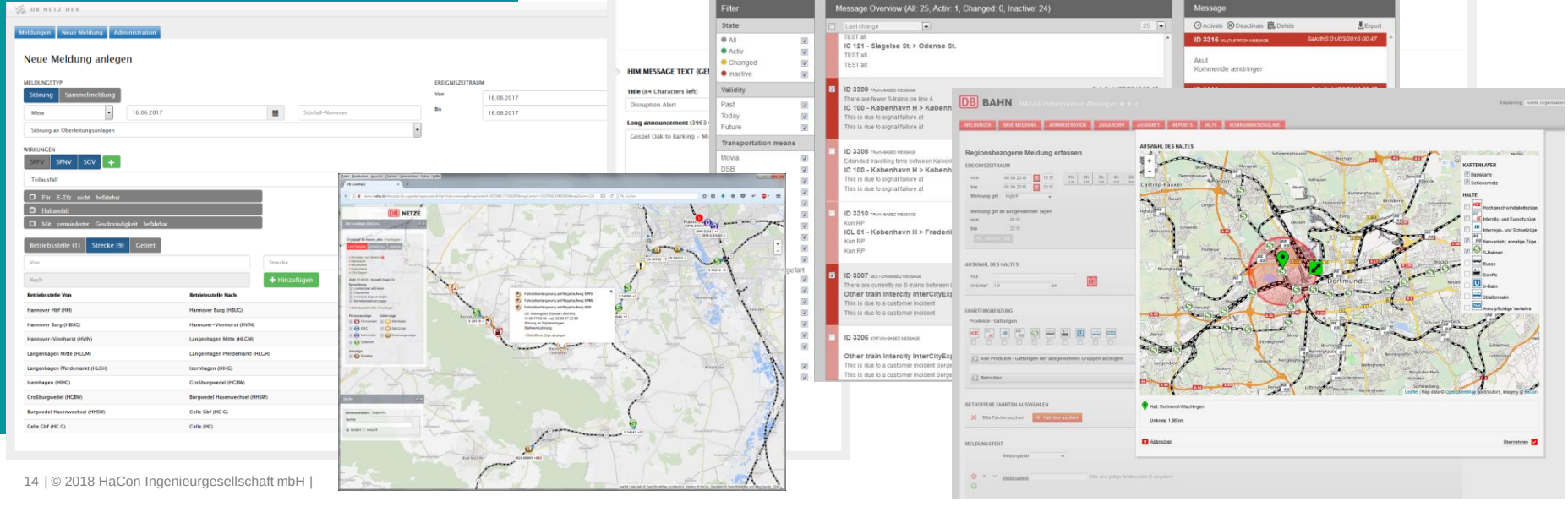
- Real-time message management
- Content from multiple sources
- Washing of “real-time” timetables
- Matching delays with other sources

Connected with HAFAS solutions and HAFAS Driver

HAFAS Information Manager HIM

HAFAS Information Manager (HIM) profile

- Rule based content management system for disruption messages & more
- ~30 customers like DB Netz, DB, ÖBB, SBB, NS, SNCB, CFL, adif, Kombiverkehr, …



HAFAS Information Manager HIM

Cloud-based application

Manage information

Distribute information

Staff

Apps

EVU, passenger, …

Maps

Management

Trip planner

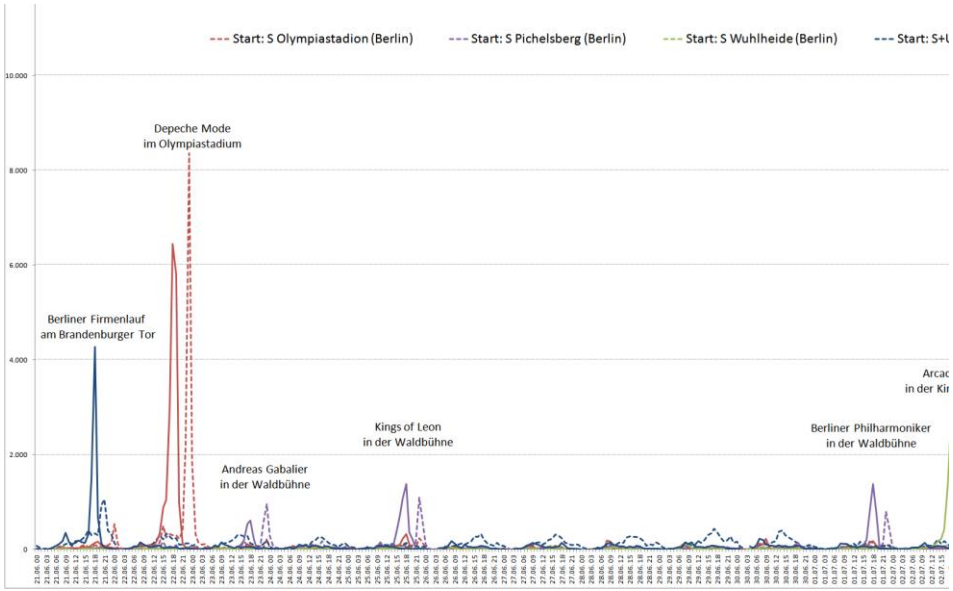
Different target groups

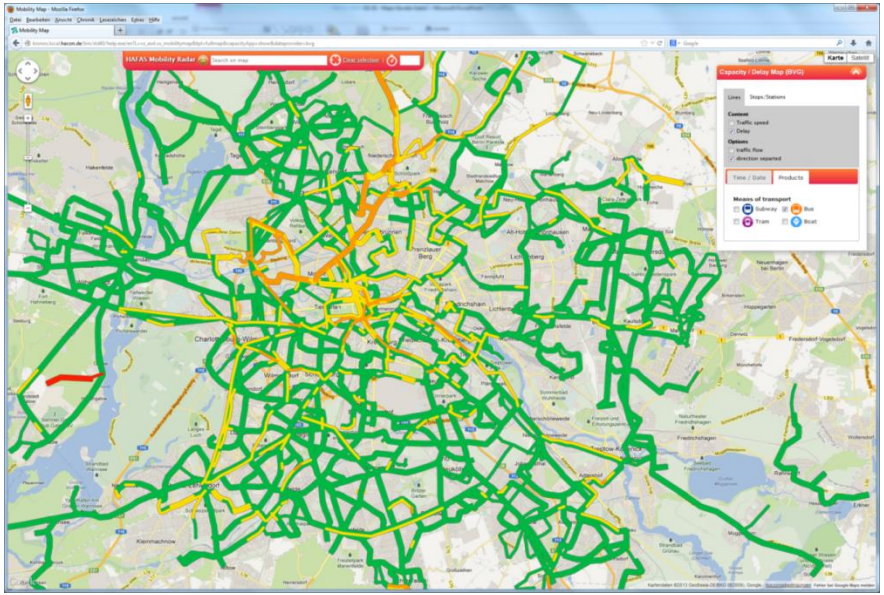
Many publication channels

Big data ….

e.g. Big Data analysis

- Use your digital gold for building better networks and improve services
- Strong applications/Apps can help to keep your data
- Examples: Event detection Berlin, HAFAS Mobility Radar (Capacity/Delay)

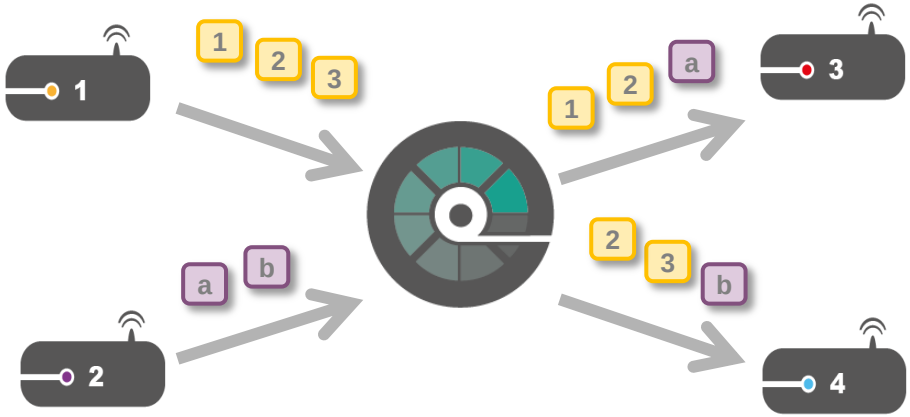


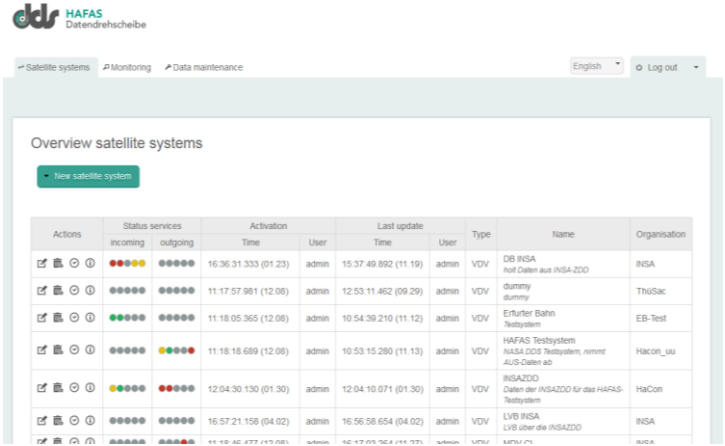


HAFAS Real-time Hub

HAFAS Real-time hub

- Import and export of real-time information
- Control on data flow (multi-client / multi-user)
- Data washing, combining and enhancing
- Web-based configuration
- No limitation of connected satellite systems with totally different data structure and content (normally around 30 systems connected / several millions of messages exchanged daily)





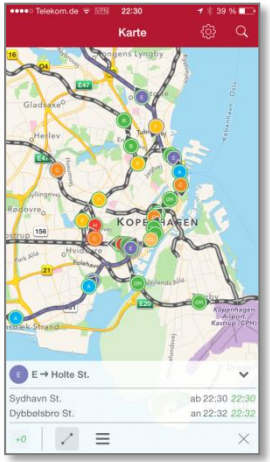
Customers

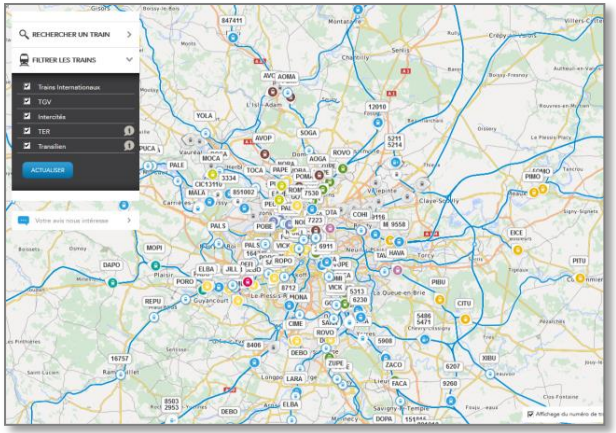
DB BAHN · verkéiers verbond · Railteam · NVV · RMV Rhein-Main-Verkehrsverbund · nah.sh Der Nahverkehr · MDV · ÖBB Personenverkehr · ARGE oevv · PostAuto · Salzburg Verkehr verbindet · OÖVV Der Verkehrsverbund · VBB Verkehrsverbund Berlin-Brandenburg Alles ist erreichbar. · VOR Verkehrsverbund Ost-Region · NASA · Google

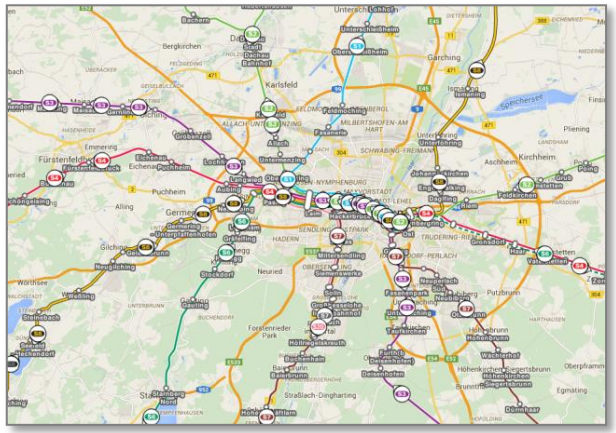
Live maps …

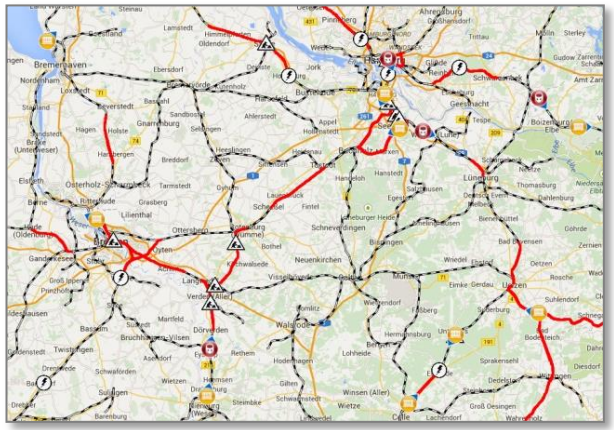
Specific Services: HAFAS Maps with Animated Vehicle Positions

- public transport map
- animation of public transport vehicle positions
- for end customers and staff
- emotional access to timetables
- popular at DB, SNCF, ÖBB, SBB, DSB, …
- popular in cities with all modes, e.g. BVG Berlin

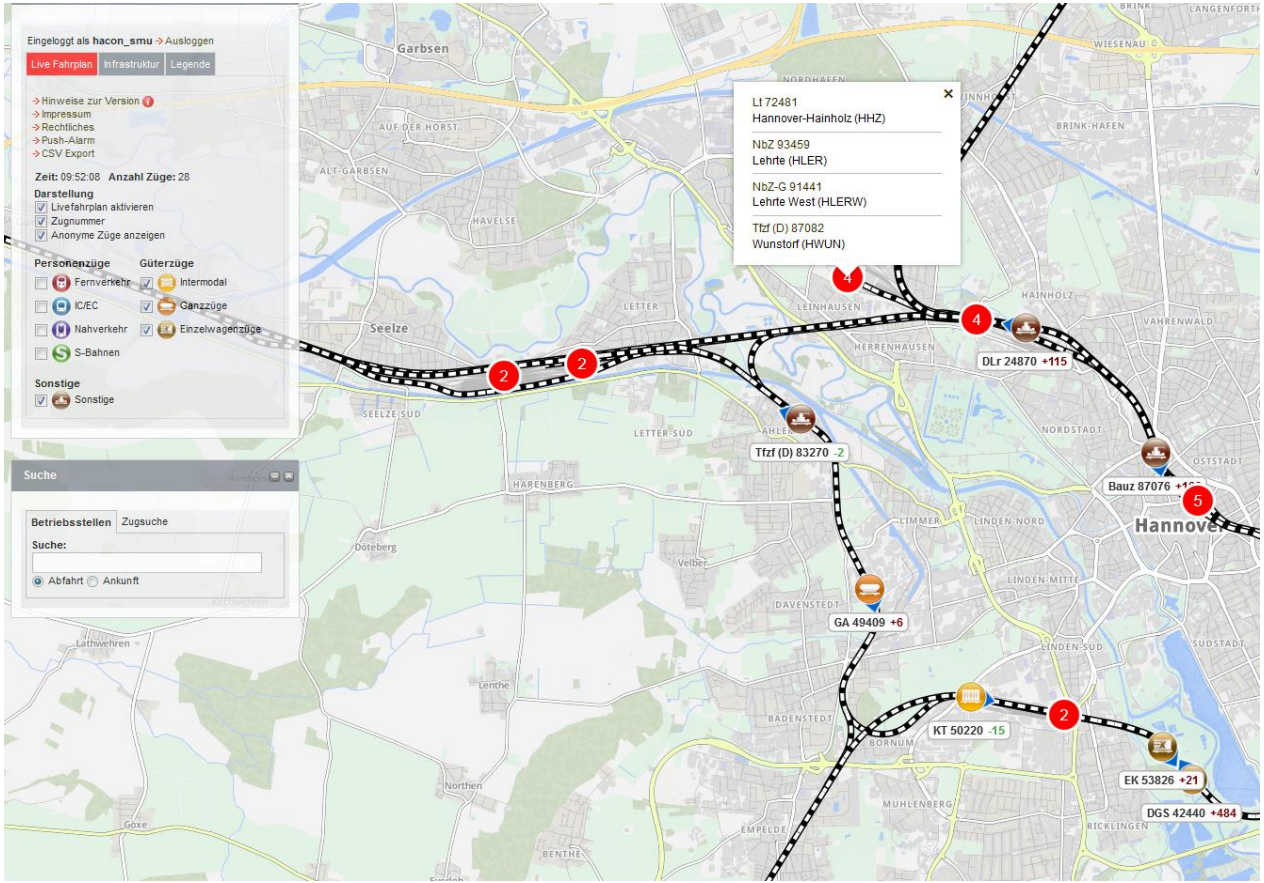








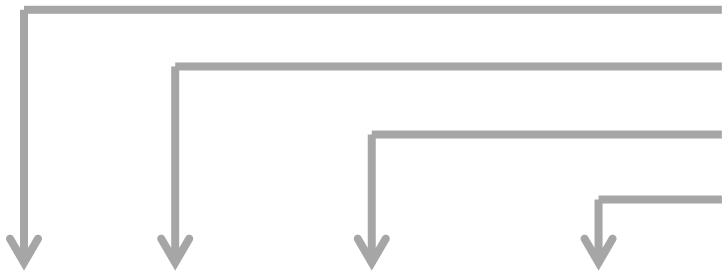
Example: DB Netz (IM) → DB Live Maps (“Zugradar”)



- Real-time operational data via LEIDIS interface
- Real-time data via HIM
- Integration of freight train data

Pushing real-time information …

Real-Time and Status Information – Munich S-Bahn



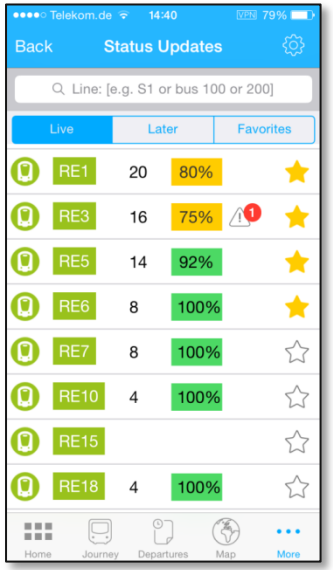
Line
trips now
Delay status
Disruptions? (HIM & more)

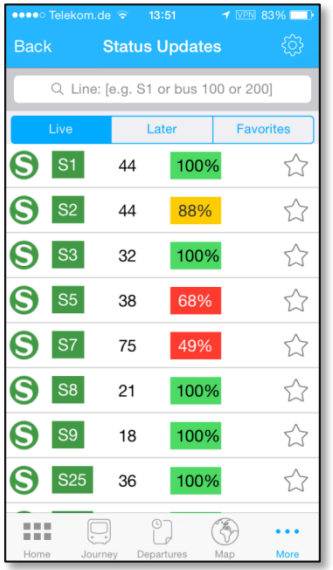
Linie	Fahrten bis 10 Min.	Störungen
Stamm-strecke	16 88.0%	
S1	10 60.0%	! 1
S2	10 70.0%	
S3	7 100.0%	
S4	9 90.0%	! 1

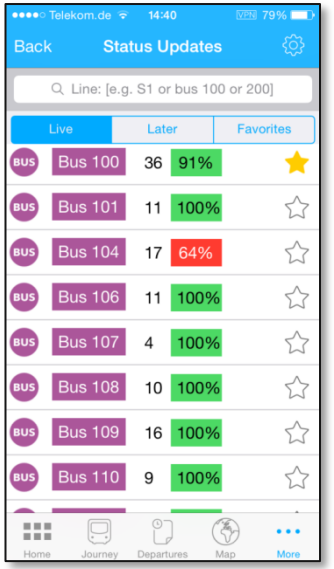
Good Trains 𝍸 IIII
Bad Trains II
81%

Solutions „HAFAS Status“

- Status for real-time situation
- Status for disruptions now (HIM messages)
- Status for disruptions in the future (HIM messages)

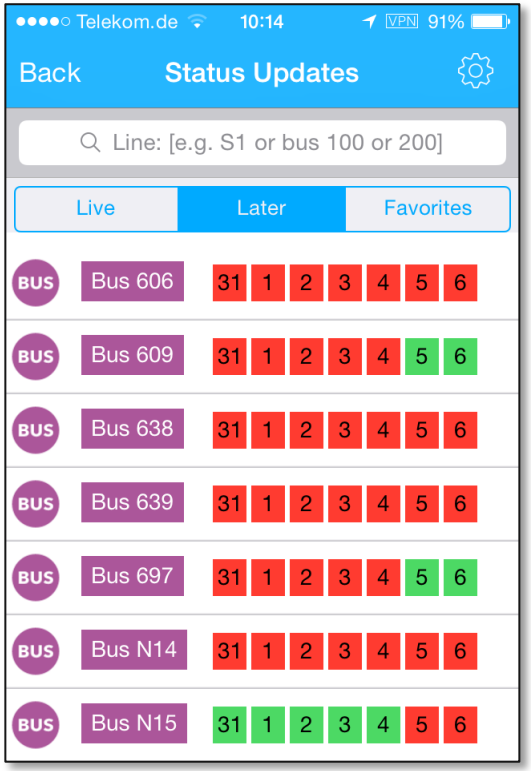


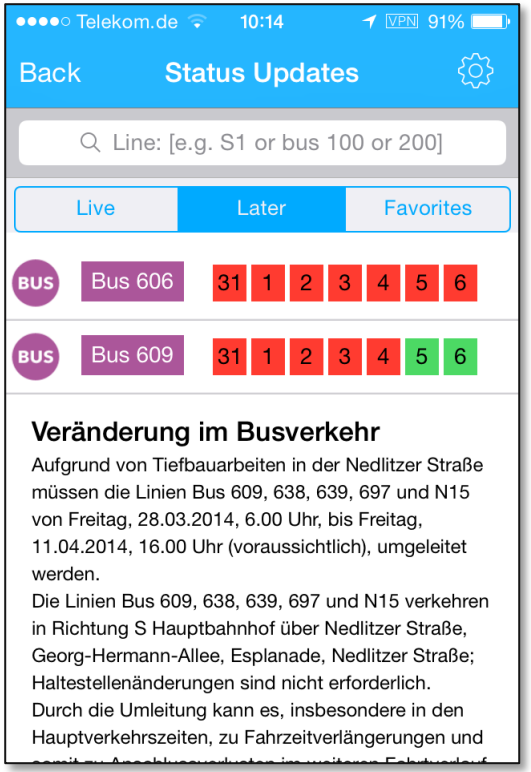




Forecast for the Next Days

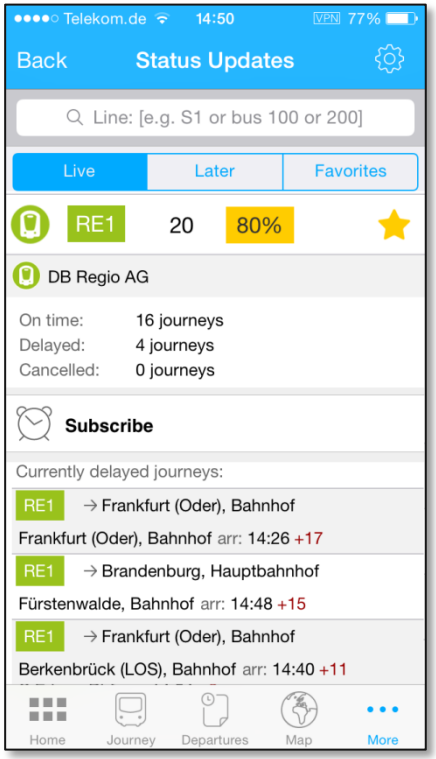
- Calendar of disruptions

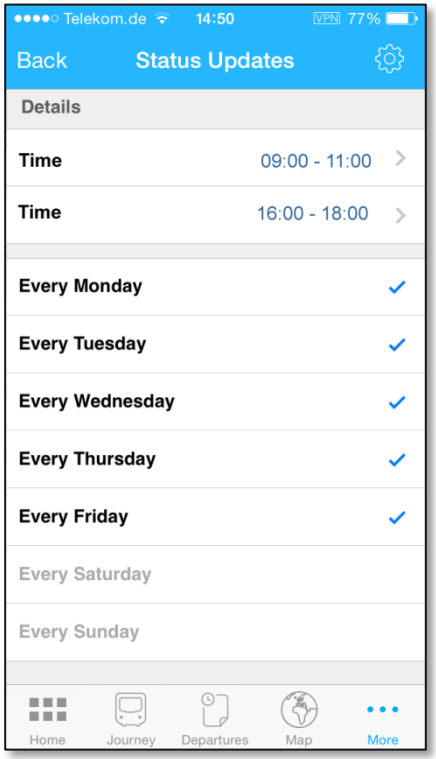


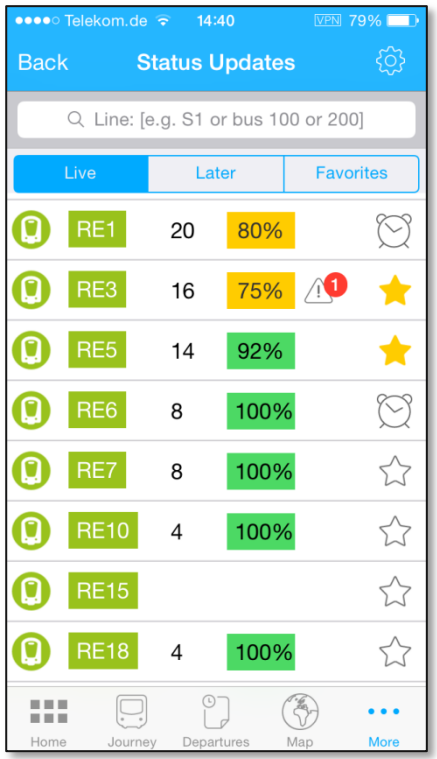


Subscription to Service Updates

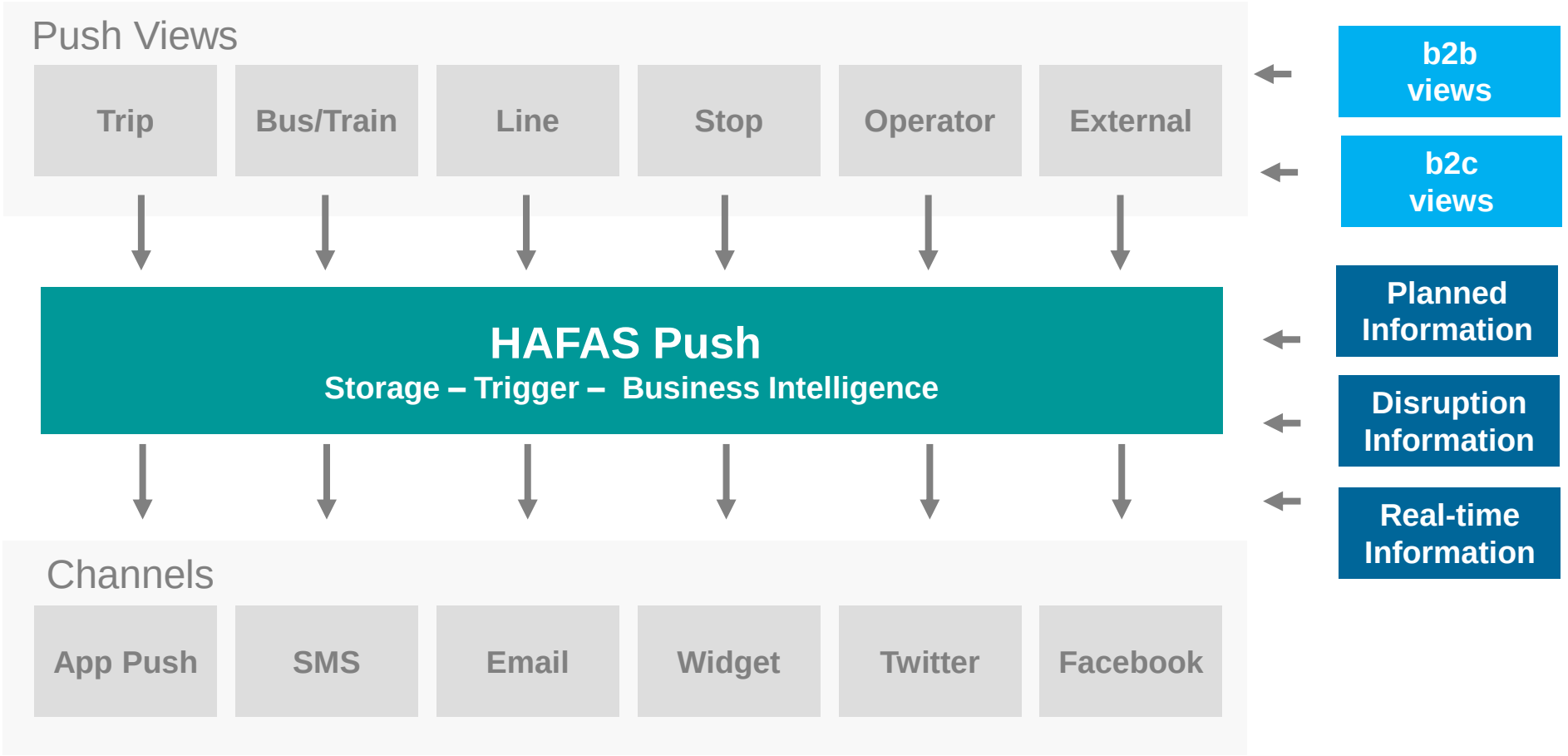
- Subscription for specific days and time, or services







Be up to date! Push Notification Services



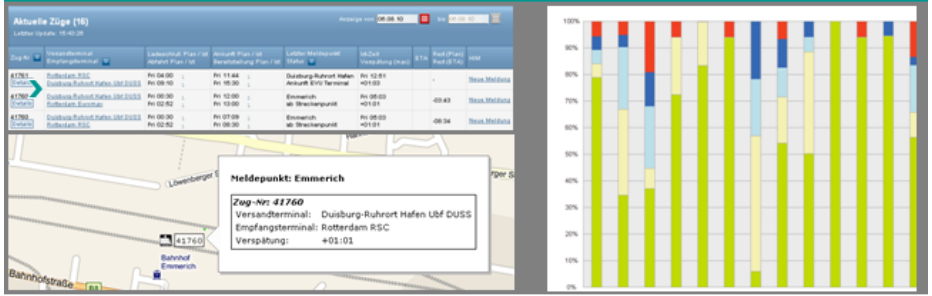
Monitoring solutions as basis for ETA calculation

Reasons to develop Train Monitor more than 12 years ago

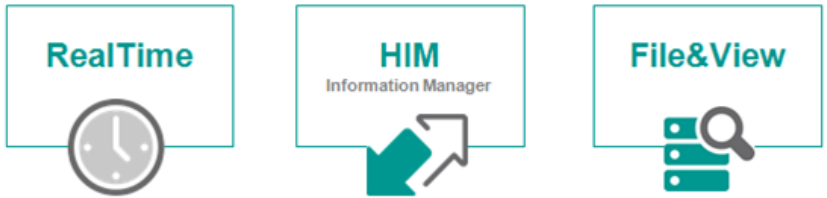
- One single monitoring system for all services (int.+nat.)
- Usage of various real-time data sources
- Different views on complex data
- Individual configuration possible
- Including „Cut-off time“ and „Availability
- ETA calculation
- Irregularity messages can be exchanged, stored and pushed
- Reliable archive functions

Kombiverkehr Train Monitor

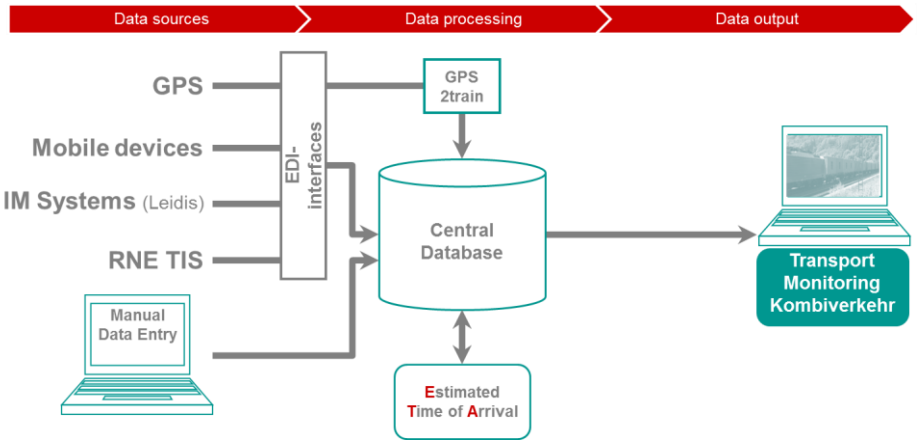
Train Monitor – Integrated train monitoring system



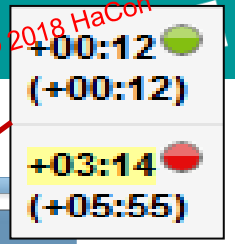
Modules:



- Commercial/productive use
- National and international services
- Kombiverkehr and cooperation partners
- ETA calculations incl. information management (HIM)
- Combines data from different sources



Train overview including RealTime information



Overview on currently operated trains (list view)

Current trains (10)
Last update: 18:03:57

from 14.04.13 to 16.04.13

Train no	Origin terminal Destination terminal	Cut-off time planned / real Departure planned / real	Arrival planned / real Availability planned / real	Last message point Status	Current time (Estimation)	Delay (max)	ETA	Remaining (scheduled) Remaining (ETA)	HIM
40539 Details	Ostrava-Paskov Verona Quadrante Europa	Mon 18:00 - Mon 18:00 Mon 19:03 -	Tue 18:10 - Tue 23:30 -				Tue 20:31		New message
43257 Details	Köln-Eifeltor Ubf Verona Quadrante Europa	Mon 17:25 - Mon 17:25 Mon 19:34 -	Tue 16:22 - Tue 17:00 -				Tue 17:4[illegible]		New message
41858 Details	Trieste Campo Marzio Rive MOLO VI Köln-Eifeltor Ubf	Mon 12:30 - Mon 12:30 Mon 14:20 -	Tue 10:45 - Tue 11:45 -	Arnoldstein at message point	Mon 18:02	+00:12 (+00:12)			New message
41859 Details	Köln-Eifeltor Ubf Trieste Campo Marzio Rive MOLO VI	Mon 10:15 - Mon 10:15 Mon 11:15 - Mon 11:24	Tue 06:24 - Tue 08:00 -	Süßen through at message point	Mon 18:01	+03:14 (+05:55)			New message
41856 Details	Trieste Campo Marzio Rive MOLO VI Köln-Eifeltor Ubf	Mon 07:00 - Mon 07:00 Mon 08:52 -	Tue 04:21 - Tue 05:30 -	Kirchseeon through at message point	Mon 18:00	+02:24 (+03:08)	Tue 05:08		New message
41860 -	Ljubljana-Deutschland	Mon 14:00 - Mon 14:00 Mon 17:25 -	Tue 22:05 - Wed 02:15 -	Jesenice Arrival transfer station	Mon 17:40	-01:26 (-01:07)	Tue 21:34		
41860 Details	Ljubljana KT Duisburg-Ruhrort Hafen Ubf DUSS	Mon 14:00 - Mon 14:00 Mon 17:25 -	Tue 22:05 - Wed 02:15 -	Jesenice Arrival transfer station	Mon 17:40	-01:26 (-01:07)	Tue 21:34		New message
41860 Details	Ljubljana KT Köln-Eifeltor Ubf	Mon 14:00 - Mon 14:00 Mon 17:25 -	Tue 18:54 - Tue 23:40 -	Jesenice Arrival transfer station	Mon 17:40	-01:26 (-01:07)	Tue 18:23		New message
41860 Details	Ljubljana KT München-Riem Ubf	Mon 14:00 - Mon 14:00 Mon 17:25 -	Tue 06:01 - Tue 06:15 -	Jesenice Arrival transfer station	Mon 17:40	-01:26 (-00:39)	Tue 05:30		New message

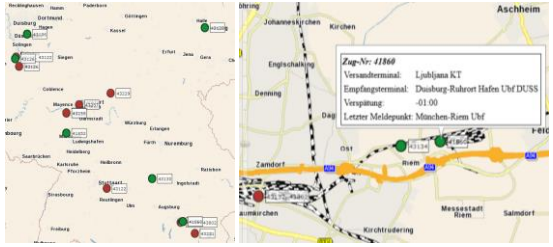
Train identification

Train real-time status

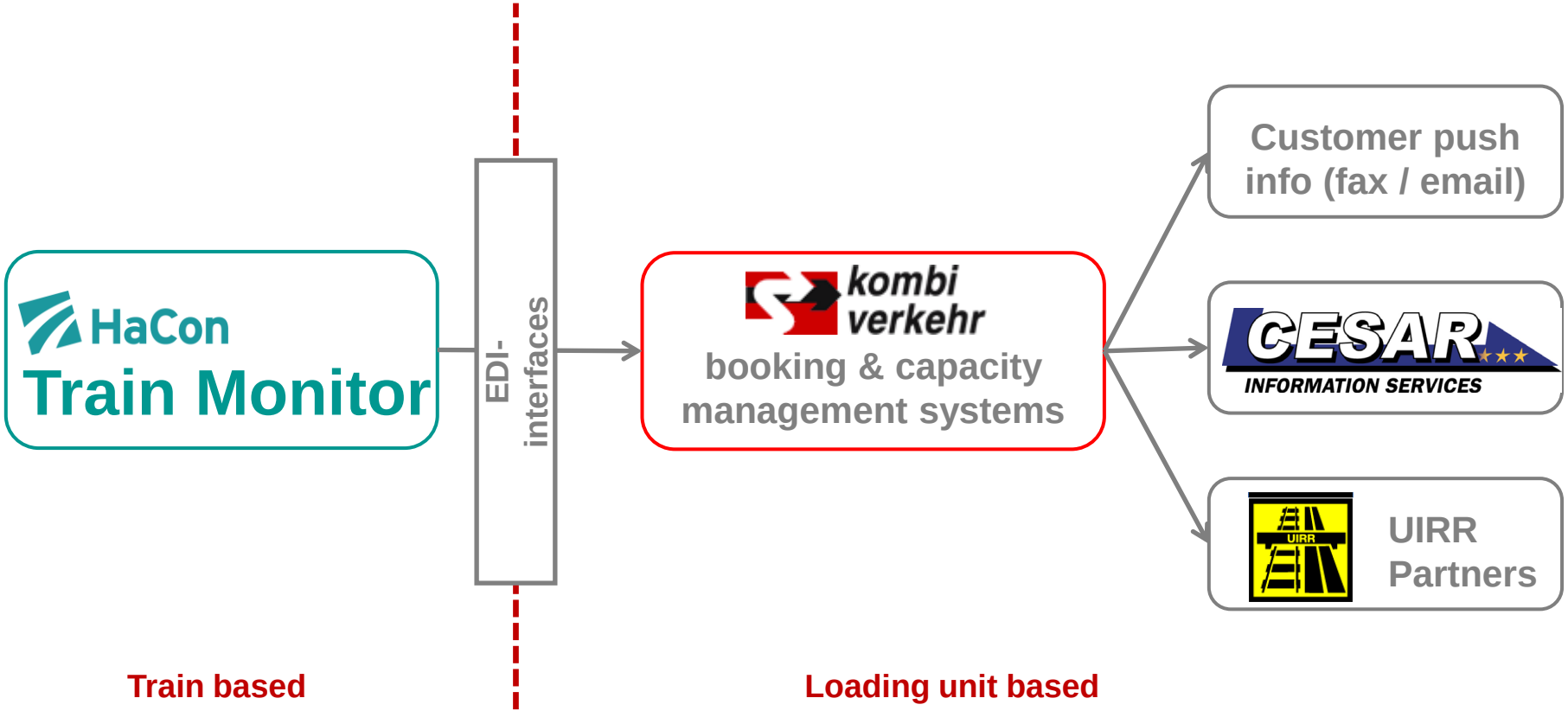
Train ETA

Irregularity messages

- Status information of your current train operations at a glance;
- Colour classification for delay status (green – yellow – red);
- same classification in maps possible →
- Individual configuration possible (train filter / column sorting)



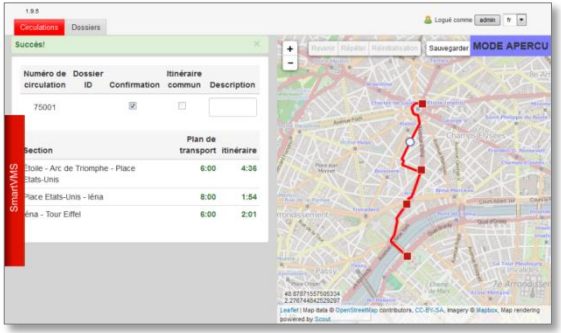
Dataflow customer information (Example Kombiverkehr)

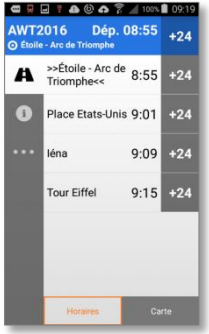


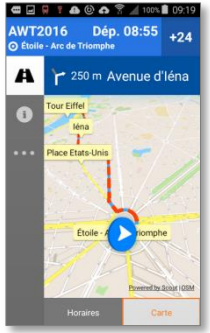
HAFAS Smart VMS

HAFAS Smart VMS – ITCS for bus & train

- Open system – platform-independent
  - Android smartphone and tablet
  - Windows and Windows CE units
  - iOS (limited functionality)
  - SDK with interface
- Multimodal usage
  - large bus operators like DB Regio Bus
  - train operators like Eurostar
  - buses as train replacement like SNCF Transilien
  - connection assurance
- Web-based control center
  - drag & drop route for detours
  - timetable editor
  - data warehouse for statistics



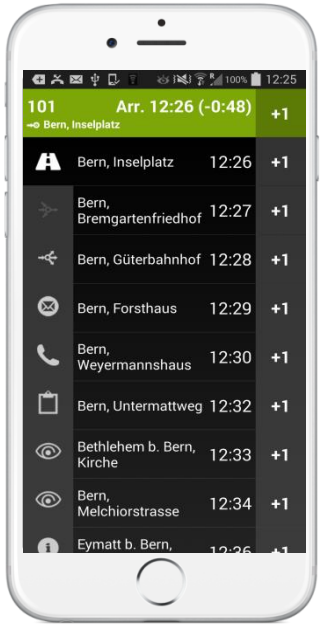


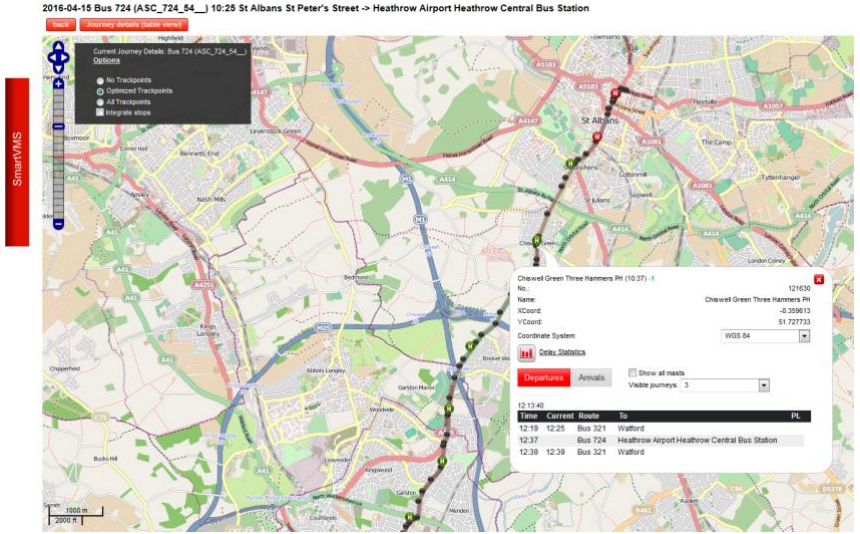


HAFAS Smart VMS Profile

- Easy solution for generating real-time information
- Automated connection assurance
- Huge data archive
- Text communication
- Performance Monitoring and Alerts
- Trip Editor

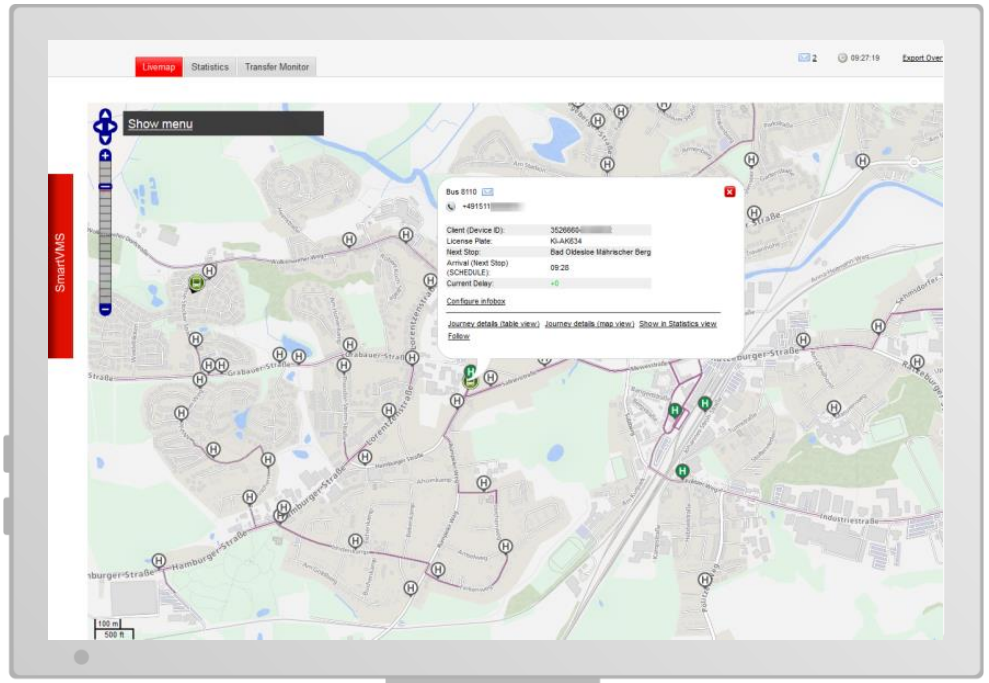
- And much more…





Driver app and web-based control center

Web-based Control Center



Multi-client solution

- Real-time trip overview
- Vehicle/train management
- Historical data / Data warehouse for statistics
- Connection monitoring and assurance
- Online Performance
- Timetable editor
- Client specific access, roles and functions…

Architecture of HAFAS Smart VMS

Client devices

optional

Crew Planning

Vehicle Planning

Crew/Vehicle Roster

GPS track

Real-time data

Connecting trips

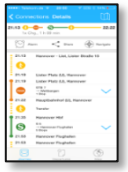
Connection assurance

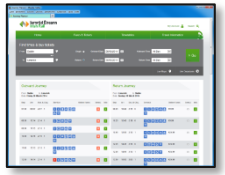
HAFAS Server

- Matching trips
- Calculating delays
- Service situation
- Data hub

HAFAS services

Real-time data





Viewer

VDV 453/454

others…

Smart VMS Online Performance

- Line/route view

Journeys | Lines | Realtime data IDs

FILTERS (160/1878) — Number of entries per page: 50

Line: bus

Realtime data ID:

Maximum Delay: to

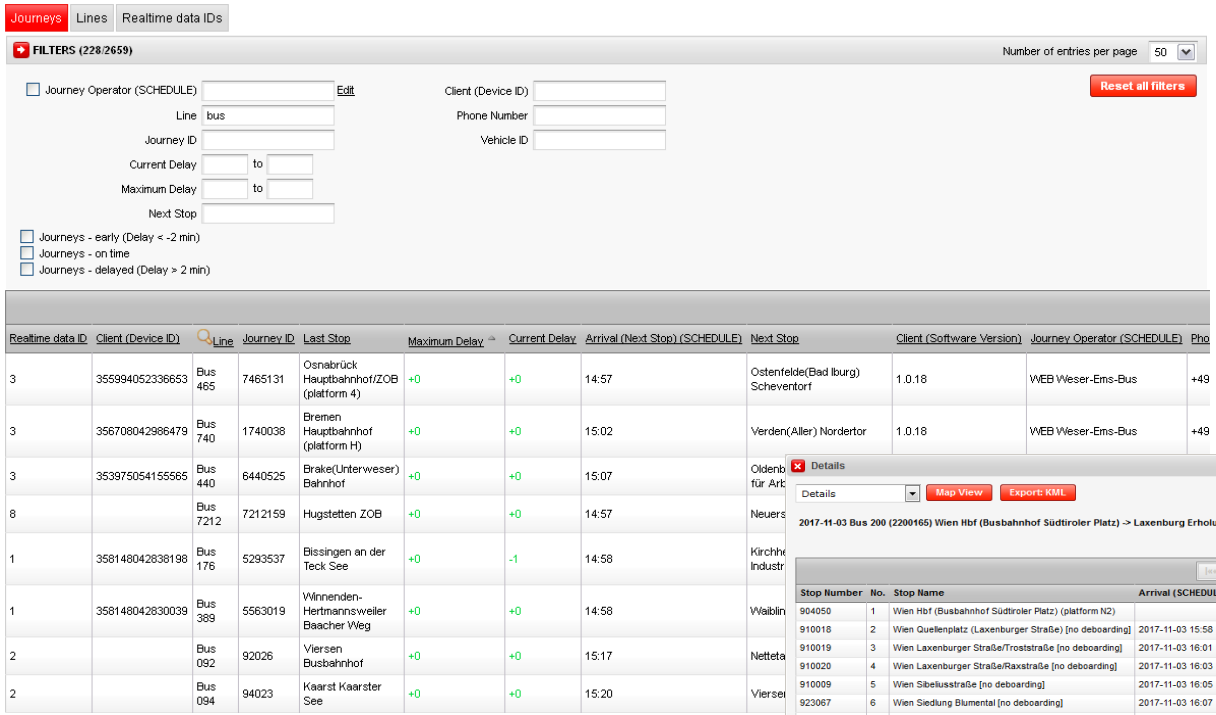
Average Delay: to

Reset all filters

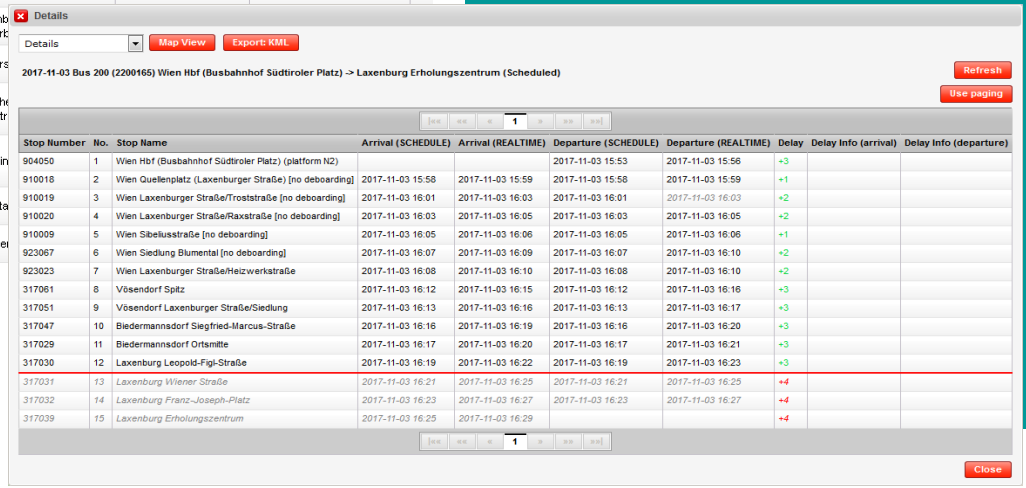
1 2 3 4

Line	Realtime data ID	Monitored Journeys	Maximum Delay	Average Delay	< 2 min	< 5 min	< 10 min	< 15 min	< 20 min	< 30 min	Time of last Report
Bus 886	BVO (2)	4	+6	+3	2 (50%)	2 (50%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	14:56
Bus 300	AK (4)	4	+5	+2	2 (50%)	3 (75%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	14:56
Bus 7550	AK (4)	4	+3	+1	3 (75%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	4 (100%)	14:56
Bus 740	WEB (3)	3	+2	+1	2 (66%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 350	WEB (3)	3	+14	+7	0 (0%)	1 (33%)	2 (66%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 900	WEB (3)	3	+11	+6	1 (33%)	1 (33%)	2 (66%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 094	BVO (2)	3	+0	+0	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 900	AK (4)	3	+6	+1	2 (66%)	2 (66%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 7600	AK (4)	3	+9	+3	2 (66%)	2 (66%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 8115	AK (4)	3	+5	+2	2 (66%)	2 (66%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 8810	AK (4)	3	+5	+2	1 (33%)	1 (33%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus S1	BVO (2)	3	+4	+2	1 (33%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus S6	BVO (2)	3	+5	+5	0 (0%)	0 (0%)	3 (100%)	3 (100%)	3 (100%)	3 (100%)	14:56
Bus 730	WEB (3)	2	+9	+6	0 (0%)	1 (50%)	2 (100%)	2 (100%)	2 (100%)	2 (100%)	14:56

Smart VMS Online Performance



- Trip view
- Filters
- Configurable views for different users
- Rights & Roles



Smart VMS Online Performance cont.

- Connection monitoring

Transfer Monitor

Last data processing: 18.06.2013 15:02:07 **Refresh Data**

Auto Refresh

FILTERS Number of entries per page 50

Reset all filters

Stop (Feeder)

Stop (Fetcher)

Journey Operator (SCHEDULE) (Feeder) Edit

Journey Operator (SCHEDULE) (Fetcher) Edit

Arrival (SCHEDULE) (Feeder) to

Arrival (REALTIME) (Feeder) to

Transfer Connection Status Edit

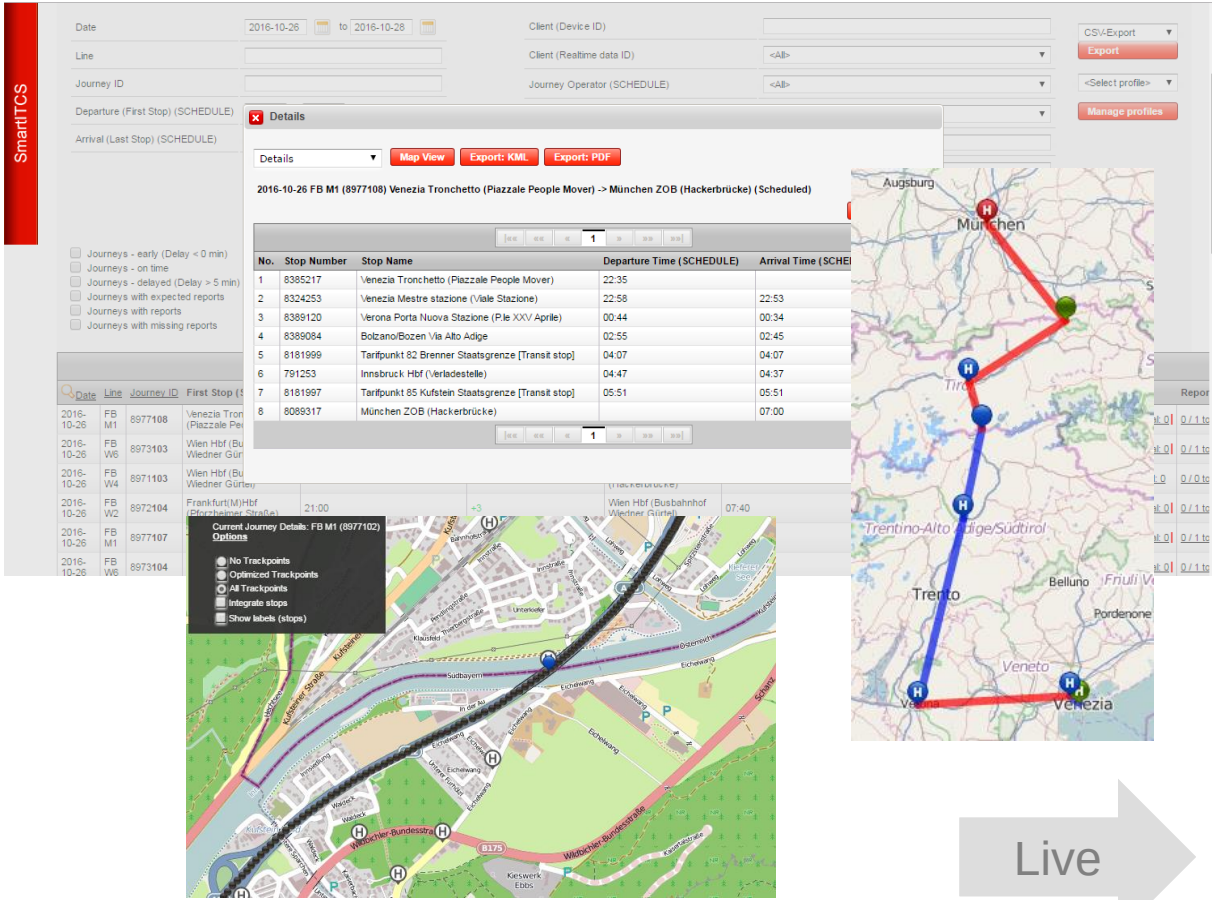
« 1 2 »

Transfer Connection Status	Line (Feeder)	Stop (Feeder)	Arrival (SCHEDULE) (Feeder)	Delay (Feeder)	Line (Fetcher)	Stop (Fetcher)	Departure (SCHEDULE) (Fetcher)	Delay (Fetcher)	Minimal transfer time	Wait time
as planned	Bus 7920	Latendorf Abzw. Boostedt	13:48	+33	Bus 7915	Rickling An der Kirche	14:27	+37	5	0
as planned	RE 21021	Neumünster	13:41	+0	Bus 7915	Rickling An der Kirche	14:27	+37	5	0
as planned	Bus 7930	Rickling Doppeleiche*	14:16	+1	Bus 7915	Rickling An der Kirche	14:27	+37	5	0
as planned	Bus 373	Aschhausen(Bad Zwischenahn) Lönskrug*	14:43	+2	Bus 350	Haarenstroth	14:49	+14	2	0
as planned	RE 4423	Bad Zwischenahn	14:12	+8	Bus 350	Haarenstroth	14:49	+14	5	0
as planned	Bus 373	Aschhausen(Bad Zwischenahn) Lönskrug*	14:43	+2	Bus 350	Westerholtsfelde EDEKA	14:50	+14	2	0
as planned	RE 4423	Bad Zwischenahn	14:12	+8	Bus 350	Westerholtsfelde EDEKA	14:50	+14	5	0
as planned	RE 4423	Bad Zwischenahn	14:12	+8	Bus 350	Westerholtsfelde	14:51	+14	5	0

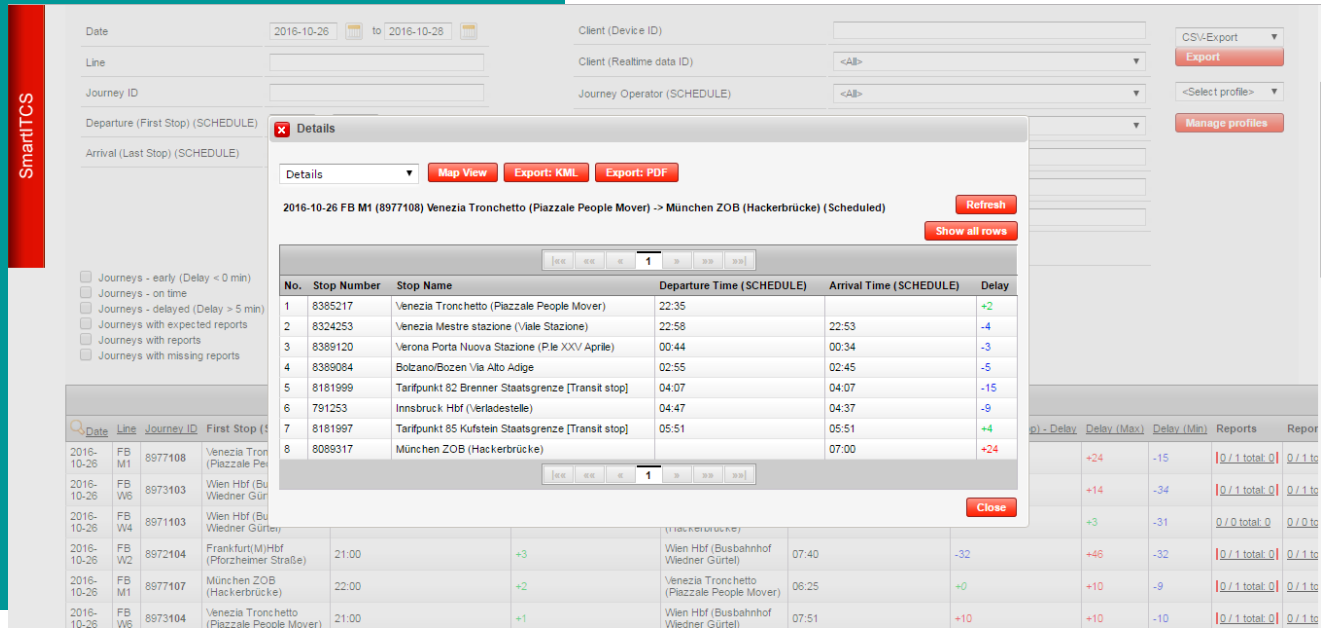
Real Time Archive

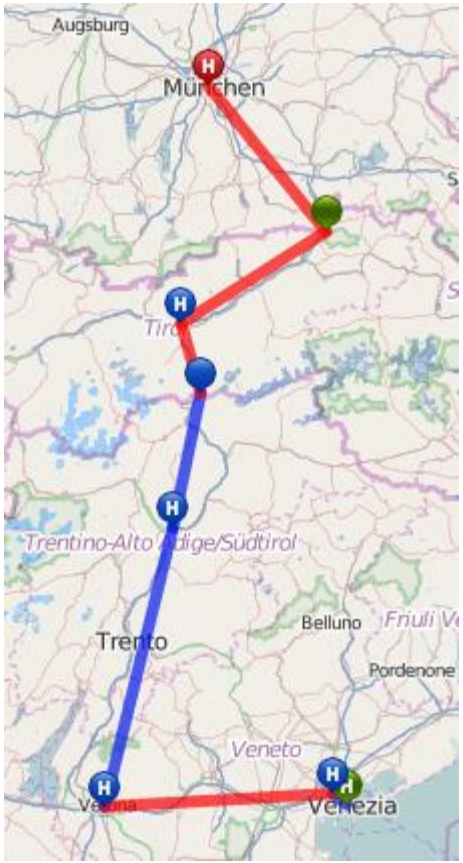
Real Time Archive

- Plan and actual trips
- GPS-coordinates
- Connections
- Operator messages
- HIM messages
- Development of Delay Built-Up
- Prognosis
- Trips w/o real-time
- Real-Time Messages matched/unmatched



Plan vs Actual comparison





Real Time Archive - Delays

„how did the delay develop over time“

Schedule	10:22	10:23	10:24	10:25	10:26	10:26
	Lyngby St.	Lyngby Storcenter (Klampenborgvej)	Firskovvej (Klampenborgvej)	Sorgenfrigårdsvej (Klampenborgvej)	Lundtoftegårdsvej (Klampenborgvej)	Helsingørmotc (Klampenbor
10:25:05		+2	+2	+2	+2	+2
10:26:56		+3	+4	+4	+4	+5
10:27:18		+4				
10:29:20		+4 ⚑	+5	+5	+5	+6
10:30:01			+5 ⚑	+5		
10:30:56					+5	
10:31:18				+5 ⚑		
10:32:45					+5 ⚑	
10:32:57						
10:34:38						+6 ⚑
10:35:03						
10:36:18						
10:37:35						
10:38:19						
10:39:38						

Real Time Archive – Operator reports

Operator reports are also archived

SmartTCS

Reports

2016-10-26 8977105 16:00 München ZOB (Hackerbrücke) -> Bolzano/Bozen Via Alto Adige

Disturbance reports

New entry <Alt+1>

Timestamp	From	To
2016-10-26 17:17:00	*Tarifpunkt 85 Kufstein Staatsgrenze*	*Tarifpunkt 85 Kufstein Staatsgrenze*
2016-10-26 19:16:00	*Tarifpunkt 82 Brenner Staatsgrenze*	*Tarifpunkt 82 Brenner Staatsgrenze*

** Reports in italic font are generated by the system. Please enter a reason to save the report permanently.*

Edit report

Date	2016-10-26 19:16:00 (Arrival (REALTIME) at stop "Tarifpunkt 82 Brenner Staatsgrenze")
From	Tarifpunkt 82 Brenner Staatsgrenze (+23)
To	Tarifpunkt 82 Brenner Staatsgrenze (+23)
Type	Delay
Reason	Traffic jam
Creator	System
Editor	admin

Save (<Return>) Cancel (<Esc>)

Real Time Archive – Delay confirmation

Customers can get confirmation of delay based on Real Time Archive

SBB CFF FFS

Drucken | Fenster schliessen

Verspätungsbestätigung

Zug **S 2 15234**, mit der planmässigen Ankunft in **Flamatt** um **10:08** Uhr, ist am **01.11.16** mit **3 Minuten Verspätung** eingetroffen.

S 2 15234 01.11.16

Halt	Ankunft	Verspätung	Abfahrt	Verspätung	Gleis
Langnau i.E.			09:07		2
Emmenmatt	09:10		09:10		
Signau	09:14		09:14		2
Bowil	09:16		09:16		
Zäziwil	09:19		09:19		2
Konolfingen	09:25		09:26		3
Worb SBB	09:32		09:32		
Gümligen	09:37		09:37		3
Ostermundigen	09:40		09:40		1
Bern Wankdorf	09:43	+ 6 Min.	09:43	+ 7 Min.	1
Bern	09:48	+ 6 Min.	09:50	+ 6 Min.	1AB
Bern Europaplatz	09:53	+ 6 Min.	09:53	+ 6 Min.	3
Bern Bümpliz Süd	09:55	+ 5 Min.	09:55	+ 6 Min.	2
Niederwangen	09:57	+ 6 Min.	09:57	+ 6 Min.	1
Oberwangen	09:59	+ 6 Min.	09:59	+ 7 Min.	1
Thörishaus Station	10:01	+ 5 Min.	10:01	+ 7 Min.	1
Thörishaus Dorf	10:03	+ 6 Min.	10:03	+ 7 Min.	1
Flamatt	10:08	+ 3 Min.	10:08	+ 5 Min.	1
Flamatt Dorf	10:09	+ 6 Min.	10:09	+ 6 Min.	1
Neuenegg	10:11	+ 6 Min.	10:14	+ 3 Min.	1
Laupen	10:21				

Real Time Archive – Report generator

Create dynamic reports

Automatic creation

Create report

Type	Stoplist
Operators	<All>
Linenames (external)	
Linenames (internal)	4194
Journey IDs	
Stopnames	
Date	2016-09-01 to 2016-10-07
All day	☑
Time	00:00 to 23:59
Limit 'early'	0 Minutes
Limit 'delayed'	3 Minutes
Include journeys without realtime	☐
Respect projected values?	☑
Journeys with missing reports	☐
Reports: Types	<All>
Visibility	Myself

Save (<Return>) Preview Cancel (<Esc>)

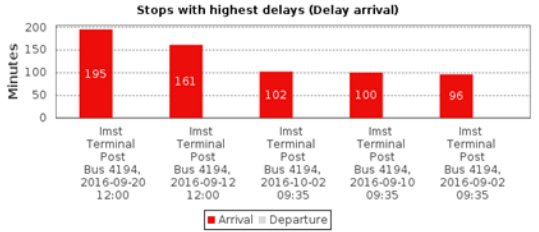
Stoplist

The following filter values were used:

Linenames (internal):	4194
Date:	2016-09-01 to 2016-10-07
Time:	00:00 to 23:59
Limit 'early':	0 Minutes
Limit 'delayed':	3 Minutes
Respect projected values?	yes

Created by RiederGünter at 2016-10-13 11:50, calculated at 2016-10-13 11:51.

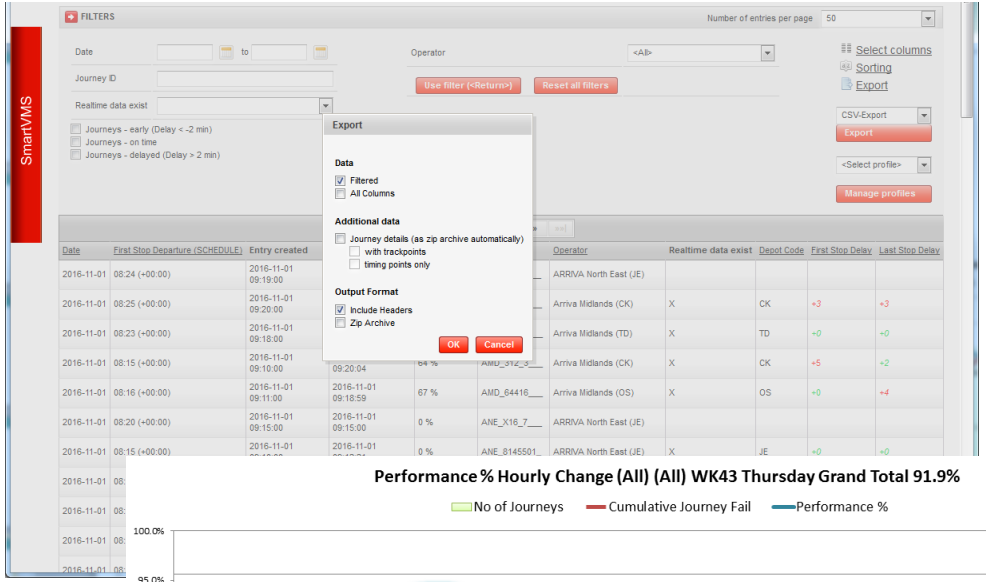
back

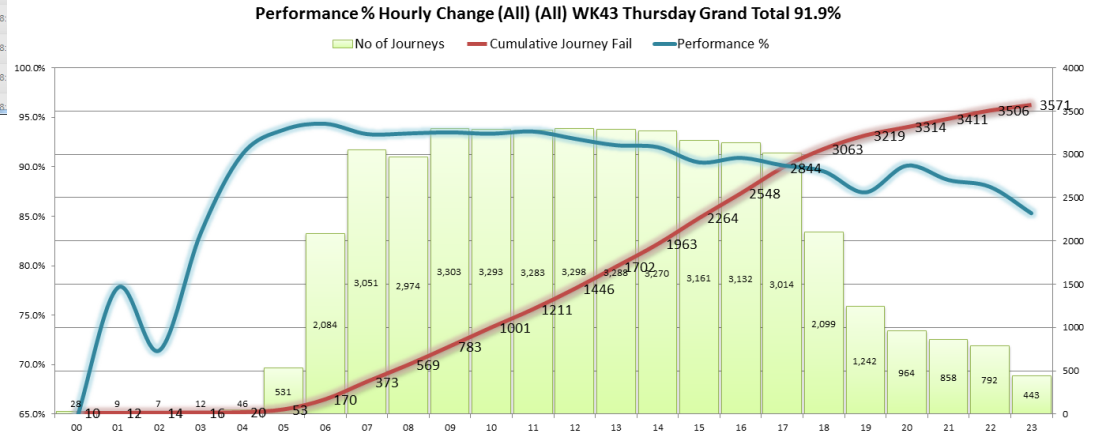


Internal linename	External linename	Journey name	Date	Stop index	Stop	Stop number	Coordinates (SCHEDULED)	Arrival (SCHEDULED)	Arrival (REALTIME)	Delay arrival	Depar
Bus 4194	Bus 4194	4194101	2016-10-07	0	Imst Terminal Post	792001	47,235446 / 10,740321				06:05
Bus 4194	Bus 4194	4194101	2016-10-07	1	Imst Langgasse/Hofer	792002	47,231797 / 10,74237	06:06	06:06	+0	06:06
Bus 4194	Bus 4194	4194101	2016-10-07	2	Imst Wolf	792003	47,227383 / 10,746676	06:07	06:07	+0	06:07
Bus 4194	Bus 4194	4194101	2016-10-07	3	Karres Wendestelle	792004	47,216407 / 10,778147	06:10	06:12	+2	06:10
Bus 4194	Bus 4194	4194101	2016-10-07	4	Roppen Trankhütte	792005	47,22101 / 10,814293	06:14	06:15	+1	06:14
Bus 4194	Bus 4194	4194101	2016-10-07	5	Roppen Innbrücke	792006	47,224039 / 10,823156	06:15	06:15	+0	06:15
Bus 4194	Bus 4194	4194101	2016-10-07	6	Ötztal Ötztaler Höhe	792210	47,231662 / 10,854025	06:19	06:19	+0	06:19
Bus 4194	Bus 4194	4194101	2016-10-07	7	Ötztal Bahnhof (Vorplatz)	792007	47,237883 / 10,859158	06:22	06:23	+1	06:23
Bus 4194	Bus 4194	4194101	2016-10-07	8	Ötztal Ötztaler Höhe	792210	47,231662 / 10,854025	06:24	06:26	+2	06:24
Bus 4194	Bus 4194	4194101	2016-10-07	9	Brunau im Ötztal	792010	47,220956 / 10,860785	06:27	06:28	+1	06:27
Bus 4194	Bus 4194	4194101	2016-10-07	10	Ambach im Ötztal	792011	47,216228 / 10,866574	06:28	06:29	+1	06:28
Bus 4194	Bus 4194	4194101	2016-10-07	11	Sautens Dorf	792012	47,20829 / 10,86688	06:31	06:31	+0	06:31

Real Time Archive

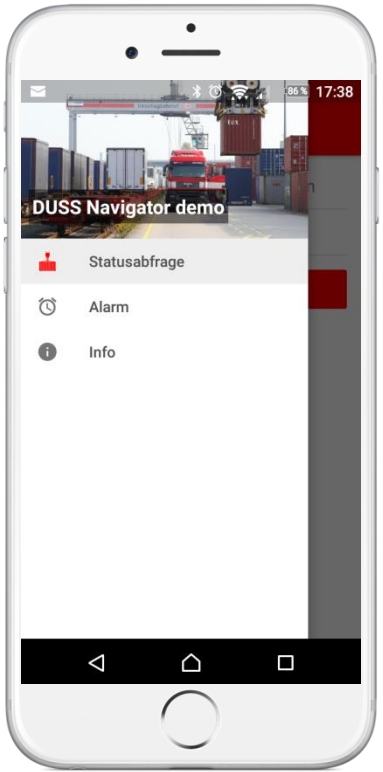
- Quality and Performance analysis
- Long time storage up to n years

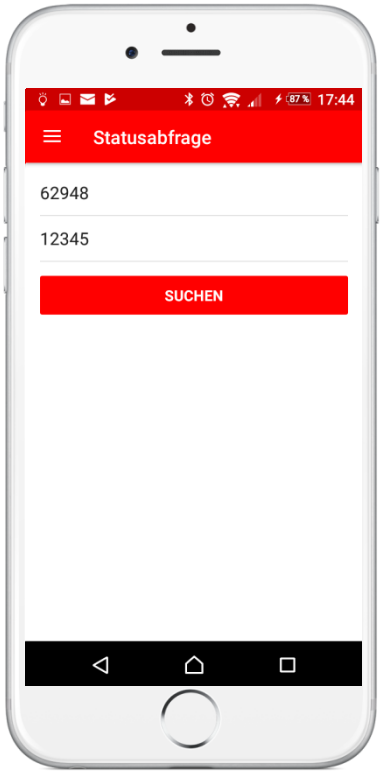


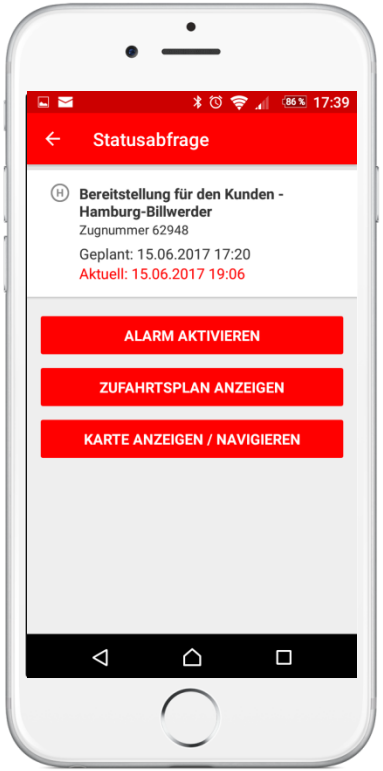


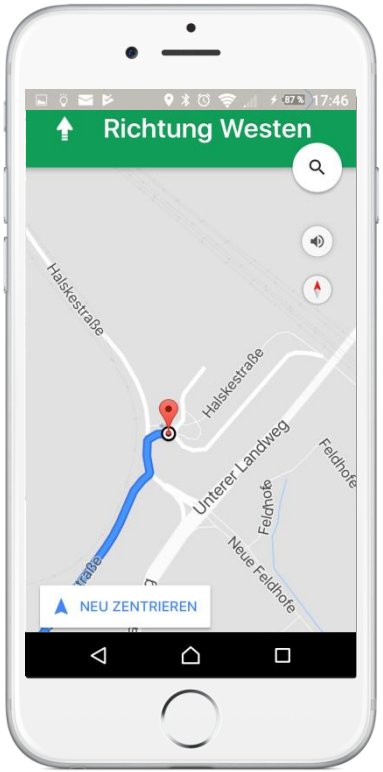
Recent developments, pilots & potential input for the ETA calculation

Pilot - DUSS Navigator

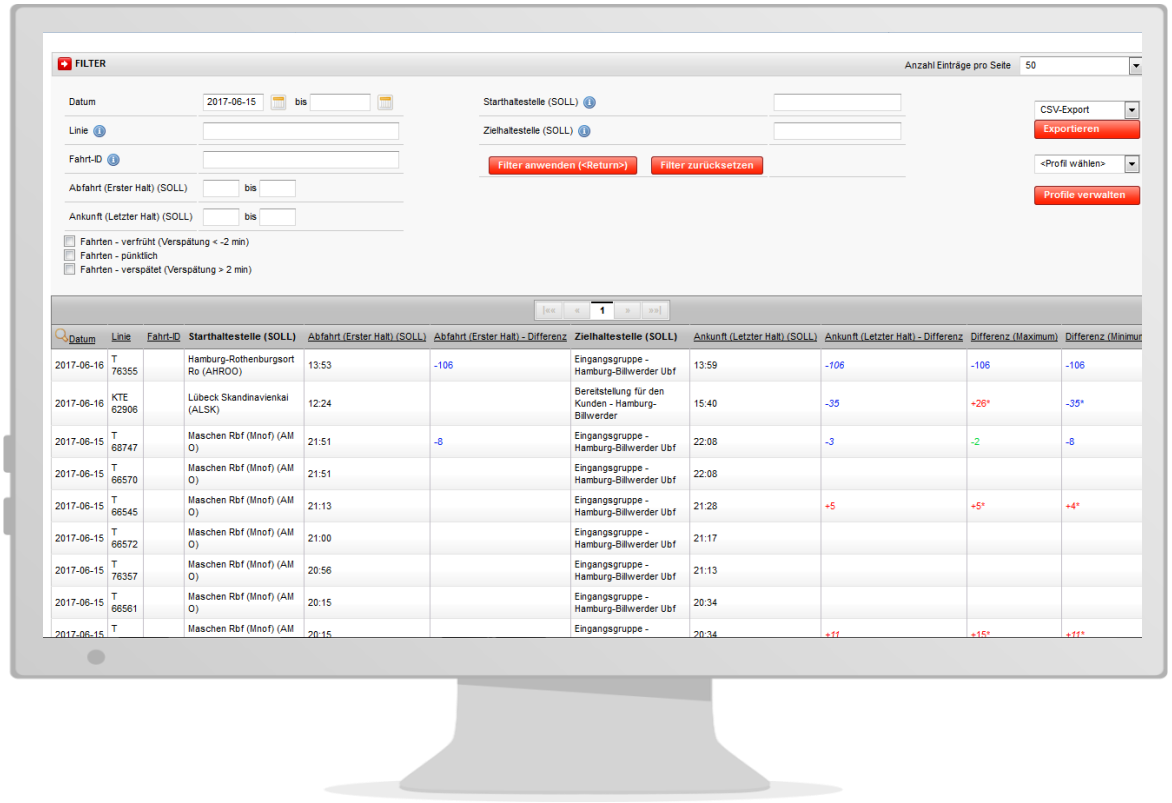








Pilot- DUSS Backend Webinterface

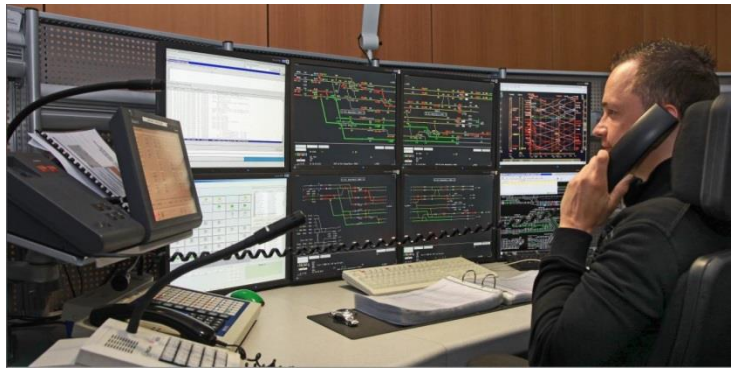


- Display of services in real-time
  - tabular
  - grafical
- Adjustment of automatic prognosis by Terminal Manager
- Archive of services, availability and pick-up times

TPS Project *BFB*

- Operational timetable management (*BFB*)
  - Provision of the daily Offline Production Plan for Traffic Management System (*LeiDis/LeiDa* today and the new *iDIS* system in the future)
  - Last-minute timetable changes (ad-hoc trains, changes related to possessions, ...)
  - Train runtime calculation (conflict detection / with potential conflict resolution)
  - Integration with the integrated standard operator station (*iSBP*) of the operational control centres of DB (BZn), replacement of *LeiDa-F*

- DB Netz as customer
  - 500 user (1000 expected)
  - Duration 2 years
  - Delivery based on TPS Standard Client



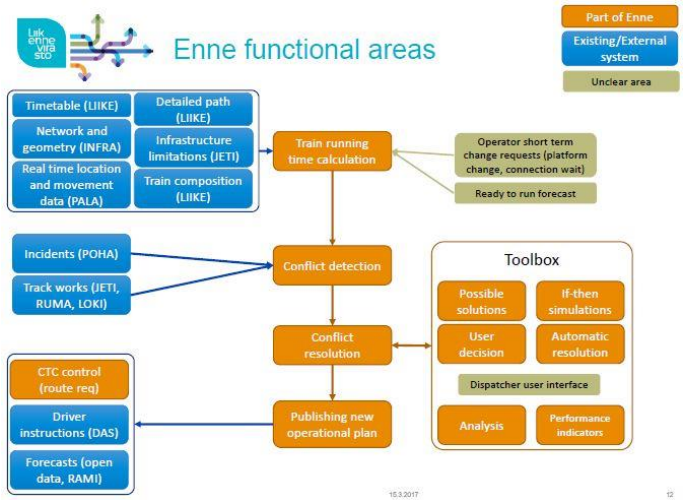
- TPS for large scale VSTP (very short term) planning
  - Link between planning (*RUT-K*) and dispatching
  - operational model enhancements (towards timetable automation)

TPS Online Project *ENNE* (Finland)

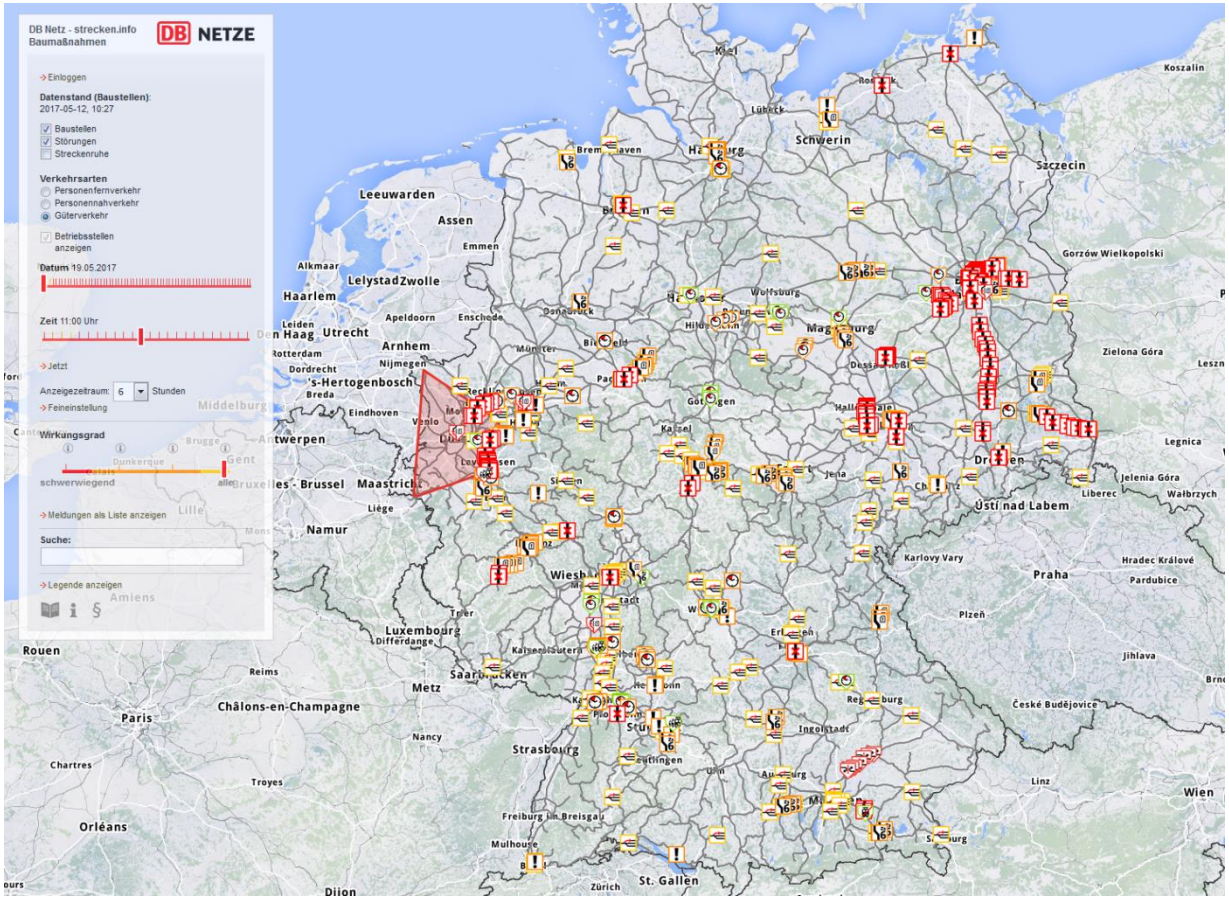
- Enne - forecasting and optimization system for railway traffic
  - Improved control for the Finish national railway network
  - Online conflict detection (based on real-time train position reports)
  - Manual, semi-automated, automated conflict resolution

- Finnish Transport Authority (*Liikennevirasto*) as new customer
  - 400 user
  - Duration 1.5 years
  - Development based on TPS Standard Client

- -> New TPS product *TPS Online*
  - Online dispatching of railway operation
  - Significant efforts for integration, operational model enhancements and algorithms



Example: DB Netz (IM) → www.strecken.info



- Graphical presentation of construction works and disruptions for different time horizons

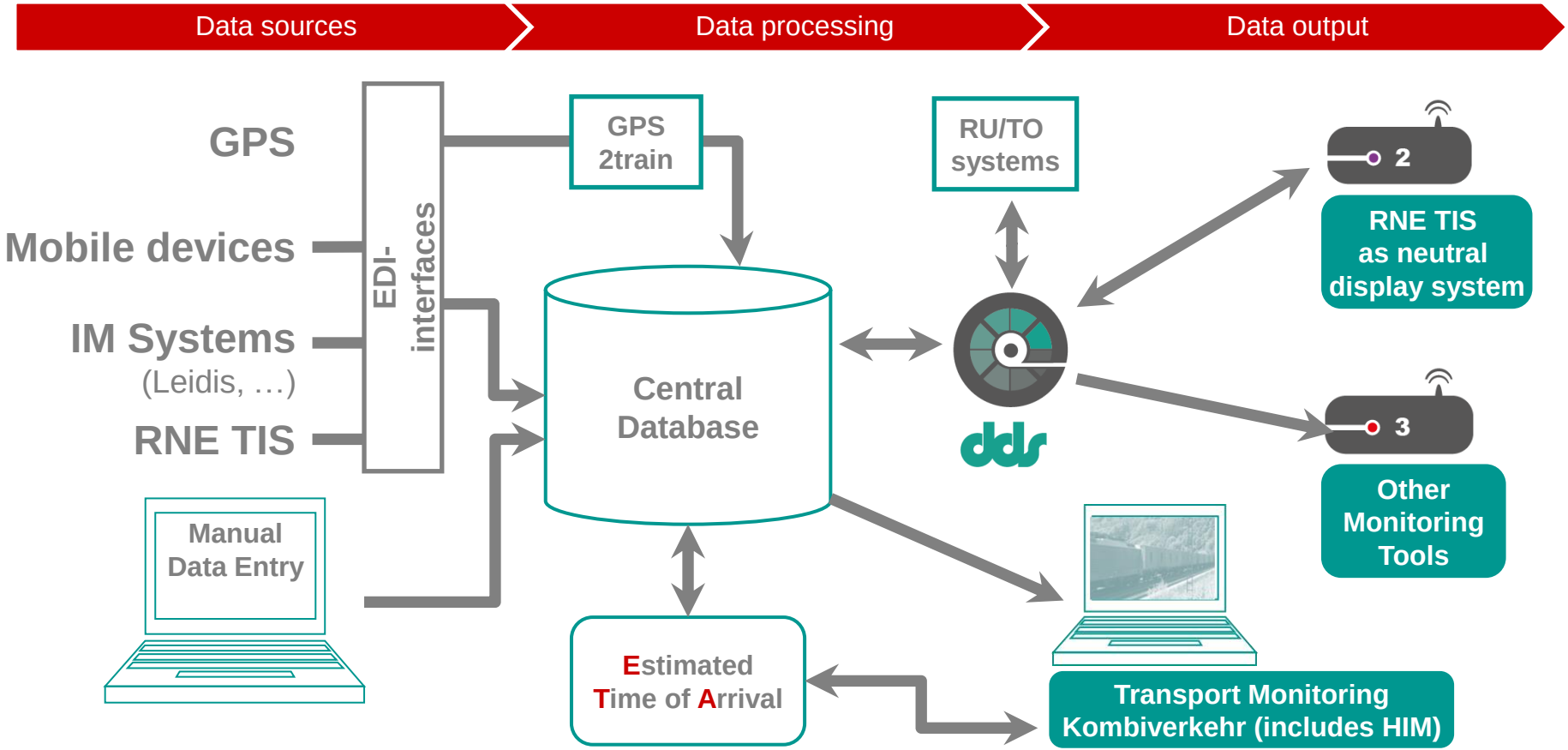
Content:

1. Real-time & ETA
History ⇒ Future

2. Background information
Overview of relevant systems
and data sources

3. Outlook (medium & long term)

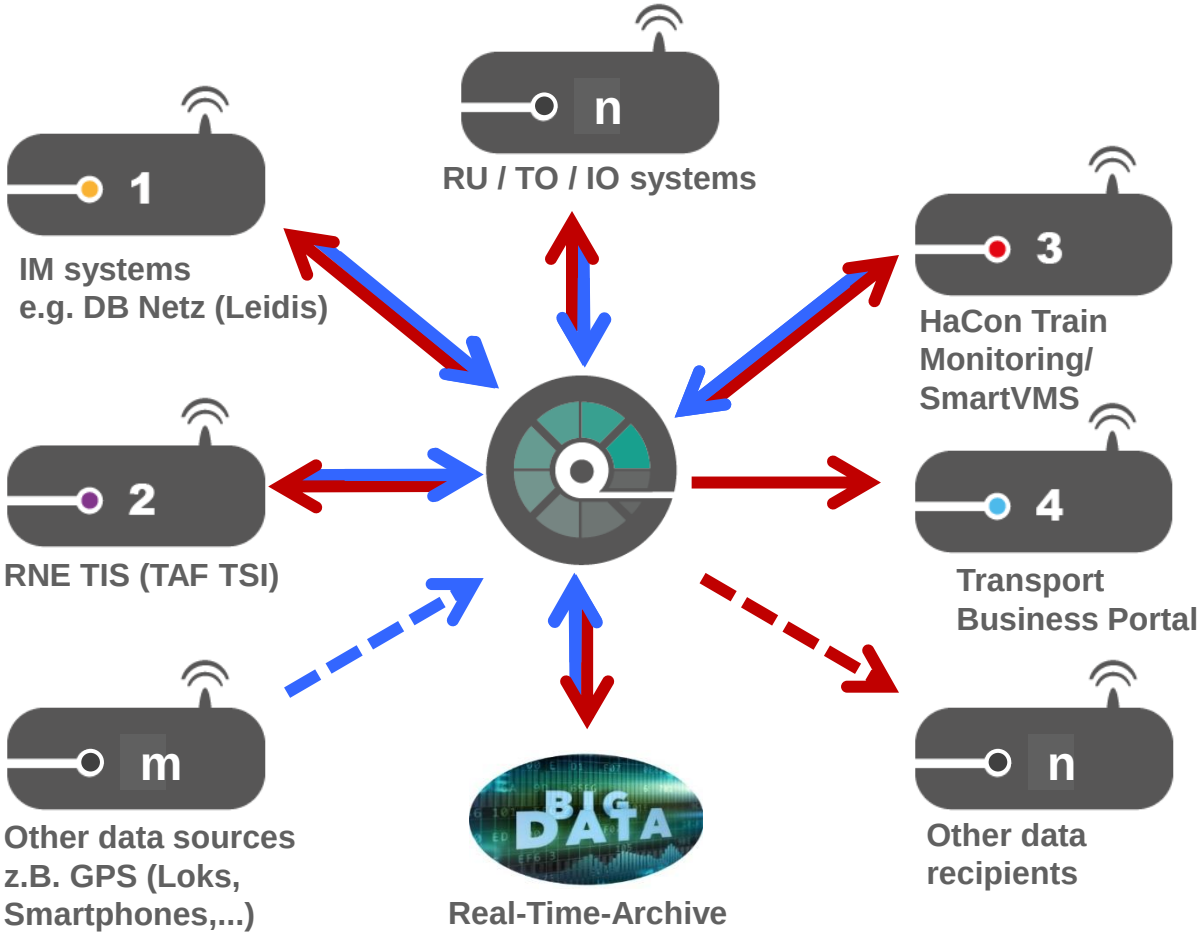
Short/medium term action – Connect proven existing systems



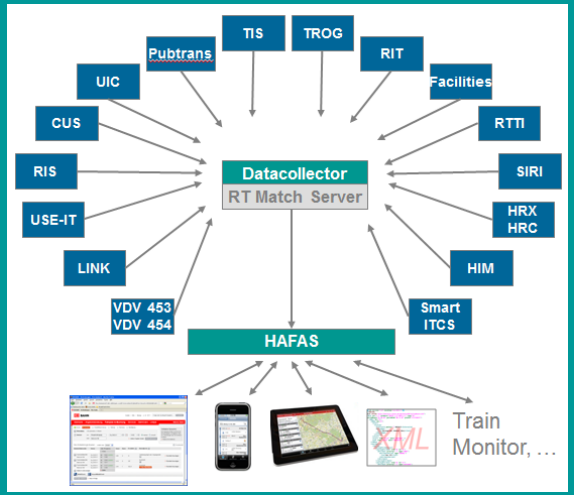
Medium term action – Connect proven existing systems

- Use existing and proven systems which are in productive use at IMs, RUs, IOs, and other operators *(e.g. TrainMonitor, SmartVMS, DDS, HIM, TIS)* for:
  - data gathering, managing, matching, validation, data washing
  - continuous data exchange in true real-time with numerous connected systems
  - live message generation, integration, exchange and distribution
- Avoid manual data transfer as it is never real-time, efficient or reliable
- Combine existing operator specific systems like TrainMonitor or SmartVMS *(operator specific layout, functions, archive, processing of IM and other data)* and general monitoring tools like RNE TIS *(standard layout and information, display of provided IM information)*

Medium term action – Data flows with HAFAS Real-Time Hub



- Real-time data exchange
- Standard-Interfaces & Individual Interfaces
- Data flow control (selective/multitenant)



ETA stages of evolution -

	TODAY	SHORT-TERM	LONG-TERM
Determination methods	1) Forward projection 2) Calculation on the basis of historical data • stat. distribution • Algorithm	3) Consideration of planning decisions … 4) ... Additional influencing factors ie. • Network- line capacity • Construction sites • Weather	5) Control centre IM / real-time simulation / taking into account RU,TO, IO, … Input/exchange via integration layer (S2R developments started and ongoing)
Point of reference	1) Arrival station (time of arrival) 2) Terminal, Unloading / transhipment point (time of availability)	3) Other relevant points on the way • Boarder stations • Loco change • Driver change • Deliveries • Handover (RU)	4) All operation & handling points
Data (Systems, Stakeholder)	• Timetable data • Actual train tracking data IM (Leidis, RNE TIS,...), • Plan-data Terminal, • Telematics (GPS, …)	as “TODAY” plus: • Plan-data Terminal • Actual Terminal data, • Telematics (extended), • Others (Partners, Apps, Influencing factors,...)	as “SHORT-TERM” plus: • Data Control Center