STRATEGIC EUROPEAN DEPLOYMENT PLAN FOR THE EUROPEAN-WIDE IMPLEMENTATION OF THE TECHNICAL SPECIFICATION FOR INTEROPERABILITY TELEMATIC APPLICATIONS FOR FREIGHT (TAF TSI)

PROJECT No: 2005-EU-93008-S

Inventory of the relevant legacy IT applications

Deliverable 1

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1 Introduction

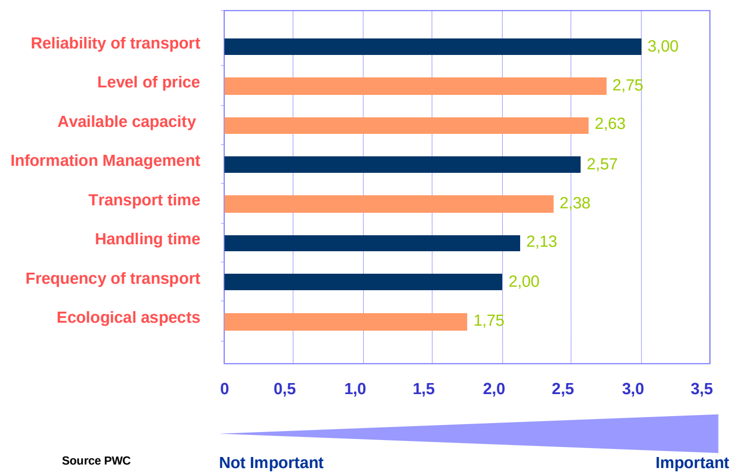
1.1 Overview and Scope of Deliverable

This deliverable encompasses the inventory of the relevant legacy IT applications that could constitute the foundation on which to build a pan-European system capable of delivering the TAF TSI. It has been completed by undertaking an inventory of existing systems with information from the European Rail Freight Industry. The functional and technical characteristics of these systems have been assessed by the Strategic European Deployment Plan Team as well as their potential to act as a platform for ensuring a future implementation of the TAF TSI requirements. The data was provided by the relevant parties within the rail sector. This deliverable is therefore a synthesis of the knowledge-base of the rail industry experts and data provided by the industry, to be used for purposes of supporting the subsequent work-packages.

1.2 The railway freight 'IT' situation in Europe

The deployment of TAF TSI is about halting and reversing the loss in rail freight market share in Europe (as measured by ton-km), which has declined from 21% in 1970 to the current level of 8%. In the same period, the road market share has grown on average from 31% to 45%. This has occurred as the city-to-city freight market has expanded at approximately 3% per year.

The impact of this market shift is enormous in that 1% market share loss by Rail results in more than 6 million additional lorry trips per annum and an annual reduction of revenue to the European Railway of over 1 billion Euros. The social cost in terms of congestion, additional highway construction, loss of usable land, reduced safety and reduction in air quality is difficult to quantify.



The primary reason for this loss in rail market share is the inability of the European rail freight Industry to individually and collectively meet the needs of Customers in the areas of transit time reliability and shipment information delivered through IT systems.

Most of the existing telematics applications for rail freight were developed and implemented according to national market requirements. On the other hand, most of the existing telematics applications for road, air freight and inland shipping were developed and implemented according to customer requirements. This stark contrast hampers the continuity of information services across rail borders, one of the key factors in the challenges facing international rail services in the fast-growing segment of international freight.

In comparable market spaces, considerable use of IT systems, either collaboratively between carriers or linked directly to the systems of consignees and consignors, has enabled significant improvements to customer information and transport efficiency. In particular, non-rail modes of freight transport have become more closely integrated with customers' information systems. These links provide instant visibility for shop-floor views of just-in-time components and production materials, whilst railways have typically limited themselves to an internal view of wagons, bills of lading and shipping documents. The European freight customer has grown used to high-quality service supported by high-quality information and high-quality IT solutions, which collectively now drive price and market volume.

This trend mirrors historic trends in similar markets around the world as they become more open and the incumbent operators become subject to competition. Investment in freight railways has tended to focus on investment in track, signalling, locomotives and wagons. Whilst these are clearly essential for service, the market that the customer is operating in has long-since moved into the digital age and more recently into self-service, internet-enabled transactions. In the North American market, this customer shift has combined with the willingness of rail operators to collaborate in delivering service to customers that competes against the alternative modes by the use of significant, shared investment in IT systems. The availability of these systems has helped turn around a market that found itself in a similar situation in the 1980s to that which the European market now finds itself.

The rail system in Europe has become excessively complex in recent years and this has resulted in difficulties in setting common priorities and targets. Politicians have increasingly stepped-in to oblige stakeholders to operate with transparent rules and the intention of the Telematics Application for Freight TSI[1] is to create improved, open conditions of operation as part of the political initiative of "Technical Specifications for Interoperability".

[1] This TSI concerns the Telematic Applications subsystem for freight services shown in the list in point 1(b) of Annex II to Directive 2001/16/EC

2 TAF-TSI Functions

This chapter briefly outlines the required TAF-TSI functionality. The functional criteria will be used in the following chapters to evaluate corresponding functionality of the legacy IT applications. The following sub-chapters are a synthesis of the required functionality as defined in the TAF-TSI Chapter 4:

2.1 Consignment Note Functionality

The wagon order is primarily a subset of the Consignment Note information. It must be forwarded to the RUs involved in the transport chain, since it could become an input for an ad hoc path request (chapter 4.2.2: **Erreur ! Source du renvoi introuvable.**). The content of the Wagon Order must show the relevant information which is needed for an RU to effect transportation during its responsibility until handover to next RU. Therefore the content is dependent on the role to be performed by the railway undertaking: Origin-, Transit- or Delivery RU.

The data of the wagon orders according the various roles of an RU are listed in detail in the TSI Annex A index 3, marked as to whether they are mandatory or optional. The main contents of these wagon orders are:

- Consignor and consignee information,
- Routing information,
- Consignment identification,
- Wagon information,
- Place and time information.
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Selected data of the consignment note data must also be accessible for all partners (e.g. IM, Keeper…) in the transport chain including customers, These are especially per wagon:

- Load weight (Gross weight of the load),
- CN/HS Number,
- Dangerous goods information,
- Transportation unit.

2.2 Wagon Movement & Interchange Reporting Functionality

The 12 TAF TSI messages involved in these areas, as follows:

- Wagon Release Notice
- Wagon Departure Notice (From Consignor's Siding)
- Wagon Yard Arrival
- Wagon Yard Departures
- Wagon Exception
- Wagon Exception Reason
- Wagon Arrival (At Destination Yard)
- Wagon Delivery (To Consignee's Siding)
- Wagon Interchange Notice (Delivery RU1 to RU2)
- Wagon Interchange Subnotice

- Wagon Received in Interchange (Accepted by RU2)
- Wagon Refused in Interchange

All of these messages are important as they define the trips taken by loaded and empty wagons. For many reasons such as service quality, fleet management, wagon tracking, wagon maintenance, liability, statistics and wagon hire (as specified in the Contract of Use) , it is important to be able to define and measure complete wagon trips.

The most important messages are;

- Wagon Departure
- Wagon Interchange
- Wagon Delivery

2.3 Shipment ETI/ETA Functionality

The forecasted times in the train related messages are all related to an arrival of a train at a certain point, which may be a handover point, interchange point, the train destination or another reporting point. These are all Train Estimated Times of Arrivals (TETA). For the various wagons or Intermodal units in the train, such a TETA may have different meanings. A TETA for an interchange point, for example, may be an estimated time of interchange (ETI) for some wagons or Intermodal units. For other wagons remaining in the train for further transportation by the same RU, the TETA might have no relevance. It is the task of the RU receiving the TETA information to identify and process that information, store it as a wagon movement in the Wagon and Intermodal Unit Operational Database and communicate it to the LRU, if the train is not running in Open Access mode.

2.4 Quality Improvement Functionality

A measurement process is an essential post trip process to support quality improvements.

In addition to measuring the service quality delivered to the customer, LRUs, RUs and IMs must measure the quality of the service components that in total make up the product delivered to the customer.

The process involves the IMs and the RUs (especially if they are Lead RUs) selecting an individual quality parameter, a route or location and a measurement period in which actual results are to be measured against predetermined criteria and which normally have been set out in a contract.

The results of the measurement process must clearly show the achievement level against the target which has been agreed upon between the contracting parties.
The measurement reports must be able to access sufficient detail to allow an analysis to indicate the location and apparent cause of reductions in quality e.g. delays. Root cause analysis must then be carried out on repetitive, quality failures, so that corrective action can be determined by the contracting parties.

It is the obligation of an IM and an RU to provide data, participate in root cause analysis, also with third parties, and to implement any corrective action which has been agreed to.

The measurement process is a repetitive one.

To measure quality the already defined messages may be used as shown under the 6 headings, listed below:

- LRU/Customer: (Transit Time, ETA, & Alert Resolution)
- LRU/Service Providers: (Transit & Handling Times, ETIs, Reason Codes)
- RU/IM Train Performance : (Train ETA, ETH)
- RU/IM: Path Availability / Planned
- RU/IM Path Availability / Short Notice
- IM/RU Train Composition Quality:

2.5 Path Request Function

It is important to note that this function does not comprise long-term planning but only addresses the need for short term path requests. Due to exceptions during the train running or due to transport demands on a short time basis, a railway undertaking must have the possibility to get an ad hoc path on the network.

In the first case, immediate actions have to be started, whereby the actual train composition based on the train composition list is known. In the second case, the railway undertaking must provide the infrastructure manager with all necessary data concerning when and where the train is required to run together with the physical characteristics in so far as they interact with the infrastructure.
The Path agreement for a train movement at short notice is based on a dialogue between RUs and IMs. The dialogue will involve all RUs and IMs involved in moving the train along the desired path but maybe with different contribution to the path finding process.

2.6 Train Movement, Reporting and Disruption Information Function

This information exchange between RUs and IMs always takes place between the IM in charge and the RU, who has booked the path on which the train is actually running. In the case of Open Access, which means that the paths for the complete journey are booked by one RU (this RU also operates the train during the complete journey), all messages are sent to this RU. The same is true, if the paths for the journey are booked by one RU via OSS.

The following information is sent using various messages as described in the TAF-TSI:

- Path number and Train number,
- Scheduled departure Date and Time at IM location,
- Most recent reporting point identification,
- Actual Time at reporting point,
- Train Reporting Point Status (Arrival, Departure, Passage, Not Specified, Departure from Origin, Arrival at Destination),

- Arrival track at location,
- Departure track from location,
- Booked Scheduled Time Delta deviation minutes,
- current schedule if multiple re-schedules,
- *For each deviation from* Booked Scheduled Time *at that reporting location….*
  - Reason code (perhaps multiple),
  - Deviation time for this reason code (multiple reasons may be posted per reporting point),
  - May add free Text about deviation.

2.7 Train Preparation Function

For the preparation of the train, the RU must have access to the infrastructure restriction notices, to the technical wagon data (Rolling Stock Reference Databases, TAF-TSI chapter 4.2.11.3: **Erreur ! Source du renvoi introuvable.**), to the dangerous goods reference file and to the current, updated information status on the wagons (TAF-TSI chapter 4.2.12.2: Other Databases: The Wagon and Intermodal Unit Operational Database). This applies to all wagons on the train. At the end the RU must send the train composition to the next RUs. This message must also be sent from the RU to the IM(s) with whom it has booked a path section, when requested by the Conventional Rail TSI Operation and Traffic Management or by the contract(s) between RU and IM(s).

If the train composition is changed at a location, this message must be exchanged once more with information updated by the RU responsible.

At each point e.g. origin and interchange point, where the responsibility changes on the RU side, the start procedure dialogue between IM and RU “Train ready – Train Running Information” is obligatory.

2.8 Main Reference Data

The Infrastructure Data (the Network Statements and the stored data in the Infrastructure Restriction Notice Database) and Rolling Stock Data (in the Rolling Stock Reference Databases and in the Wagon and Intermodal Unit Operational Database) are the most important data for the operation of freight trains on the European network. Both types of data together allow an assessment of the compatibility of the rolling stock with the infrastructure, help to avoid multiple data input, which increase especially the data quality, and they give a clear picture on all available installations and equipment at any time for fast decisions during the operation.

2.9 Reference Files and Databases

For the operation of freight trains on the European network the following reference files must be available and accessible to all Service Providers (IMs, RUs, Logistic providers and Fleet managers). The data must represent the actual status at all times.

Locally stored and administrated:
Reference File of the emergency services, correlated to type of hazardous goods.

Centrally stored and administrated:
- Reference File of the Coding for all IM', RUs, Service provider companies,
- Reference File of the Coding for Transport Customers,
- Reference File of the Coding of Locations (Primary, subsidiary and zone-track-spot),
- Reference File of the Coding for customer locations,
- Reference File of all existing train control systems,
- Reference File of Hazardous goods, UN and RID numbers,
- Reference File of all different locomotive types,
- Reference File of all CN and HS codes for goods,
- Reference File of all European maintenance workshops,
- Reference File of all European audit bodies,
- Reference File of all European licensed operators including respective list of national safety certificates granted.

Other Databases

To allow for the tracking of train and wagon movements, the following databases, updated at each relevant event in real time, must be installed. Authorised entities such as keepers and fleet managers must have access to the data relevant to fulfil their functions, according to contractual conditions.

- Wagon and Intermodal Unit Operational Database,
- Trip plan for wagon / Intermodal unit.

These databases must be accessible via the Common Interface.

2.10 Networking and Communication

This subsystem will see, over time, the growth and interaction of a large and complex Telematic rail interoperability community with hundreds of participating actors (RUs, IMs, ...), which will compete and/or co-operate in serving the market's needs.

The Network & Communication infrastructure supporting such rail interoperability community will be based on a common **Information Exchange Architecture**, known and adopted by all participating actors.

The proposed **Information Exchange Architecture:**

- is designed to reconcile heterogeneous information models by semantically transforming the data that is exchanged between the systems and by reconciling the business process and application-level protocol differences;
- has minimum impact on the existing IT architectures implemented by every actor;
- safeguards IT investments made already.

The Information Exchange Architectures favours a mostly Peer-to-Peer type of interaction between all actors, while it guarantees the overall integrity and consistency of the rail interoperability community by providing a set of centralised

services.
A Peer-to-Peer interaction model allows the best cost distribution between the different actors, based on actual usage and it will present, in general, lesser scalability problems. A pictorial representation on the general architecture is given in Annex A index 5 chapter 1.5.

<u>Network</u>

Networking in this case means the method and philosophy of communication and does not mean the physical network.

Rail interoperability is based on a common **Information Exchange Architecture**, known and adopted by all participants, thus encouraging and lowering barriers for new entrants, especially customers.

The security issue will therefore be addressed not by the network (VPN, tunnelling, ...), but by exchanging and managing inherently secure messages. A VPN network is therefore not required (the administration of a large VPN network will be complex and costly to manage), thus avoiding problems with responsibilities and ownership allocation. Tunnelling is not considered as a necessary means for achieving the appropriate security level.

In any case if some actors already have or want to implement various degrees of security on selected partitions of the network, they can do so. Over the public Internet network it is possible to implement a hybrid Peer to Peer model with a ***central repository*** and a ***common interface*** at each actors' node.

The central repository is approached first to obtain meta-information, such as the identity of the peer (actor) on which some information is stored, or to verify security credentials. Afterwards, a Peer to Peer communication is performed between involved actors.

3 Relevant Legacy IT Applications

This chapter addresses the requirement to identify systems and applications capable of being leveraged to provide starting points for TAF TSI implementation. The railway industry was invited by the European Commission to present their appropriate applications and. All information contained in this chapter was provided directly from the material presented by the rail industry representatives.

This list is not exhaustive, however contains those systems/applications that fulfil one or more TAF-TSI functional requirements.

For information on other existing systems, please see the inventory of projects from Deliverable 1 of the TREND project.

3.1 RailTrace

3.2 Overview

RailTrace is a Railway oriented consignment and wagon tracking and tracing system for domestic and international traffic. Today RailTrace covers transports TO and FROM Finland as well as Finnish domestic traffic. It could be expanded to include domestic or international traffic of other railways.

Russian Railways (RZD) is the biggest partner providing consignment note and status information to RailTrace. Electronic information exchange covers the traffic between RZD and VR. Information about incoming consignments to Finland from third countries (other CIS and Far East railways) is also forwarded to RailTrace.

The functional specification of RailTrace system started in September 1997. After extensive interviews among end customers, logistic service providers and operative sales personnel of various Railways involved in international traffic market requirements were specified. RailTrace concept is based on these requirements. The system was fully operational in December 2000. Development of the system is an ongoing procedure depending on the feedback from the users such as end customers and wagon keepers. New features, queries and data fields are developed and added constantly depending on the users' needs.

The main processes and related functions of RailTrace are:

1. Trip plan creation
2. ETA calculation, Trip plan maintenance and follow-up (See below)
3. Tracking and tracing related queries, responses and reports
4. Exception reporting
5. Post-Trip historical data analysis

3.2.1 Main Processes and TAF-TSI Related Functions

3.2.1.1 Consignment Note Data

RailTrace contains data information of all railway transport routes and duration between nominated stations. When system receives initiating consignment data (e.g.

electronic Consignment Note), this particular consignment is connected to a specific Trip plan that calculates ETA and other passing events (e.g. ETIs).

This Consignment Note Trip plan is used for tracking and tracing as well as ETA calculation at a later stage.

This function requires the Consignment Note (e.g. rail waybill) in electronic format as an input. The output is the Consignment Note Trip plan.

Data volume:
No restrictions, depends on the number of Consignment Notes.

Interfaces to existing functions:
Consignment Note Trip plan is used for

- RailTrace tracking and tracing services
- ETA calculation and Trip plan maintenance and follow-up
- Exception reporting

3.2.1.2 Shipment ETI/ETA

3.2.1.2.1 ETA calculation and Trip plan maintenance and follow-up

After having received electronic Consignment Note, RailTrace generates Consignment Note Trip plan. When train is on the move, electronic status data, e.g. ORFEUS messages, Hermes 30 messages or status messages in any other electronic format are sent to the system. Based on status events, RailTrace checks whether wagon and consignment are on schedule and on planned route (status date/time < planned passing date/time).

In case of exceptions (status date/time > planned passing date/time), system re-calculates the route passing dates as well as ETA for the remaining Consignment Note Trip plan and sends exception notification to nominated parties via e-mail. The recalculation is based upon hours late at a point which is used to add to the initial ETA. At the moment ETA is calculated to the destination yard, not the consignor's siding as no other RailTrace partners except VR can provide information covering customer's siding For example, 6 hours late at a passing point can mean 24 hr late at destination. The way RailTrace works the ETA would be extended by 6 hr.

ETA calculation and Trip Plan maintenance is not a dynamic trip planning as described in SEDP Deliverable # 2 (From Work Package # 2) Functional Requirement Specification # 1 – Wagon/ILU Trip Planning. Dynamic Trip Plan is out of the scope of TAF TSI and serves as operational planning tool for Railway Undertakings, not as a function in Wagon and Intermodal Unit Operational Database WIMO.

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ETA calculation and Trip Plan maintenance function requires the status event data (e.g. border crossing information) in electronic format (real time information) as an input. The output is an updated Consignment Note Trip plan. If there is no status, it is simply considered an event.

Data volume:
Depends on the number of parties and stations that can deliver electronic status events.

Interfaces to existing functions:
ETA calculation and Trip plan maintenance and follow-up is used for
- RailTrace tracking and tracing services
- Exception reporting

3.2.1.3 Wagon Movement

When Consignment Note is stored in RailTrace, each party (e.g. Consignor, Consignee, Freight payer, Wagon keeper, Infrastructure Manager and all consignment related Railway undertakings) can connect to the system and make pre-defined queries. Wagon movements cover both loaded and empty wagons.

RailTrace is also sending automatically Status event messages to interested parties. E.g. wagon keepers receive information either when the wagon is touched (incoming or outgoing train) or periodically based on timing (1-x times/day). In co-operation with other railways Status event messages (e.g. arrival notice, departure notice) are sent in real time. Status event message exchange is based on contracts between parties.

Query types are based on user profiles since users have dissimilar data enquiries. Archetypal user queries are ‘Where is my wagon/ILU/train?’ or ‘Where is my consignment?’ generate the system reports on the latest location and date/time where train/wagon/ILU/consignment was last seen. In addition to these RailTrace offers a great variety of different optional queries specially tailored for each user profile.

Some users also have access to various reports, which provide statistics of ended transports and system usage.

This function requires the Consignment Note (e.g. rail waybill) and event data (e.g. Wagon Interchange Notice) in electronic format. Input includes various key parameters for selected queries. Output is responses to queries based on key parameters.

Data volume:
Depends on the number of individual users and their interest. Today there are app. 20 000 queries / month in RailTrace.

3.2.1.4 Reference Files and Databases

The system supports a database with wagon movement and consignment note data. It also uses comprises reference files for location (based on ENEE), Customer and Company Coding and an internal Rolling Stock Register.

3.2.1.5 Quality Improvement

3.2.1.5.1 Exception reporting

After having received electronic Consignment Note, RailTrace created Consignment Note Trip plan. When train is on the move, electronic data (e.g. ORFEUS messages have no link between Orfeus messages and Train Movement) is sent to the system. Based on this information RailTrace checks whether wagon and consignment are on schedule and on planned route.

After having received electronic Consignment Note, RailTrace created Consignment Note Trip plan. When train is on the move, electronic Status event data is sent to the system. Based on this information RailTrace checks whether wagon and consignment are on schedule and on planned route.

If there are exceptions (wagon/consignment is late from planned time schedule or event data is received from for the Trip plan unknown station), system re-calculates the route (based on hours late) passing dates as well as ETA for the remaining Consignment Note Trip plan and sends exception notification to nominated parties via e-mail.

It is possible for the end user to maintain planned Trip plan by changing route via internet interface.

This function requires the Status event data (e.g. border crossing information) in electronic format as an input in order to deliver an updated Consignment Note Trip plan and exception report via e-mail as an output.

Data volume:
Depends on the number of parties and stations that can deliver electronic status events.

Interfaces to existing functions:
Exception reporting has interfaces to:

- Dynamic ETA calculation and Trip plan maintenance and follow-up.

3.2.1.5.2 Post-trip historical data analysis

Post-trip historical data analysis is based on archiving, retrieval and statistical analysis of historical data. It delivers any required statistics, e.g. on consignments, transport exceptions, number of finalised consignments periodically, Trip plan status.

3.2.1.6 Networking and Communications

3.2.1.6.1 Telecommunication and Security Systems

System usage and data access is based on user profiles. Web-based user access is secured through user identifications and passwords. Telecommunication is secured by Secure Socket Layer (SSL) encryption method, which is supported by normal Internet browsers and uses public and private keys in a client/server connection.

Telecommunication protocols used include X400, FTP and HTTP. The communication infrastructure is not limited to any railway specific networks such as HIT Rail.

3.2.1.6.2 Scalability, Network versus Corridor Orientation

RailTrace receives today app. 20 000 queries per month. VR has 24-hour/7 day operative control over the system.

RailTrace is based both on network and corridor orientation. RailTrace may communicate with every partner who can provide electronic messages (network orientation) and core functions which are based on corridor orientation (Consignment Note Trip plan).

3.2.2 General Architecture:

RailTrace core system runs on BEA servers. All messages and interfaces to and from other data systems are run via TradeXpress Message Broker. User interface (B-to-C) is completed via HTML (web based interface).

3.2.2.1 Critical success factors:

RailTrace can process any waybill type in Europe. E.g. CIM waybills are not used in Finnish-Russian traffic. When goods are delivered from Russia via Finland to other parts of Europe, RailTrace is able to relate all waybill types used into one traceable consignment and have full control over the movement all the way from Russia to other European countries even though no CIMs are used.

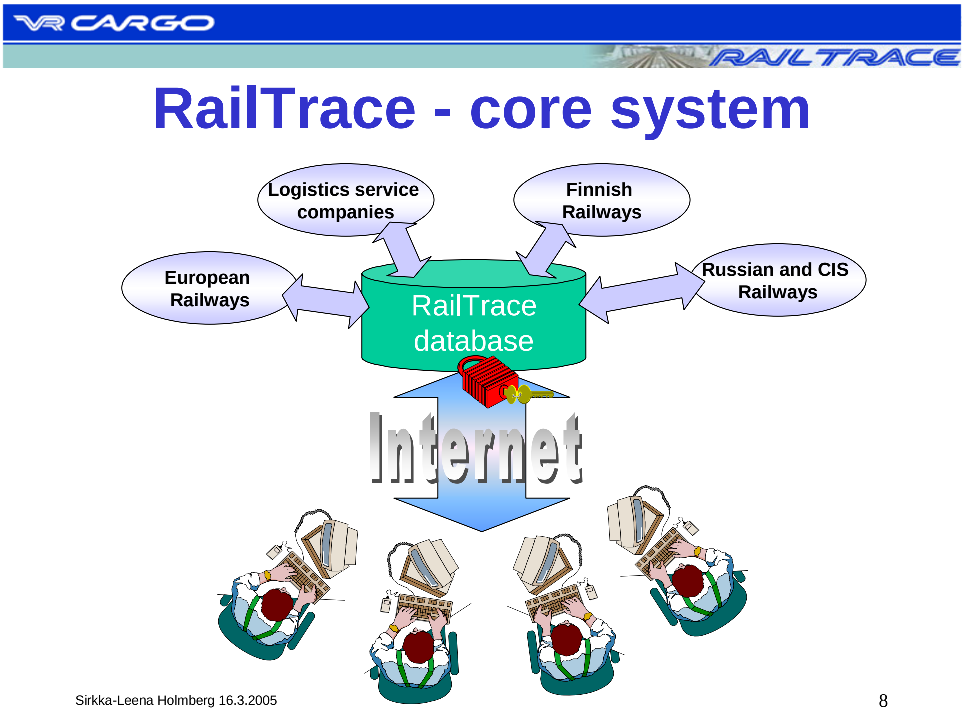
RailTrace is able to relate different wagon numbers in case of e.g. reloading. RailTrace also breaks down train status information to wagon/ILU/consignment level. Queries can be made on consignment, ILU, wagon and train level.

Other stakeholders can also be served by RailTrace. Special customs interface is specially designed to track and trace undeclared consignments. Customs can update the consignments status when the consignment is released from customs control. By using the customs interface no customs documents are needed during the transportation.

RailTrace is in production use since 2000 and is used by:

- Finnish Railways
- Russian Railways
- Finnish Customs
- Logistic Services Providers
- Wagon keepers
- End customers

Below are diagrams of the high-level RailTrace Architecture.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RAILTRACE
RailTrace - core system
Logistics service companies
Finnish Railways
European Railways
RailTrace database
Russian and CIS Railways
Internet
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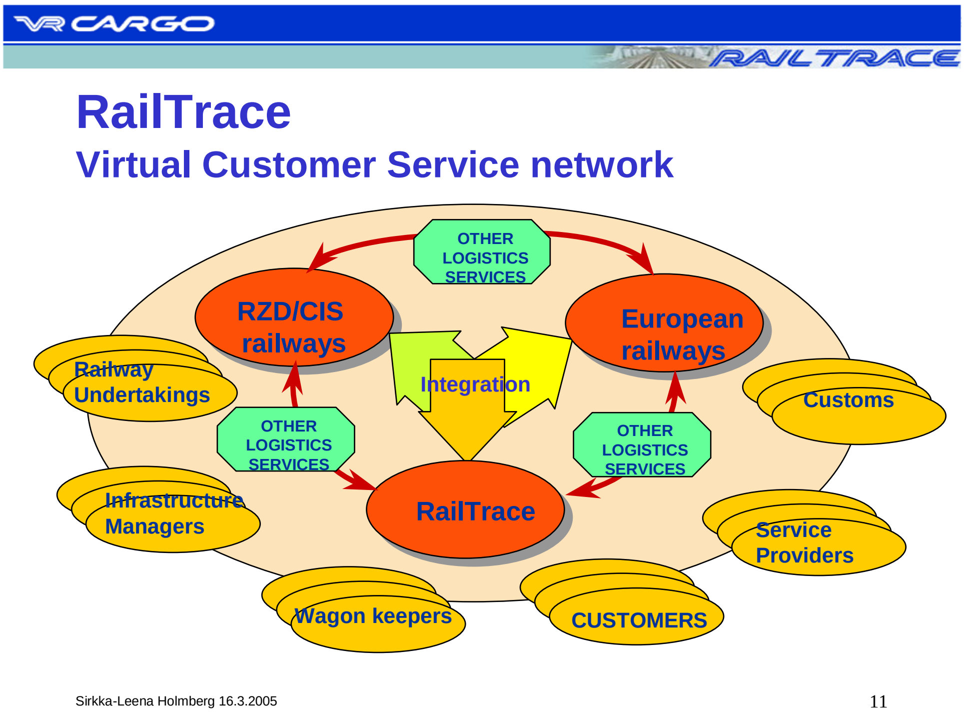
VR CARGO
RAILTRACE
RailTrace
Virtual Customer Service network
OTHER LOGISTICS SERVICES
RZD/CIS railways
European railways
Railway Undertakings
Integration
Customs
OTHER LOGISTICS SERVICES
OTHER LOGISTICS SERVICES
RailTrace
Infrastructure Managers
Service Providers
Wagon keepers
CUSTOMERS
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3.3 CroBIT

3.3.1 Overview

Crobit (Cross Border Information Technology) was realised as an EU project involving 11 partners. Although the project is closed, a tested system is available.

Many TAF – TSI functions are available and additional ones can be realised (using a built-in mapping tool) according to needs of stakeholders in subsequent projects. The "CroBIT Economic Interest Grouping", as the successor of the CroBIT Consortium, is willing to offer its functionality as a basis for TAF-TSI implementation.

CroBIT co-operates with two major systems (RAILTRACE and INTELLIGRATOR) which represent a development effort and application experience of several years.

The purpose of CroBit is to enhance railway performance by providing

- better visibility of goods
- enhanced service reliability
- new customer services
- interoperability among railways
- higher market share of rail freight

To reach these general goals CroBIT concentrated on the realisation of functions not available from other projects and devised an architecture facilitating the integration of proven existing systems.

Data can be provided (in any format) by individual RUs, IMs, others and/or related common systems (i.e. ISR or EUROPTIRAILS)

3.3.2 Main Processes and TAF Related Functions

Main Processes and related functions:

1. Consistent consignment note management during complete transport chain
2. ETA calculation and tracking/tracing
3. Exception notification
4. Post-trip historical data analysis
5. Interfaces – mapping and switching capabilities
6. Utilisation of existing software and systems
7. Security and authentication processes
8. Data quality controls

3.3.2.1 Consignment Note Data

CroBIT provides capability to import Consignment Notes data in different formats, including manual input. it provides hierarchical handling of data on the levels of consignment, ITU, wagon, train.

This function requires as input Consignment, ITU, wagon, train, dangerous goods, customs declarations. The output are Wagons of a train, link (consignment/ITU/wagon/train) of various consignment notes of different RUs

Interfaces exists to consignment note management systems, an interface to Orfeus is possible. This function delivers for the Consignment note data CroBitxml to the linked systems.

3.3.2.2 Shipment ETA/ETI and Wagon Movement

CroBIT provides recalculation and control of ETA/ETI based on a comparison of scheduled against real events. Processing is done by using data provided during the transport by related stakeholders and/or GPS-based.

This function requires contractual relationship with CroBIT for the provision of data by RU, IM, service provider or customer.

Inputs are according the events:

- Empty wagon report
- Consignment note
- Customer departure
- Rail station departure
- Passing stations
- Border crossing
- Wagon changing train
- Rail station arrival
- Actual customer arrival
- Exceptions

As an output this function delivers ETA, delays, updated transport schedule, related CroBIT queries and reports:

- Queries: all wagons and consignments in a certain location, delayed consignment and wagons, location of a consignment, trains/wagons at a certain location, train wagons;
- Reports: number of finalised consignments, query statistics report, number of user company queries, updated transport schedule, consignment statistics, and transport schedule statistics.

Interfaces exist to Tracking and Tracing function and are possible to other Projects like ISR and EUROPTIRAILS. Data supply is delivered according to access rules.

3.3.2.3 Reference Files and Databases

The system supports a database with wagon movement and consignment note data. It also comprises reference files for locations (based on ENEE). and an internal Rolling Stock Register.

3.3.2.4 Quality Improvement

3.3.2.4.1 Exception notification

This function sends predefined alerts to contracted users. It requires the existence of a contractual relationship. The Inputs are the IM and RU exception messages. Outputs are the notifications of exceptions depending on allowable delay between event and notification and the related CroBIT reports. The data is delivered according to access rules. There are three ways to receive shipment status information:

- Notification: Status based alerts via email, automated data exchange
- Reports: number and type of transport exceptions, delayed consignments
- Alerts: sent via email or automated data exchange.

Interfaces exist with tracking and tracing functions and an interface to ISR and EUROPTIRAILS is possible.

3.3.2.4.2 Post-trip data analysis

CroBIT can handle Post-trip historical data analysis that is a function of archiving, retrieval and statistical analysis of historical data. It delivers any required statistics, e.g. on consignments, on transport schedule, number of finalised consignments, on exceptions.

Interfaces exists to tracking and tracing function, also interfaces to European performance regime (EPR), EUROPTIRAILS and ISR are possible.

3.3.2.5 Networking and Communications

3.3.2.5.1 Interfaces – mapping and switching capabilities

A powerful message broker is used for mapping messages from partners applying different standards/formats and as a switching tool that distributes messages among related partners. It requires a contractual relationship between partners.

3.3.2.5.2 Utilisation of existing software and systems

To enable the reuse of successful software and systems, co-operating on the basis of their relative strengths, a simple architecture is devised that uses the message broker as input facility mapping messages into a newly developed CroBITxml. Internally, systems can communicate directly using this format or via the message broker in any agreed format. The output for processed input information to a user may be effectuated by any of the co-operating systems.

Based on the agreement on formats to be used, the data and messages are processed and the processed information is sent to users of CroBIT, preferably via that system they normally use

3.3.2.5.3 Security and authentication processes

Two tier user profile defining roles and rights of user, SSL, User ID and password

3.3.2.5.4 Data quality controls

Verification of inbound and outbound data against locations, entities and mandatory requirements. This function requires Reference file (ENEE). It has an interface to

Reference files, also a direct interface to RICS or ENEE is possible.

3.3.3 General Architecture:

CroBIT comprises the following architectural components:

1. Message Mapping and switching
2. Centralised wagon movement Database
3. Integrated tracking and tracing systems (now RailTrace and Intelligrator) or others

The system is used at CP and VR.

Remarks regarding Intelligrator™":
This is a Complete system for:

- Tracking & Tracing
- Supply Chain Management (SCM)
- Container management

The following diagrammes describe the CroBIT component and Interface Architectures.

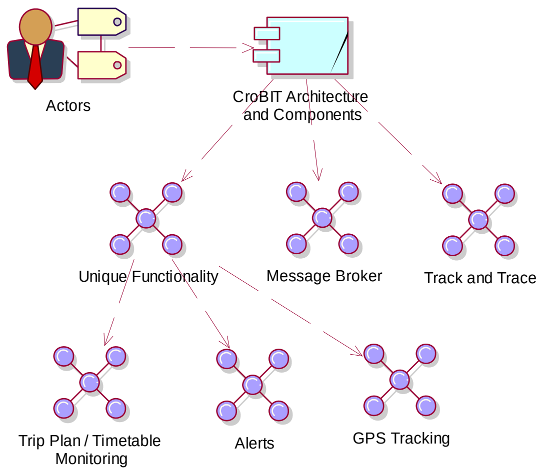


Diagram 3.1 CroBIT Component Architecture

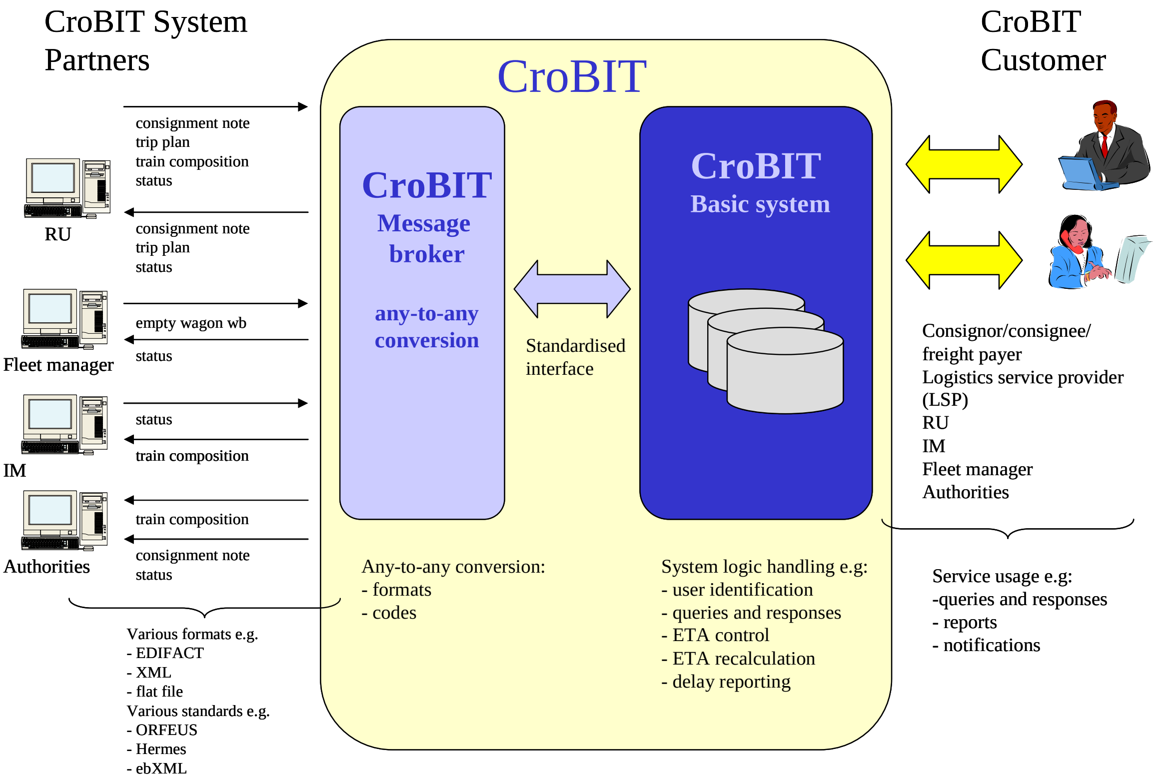


Diagram 3.2 CroBIT Unique Interface Architecture

3.4 ISR

3.4.1 Overview

ISR is an initiative of the European cargo railway undertakings for concentration and exchange information about movements of freight wagons (both loaded and empty) in international traffic through a common central platform.

Wagon event data from railway information systems are collected on a regular basis, using the central applications (ISR and CDS). The stability of both central systems and "national" railway applications is close to 100%. The User Support Centre (USC) in Basel provides production support for the ISR system, as well as coordination between the individual suppliers.

A connection to HERMES VPN allows an overall coverage of the Railway community and a User Support Centre is available commonly used for ISR and ORFEUS.

The following railway companies currently take part in the production:

- Austria (RCA)
- Belgium (B-Cargo)
- Czech Republic (CD)
- France (SNCF Fret)

- Germany (Railion DE)
- Italy (Trenitalia)
- Luxembourg (CFL)
- Slovakia (ZSSK Cargo)
- Sweden (Green Cargo)
- Spain (RENFE)
- Switzerland (SBB Cargo)
- Netherlands (Railion NL)

The ISR members use the website for monitoring their wagons. This web site offers the following search possibilities:

- Wagon Tracking
- Trip Analysis
- Transport tracking (as forwarding, trasnit or destination railway undertaking)
- Wagon Monitoring

3.4.2 Main Processes and TAF-TSI Related Functionality

ISR is a Freight RU tool used for the tracking and tracing of international shipments according to pre-defined profiles.

3.4.2.1 ISR Components

- CDS message broker ensures reception of the messages, their validation as well as format conversion and distribution
- Central ISR database server stores the wagon movement and transport details
- ISR web site allows to search in the stored data and to display different views on them.
- Information systems of connected railway undertakings, providing and receiving the wagon movement information.

3.4.2.2 Wagon Movement Registered Wagon Events

The following events may be reported to and stored by the ISR system:

- Shipment order (CIM consignment note)
- Departure from shipping station
- Arrival to intermediate station (typically marshalling yard)
- Departure from intermediate station
- Border crossing (planned)

- Border crossing (real)
- Arrival to destination station

Inclusion of the Wagon Order (subset of ORFEUS information) allows a linkage between production and commercial information.

Note: both loaded and empty wagons are supported by the ISR application.

3.4.2.3 Reference Files and Databases

The system supports a database with wagon movement data.

3.4.2.4 Networking and Communications

3.4.2.4.1 Message Syntax

The ISR central system receives messages using the CDS message broker. Several formats are allowed.

- XML wagon status message (WSM)
- Edifact IFTSTA wagon status message
- Flat file wagon status message
- UIC 912 message (application 30, version 1) for planned border crossing
- Edifact 90.2 ORFEUS CTD message for shipment order event
- XML ORFEUS CTD message for shipment order event (planned)

3.4.2.4.2 Communications

- ISR uses the FTP (file transfer protocol) for transmission of messages. FTP is an Internet standard (RFC 959).
- For specific needs of the ISR application, each connected system needs to install specific FTP client to communicate with the CDS. Exceptions are the copies of the application 30 messages (border crossing) transmitted using the HOSA FTP clients.
- The communication infrastructure used is the HERMES IP VPN (Virtual Private Network) provided by HIT Rail.
- ISR can support other types of communications protocols where needed.

3.4.2.5 Additional Technical Functionality

Several ISR members are using the new ISR features for distribution of information:

- Web service (allowing to provide own web interface with local language and added features)
- Push function (automated distribution). Specific railway undertaking receives information about all its wagons or consignments in which it is involved for further internal processing.

3.4.2.6 Foreseen Application Functionality

The current goal is to have full integration with commercial data as contained in the ORFEUS system and to also integrate a theoretical transport plan to:

- prepare the provision of ETI and ETA
- make a linkage with the actual transport status and produce appropriate alarms
- To prepare the re-calculation of ETI and ETAs
- Integration of appropriate Industry Reference Files

Integration of appropriate Industry Reference Files

The first priority is to attain a high level of data quality and integrate all European Freight RUs into the system. Further development of this system is under the responsibility of “Raildata”, a special group of the UIC.

3.5 Orfeus System

3.5.1 Overview

The main goal of ORFEUS is to improve the speed and reliability of international freight rail transport and to allow significant cost savings.

ORFEUS ensures the exchange of the railway CIM consignment note data between co-operating railway undertakings using a centralised information exchange platform. The Consignment Note data are delivered by the forwarding railway undertaking and distributed via ORFEUS to other railway undertakings involved in the transportation.

3.5.2 Main Processes and TAF-TSI Related Functions

3.5.2.1 ORFEUS Components

ORFEUS utilises a Central Data-management System (CDS). It acts as a message broker for the collection and distribution of information, including specific compliance checking and editing.

The National Information Systems (NISes) of connected railway undertakings are connected covering both commercial and production functions.

3.5.2.2 Consignment Note Data

Orfeus comprises the following functionalities:

- The exchange of international consignment note (CTD)
- Switch of the international consignment note (CTD) from the CDS to the other RUs involved in the transport
- Sending of the UTD of the international consignment note from the LRU to the CDS
- Switch of the UTD of the international consignment note to the other RUs involved in the transport

3.5.2.2.1 Messaging Scenario

The following is a description and diagram of the ORFEUS system messaging functionality.

- The forwarding railway company collects data about an international transport (majority of the CIM consignment note information)
- The NIS sends the data to the CDS using the Create Transport Dossier (**CTD**) message.
- A copy of the CTD message is sent by the CDS to all other railway undertakings involved in the transport. The CDS also has a filter function so that distribution rules may be adjusted.

- General Response Messages (**GRM**) are used if any application or data error is detected by the CDS.

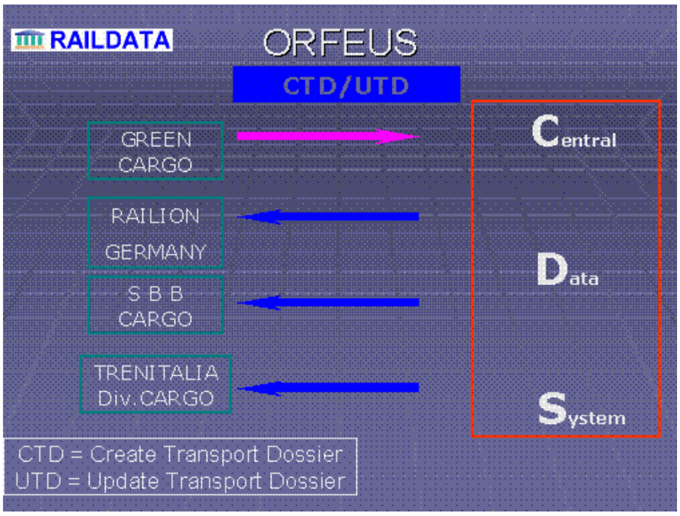


Diagram 3.3 ORFEUS CTD/UTD Message Flow Diagramme

3.5.2.3 Networking and Communications

3.5.2.3.1 Message Syntax

- The CDS exchanges data with the NISes using **Edifact v. 90.2** messages. Although they were created using the IFTM guidelines, they are railway specific.
- A new **XML interface** was developed to allow data exchange using an XML Schema

3.5.2.3.2 Communications Platform and Protocol

- ORFEUS uses the **FTP (file transfer protocol)** for transmission of messages. FTP is an Internet based standard (RFC 959).
- For specific needs of the distributed application, special FTP modules were developed. Each connected national system needs to install a specific **FTP client** to communicate with the CDS.
- The communication infrastructure used is the **HERMES IP VPN** (Virtual Private Network).

3.6 Europtirails

3.6.1 Overview

The purpose of EUROPTIRAILS is to improve the effectiveness and efficiency of train running on European rail corridors in the operational range through information sharing and support.

The following list sets out the problems that EUROPTIRAILS is designed to assist in solving. The list comes from the project team's understanding of the project and some of the weaknesses of European traffic management identified in previous studies.

The system aims to address the following:

- The lack of responsiveness to the market's needs for information and reliable rail service delivery
- The lack of whole journey based information provision and input to decision making for the Infrastructure Managers
- The different levels of technological exploitation within the Operating Control organisations and the missing of central availability of information
- The lack of technological exploitation in linking the National or Domestic Operating Control Centres
- The lack of recorded information about the performance of service delivery on specific routes against management and control indicators to highlight the actual level of performance achieved in international traffic management.

<u>Organisational Scope</u>
EUROPTIRAILS is limited to international trains crossing at least one border of the EUROPTIRAILS corridor and crossing at least two of the additional agreed passing points.

EUROPTIRAILS is a project consortium set up by European Infrastructure Managers. In this framework it addresses the objectives and requirements of their organisations. The necessary information flow from Railway Undertakings will come through input from the Infrastructure Managers only.

Nevertheless, especially for the Path Assembly functions, it is necessary to find agreements with the Railway Undertakings. The final decision of the agreement process should be put into the EUROPTIRAILS system by the Infrastructure Managers.

Moreover, both Infrastructure Managers (IMs) and Railway Undertakings (RUs) can benefit from the output of EUROPTIRAILS. The latter can in fact access the system for information gathering only. Outside EUROPTIRAILS the RU can interact with IMs for reaching agreements about current traffic situations. In the present scope of the project the results of these interactions are required to be input to the system through the IMs who therefore remain the only responsible bodies for data management.
In addition the project aims to set up common understanding and procedures in view of:

- improved rail traffic management on international routes

- interoperability exploitation supported by information technology.

<u>Geographical Scope</u>

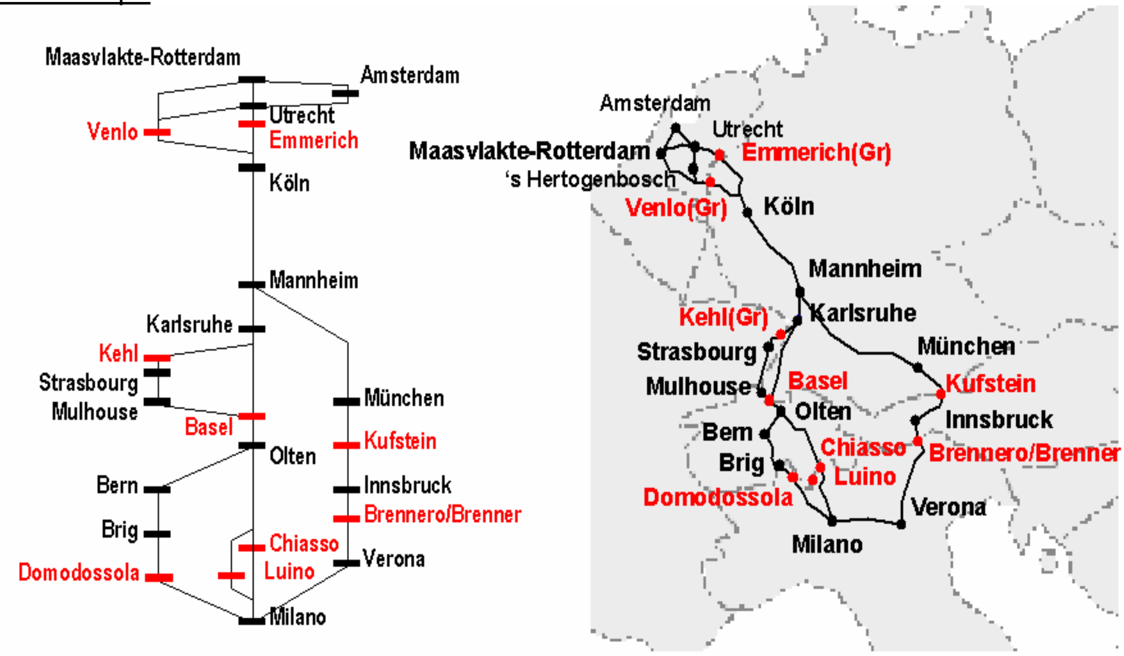


Figure 1 – EUROPTIRAILS corridor, 1st implementation

Moreover the system has not only to focus on the corridor area itself but can also regard some information about EUROPTIRAILS trains which enter the corridor from another line, led by a partner Infrastructure Manager, or leave the corridor to a destination within the network of another participant IMs. This scope is of advantage to the Infrastructure Managers because foresight on trains entering the corridor in the next hours is also necessary for dispatching and path assembling, and forecast to the final destination meets the wider customer needs.

Moreover service quality analysis should focus on the entire product and therefore include the whole run of the train. This means that some information will have its source, and will be made available for, outside of the corridor itself.

In this regard we define here a “corridor” as a set of major railway lines, which can interconnect at railway main junctions or nodes. The geographical data are those essential to implement the system functions.
In addition EUROPTIRAILS is required to be easily and flexibly enlarged as new lines or corridors (i.e. IMs) need to be added to the initial project geography.

<u>Main Functions and General Architecture</u>

The system provides three primary functions that are:

- On-line centralised information supply to Infrastructure Managers as well as other authorised users (e.g. RUs)
- Data Recording and Monitoring to provide management reporting and performance indicators
- Path Assembly for supporting IMs in train re-scheduling.

These functions, which are designed to address the corridor as a whole or in part, are outlined below respectively as:

- Information Model
- Monitoring Model
- Path Assembly Model

and will represent the scope of the functional requirements.

<u>Information Model</u>

The objective of the centralised information function is to provide data to users as continuous flow or in response to their requests.
These data concern real-time train running and the corridor status, as defined in the following.

- Source of data will be in general the domestic control and traffic management systems of the partnering IMs in addition to manual input, where necessary.
- When EUROPTIRAILS does not have the data available to answer the request, it will attempt to obtain the data and make them available.
- The system will give an indication to users making requests as to its ability to reply to their requests.
- It shall always give users a response to their requests. This response might be the answer to the request, or an advice that the system cannot respond soon, but it will later. On the other hand the system will prompt specific users for single answers. Other requests will initiate a flow of data that the system will make available as soon as it becomes available.
- EUROPTIRAILS uses a standardised protocol for data exchange. The general principles affect all the other EUROPTIRAILS functions as well.

<u>Monitoring Model</u>

The objectives of the Monitoring Model (MM) are:
- to provide recording data about the running of Trans-European passenger and freight trains and
- to provide other Corridor's performance records, in order to identify the strengths and weaknesses of the current method of service delivery and provide Infra Managers, as well as other Stakeholders, with basic information for other planning and policy purposes.

In particular the MM shall

- provide detailed information concerning EUROPTIRAILS trains on the whole network, on certain reporting points or certain relations, in order to
- measure and analyse the quality of services
- trace weaknesses and responsibilities of the operations processes
- introduce actions to improve performances and process quality
- measure and analyse the effects of improvements.
-

The MM involves EUROPTIRAILS trains. However analyses about these trains are not restricted to the corridor, according to the available information, as above said.

<u>Path Assembly Model</u>

The objective of the Path Assembly Model (PA) is to provide a rescheduling method on the corridor in case of disturbed train running, lines difficulties and other contingencies.

For the Path Assembly function two organisational models are to be adopted, which are described within the framework of TSI:

An Infrastructure Manager "coordinator" is in position to coordinate the whole international path among the Infrastructure Managers of this offer and reach agreement with the requesting Railway Undertaking.

The rescheduling of an international path is carried out without any "central" coordination. In this case the Infrastructure Managers concerned are in contact with the Railway Undertaking(s) and coordinate their path offers and reach agreements separately.

3.6.2 Main Processes and TAF-TSI Related Functions:

The main functions are to collect and supply information on trains and operations in real time on the basis of UIC leaflet 407, provide train monitoring information and provide train paths on a short-term basis in disturbed situations.

3.6.2.1 Train Running Information Function

Each IM provides timetable information and real-time information about train run, forecast and disruptions. Requirements are the Standard 407-1 messages with MQSeries data communication as input from domestic IM real-time systems (Train running forecast and Service disruptions).The output is the consolidated information about train status and corridor status on a corridor in real time.

Interfaces exist to the domestic Infrastructure manager IT Systems, to domestic timetabling and real-time functions.

Europtirails can also provide Train information to the RUs

3.6.2.2 Quality Improvement

From time-table and real-time information received in the information function the monitoring function provides quality reports. Input is the consolidated real-time information from the domestic IM IT systems. Outputs are quality reports on international train and corridor performance. Interfaces exist to the information function of Europtirails

3.6.2.3 Path Request Function:

The task of this function is to find the most suitable path on the corridor for a train at short notice (rescheduling may be needed for various reasons during operation.).IMs coordinate and offer "segments" of a path on their infrastructure and link it to the neighbouring IMs. This function is based on the free capacity on the corridor and on real time information. Outputs are a rescheduled train run. This function builds on an existing contracted time table which then is modified in a dialogue between IMs. The IM – RU dialogue is not covered by Europtirails

A link exists to the information function.

3.6.2.4 The Main Reference Data: The Infrastructure Restriction Notice Databases

Europtirails provides corridor status information. This corridor status provides information used during the operational phase of a train movement like :

- Line closing
- Rerouting
- Reduced line capacity
- …

It does not cover information used for the train composition as required for the Infrastructure Restriction Notice Database.

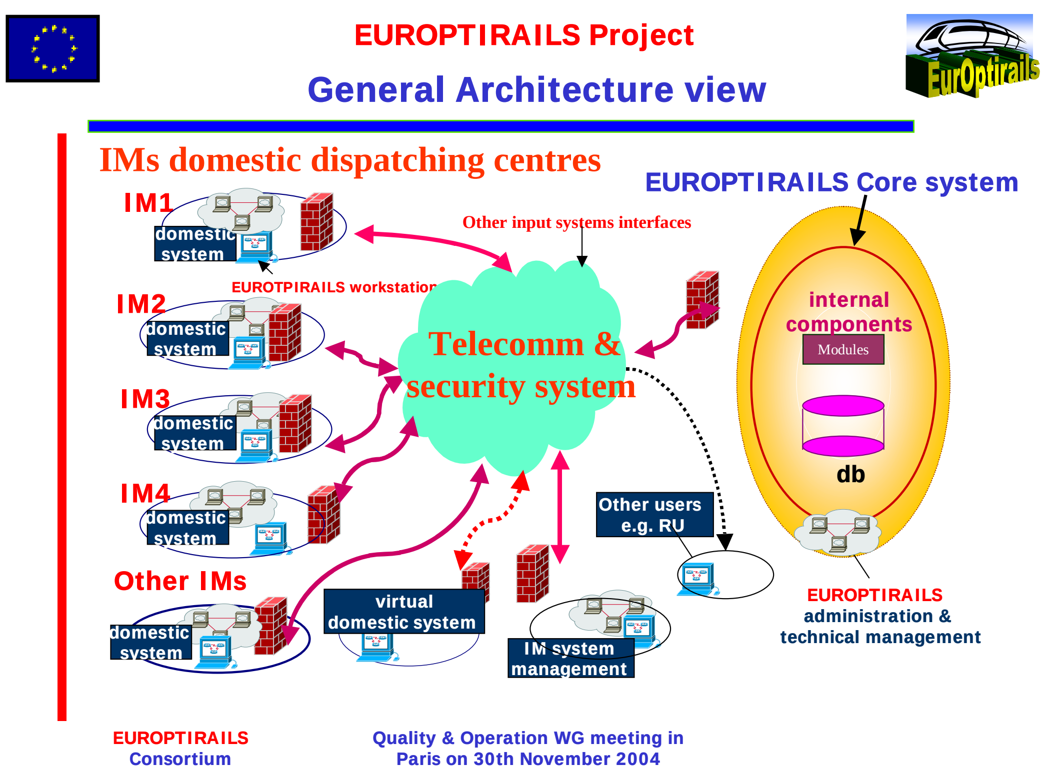
3.6.2.5 Networking and Communications:

The architecture shows a central component, Database and web service and distributed proxy server to manage the interface with the IMs. The telecommunication and security systems are MQSeries for communication and use of the HOSA VPN network.

Europtirails is in use at ProRail, DB Netz, CFF Infra, RFI, ÖBB infra, RFF/SNCF

3.6.3 General Architecture

Below is a graphic depicting the general architecture of the Europtirails system.



3.7 HERMES

3.7.1 Overview

HERMES is the data transmission system and standard messaging format for the railway industry as originally specified by UIC. The description of the HERMES VPN is given in the UIC leaflets 917, especially in 917-5. HERMES comprises two distinct elements:

- The secure HERMES VPN Network
- The applications (messages) exchanged on a bi-lateral basis between subscribers. The relevant application messages will be addressed in the following chapter.

3.7.2 Main Processes and TAF-TSI Related Functions

3.7.2.1 Networking and Communications

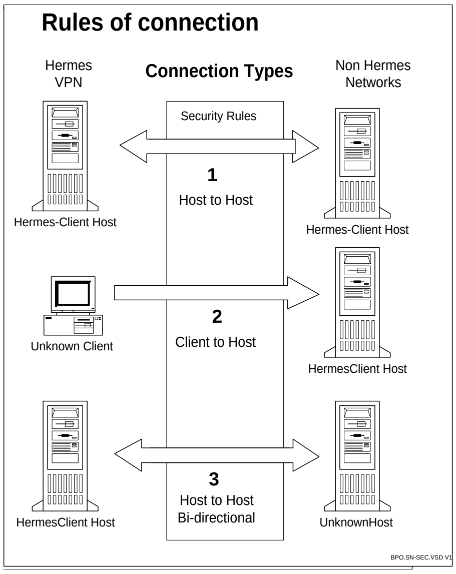
3.7.2.1.1 Network Security

The Hermes network itself is a secure network that uses no publicly addressable IP addresses and encrypts all traffic using IPSEC. However since it doesn't have its own firewalls it adopts this policy to give confidence to its users. In practice it will deliver encrypted traffic from point to point reliably and securely and support whatever protocols are presented.

The following types of connections are allowable:

- connection (client/host/direction)
- transport mechanism
- service type (sub-protocol)

The following diagram shows the 3 basic types of connection.



1. Represents the normal Hermes FTP and MQ traffic
2. Represents Hermes clients providing international services through the VPN network examples being Minotaurus and Rail Europe
3. Represents a Hermes client providing Host to Host services to a non Hermes client user. An example would be a back office service such as provided by RMF

For each type of connection above there will be a range of transport mechanisms.

Services supported are FTP, HTTP, HTTPS, SNMP (Traps only), SMTP , IP sockets (to defined ports only), SSH, Telnet and MQ. Over time these will be extended as technology develops and demands require. The standards will take account of the inherent security of the various service types and will identify any additional requirements or prohibitions.

3.7.2.1.2 Data Security

A further factor to consider is the confidentiality of the data to be transported. Data security includes all the capabilities contributing to guarantee end-to-end traffic privacy. The Hermes VPN data security includes the following features:

- Tunnelling including end-to-end IPSec multilevel encryption using DES or 3DES secret key encryption system and MD5 or SHA1 hashing techniques
- Anti Spoofing protection preventing from attacks based on the ability to falsify the source IP address
- Protect the Hermes VPN against most of the known Denial-of-Service attacks and flooding
- Protect against Network Sniffing revealing confidential data.

3.7.2.2 HERMES Applications (Messages)

For international freight transport the following messages are defined for transmission via Hermes and are currently in production:

No. 30:Wagon pre-announcement and wagon trans-shipment
No. 38: Border Crossing, Incidents in Transit and Wagon Search

No. 39: Freight wagon km counting
No. 41: Despatch Advice
No. 42: Arrival Advice
No. 70: EENE data

The Hermes network is open to all UIC members, but participation in message exchange is not mandatory. The most commonly used message is the HERMES 30.

3.7.2.3 Consignment Note Data

Consignment note data may be passed via the HERMES network and is addressed in the ORFEUS chapter.

3.7.2.4 Wagon Movement

HERMES Application 30 may be used to report wagon movements. The ISR chapter addresses the functionality of these applications using the ISR central system. It is also possible to pass these application messages bi-laterally using the HERMES network.

3.7.2.5 Reference Files - ENEE

The HERMES Application 70 (ENEE Update) still exists, but is no longer used. This application has been replaced by other formats for the ENEE information updates. These new messages are also carried over the HERMES network.

The ENEE database is currently in operation and identifies the Railway Locations as specified in the TAF-TSI. This database is currently integrated into several international platforms – and is heavily used by the Infrastructure Managers.
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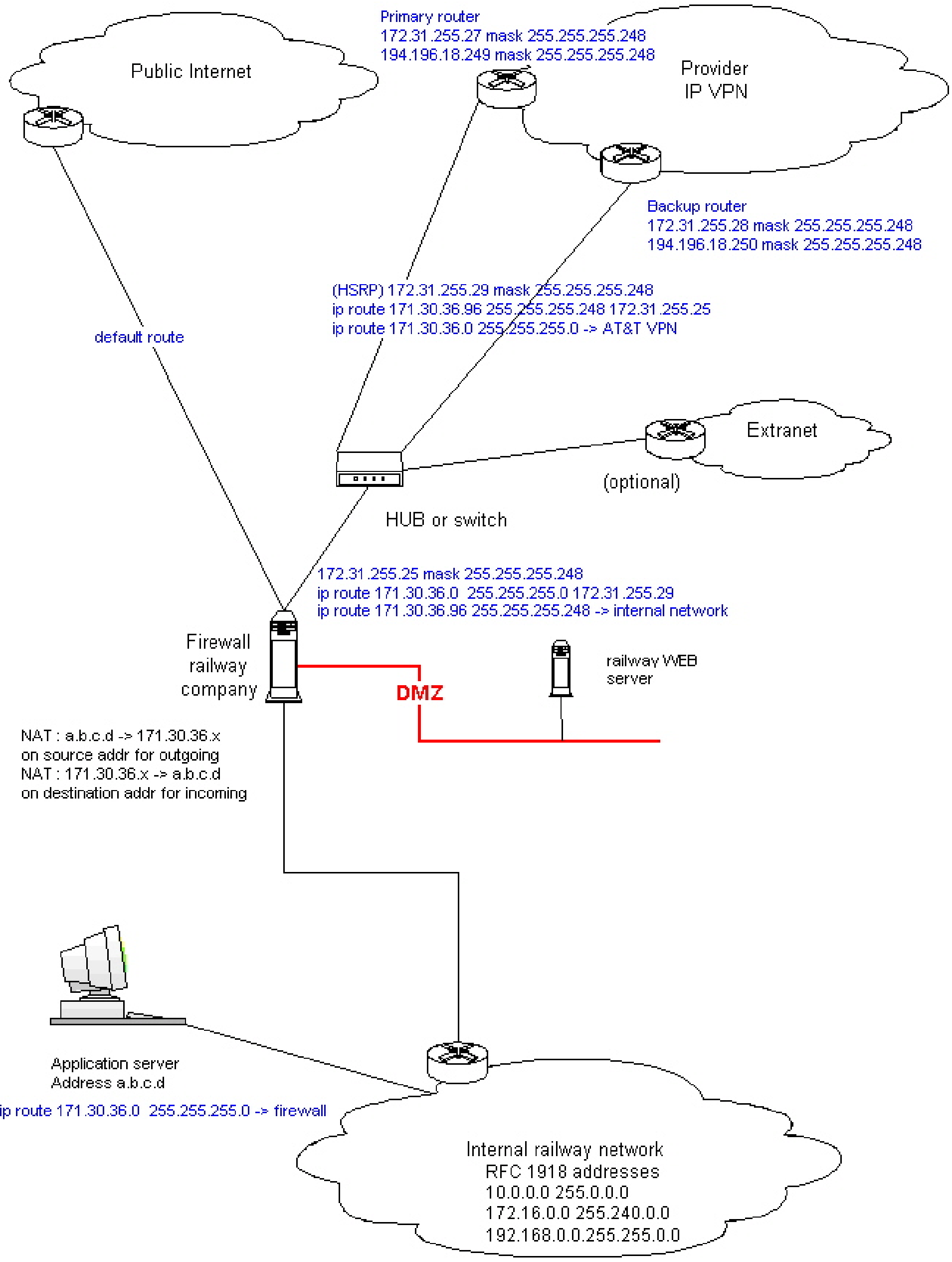
3.7.3 General Architecture:

The general architecture of the HERMES network is shown below:



4 Supporting Systems for TAF-TSI Functionality

4.1 Consignment Note Functionality

Virtually all RUs have some sort of electronic Consignment Note capability in their internal systems. Most RUs also have the capability of exchanging Consignment Note messages with other RUs.

Since Wagon Order messages as specified in the TAF TSI are a subset of Consignment Note Data; collectively the existing internal systems of the RUs form a solid basis for implementing this portion of the TAF TSI.

Wagon Orders are critical to the TAF TSI and Interoperability in general, therefore they represent a key building block in the development of a competitive and productive Rail Freight industry.

The biggest challenge in this area is data quality. Common, up to date reference files are essential for key data elements such as location. Each Wagon Order message exchanged between RUs must be checked against these reference files to ensure that the required level of data quality is achieved. Since these reference files are not well developed and used, it is probably safe to assume that existing data quality is not adequate and considerable effort will be required to bring it to the required level.

4.2 Wagon Movement & Interchange Reporting Functionality

The 12 TAF TSI messages involved in these areas, as follows:

- Wagon Release Notice
- Wagon Departure Notice (From Consignor's Siding)
- Wagon Yard Arrival
- Wagon Yard Departures
- Wagon Exception
- Wagon Exception Reason
- Wagon Arrival (At Destination Yard)
- Wagon Delivery (To Consignee's Siding)
- Wagon Interchange Notice (Delivery RU1 to RU2)
- Wagon Interchange Subnotice
- Wagon Received in Interchange (Accepted by RU2)
- Wagon Refused in Interchange

All of these messages are important as they define the trips taken by loaded and empty wagons. For many reasons such as service quality, fleet management, wagon tracking, wagon maintenance, liability, statistics and wagon hire (as specified in the Contract of Use) , it is important to be able to define and measure complete wagon trips.

The most important messages are;
- Wagon Departure
- Wagon Interchange
- Wagon Delivery

All Freight RUs (with one major exception) have the capability of capturing some of these 12 events in their own systems. Several RUs also have the capability of forwarding messages based on these events to a central movement data base.

The capture of the key Wagon Departure and Wagon Delivery events is the weakest reporting area. In some cases the RUs' systems cannot accept these events, in other cases the system capability exists but the "on the ground" business processes and or data processing are not in place. Without these events, Wagon Trips cannot be fully defined. Only three RUs rigorously capture all of the Wagon events listed above.

The capture of all of these wagon events, and especially; Wagon Departure, Wagon Interchange and Wagon Deliver events is a key success factor in TAF TSI implementation since this capability is essential for Customer Service Quality measurement as well as the Tracking and Tracing of Wagons.

4.3 Shipment ETI/ETA Functionality

While wagon event reporting has many benefits, dynamic shipment Estimated Time of Arrival real-time calculation is a tool specified in the TAF TSI which is essential for the delivery of reliable wagon transit times. This service capability is viewed by freight customers as the most important criteria in modal choice decisions – even ahead of price.

The functional capability to dynamically calculate Estimated Times of Interchange and Estimated Times of Arrival (at consignee's siding) for individual wagons represents the most complex (and the most beneficial) portion of the TAF TSI. The term dynamic means that when exceptions occur, revised ETIs and ETAs are automatically calculated.

The TAF TSI also specifies that the Lead RU must have the capability of comparing ETAs (contained in messages from delivering RUs) with transit time commitments made to a customer.

The Lead RU must also have the capability of generating alert messages and wagon deviation requests when ETAs do not map to customer commitments.

Currently, eight RUs have some type of ETA capability. Three of these eight have dynamic ETA capability at consignees' sidings for all wagons, although one of the three RUs is not using it. One RU has the capability of automatically comparing ETAs with customer commitments – for domestic traffic.

Five RUs have wagon ETA capability for selected traffic based upon various systems such as predetermined (vs dynamic) trip plans. Predetermined trip plans can be effective, however they are very labour intensive and cannot be applied to all traffic.

It is important to note that when RUs have the capability of dynamically generating

ETIs as specified in the TAF TSI, this will become a significant factor in delivering reliable siding to siding transit times. Studies have shown siding to siding wagon transit time reliability must be in the 90% range to enable RUs to compete with over the road trucking.

4.4 Quality Improvement Functionality

The Quality Improvement Functionality is dependent on the implementation of the TAF-TSI prescribed data exchange and depends on the timeliness, completeness and utility of the information exchange. This has been proven by the effect of implementing data similar to the TAF TSI in other markets. Currently in Europe, the progress of Quality Improvement is difficult to evaluate from the point of view of legacy system applications until such time that systems are in place to measure data quality.

For train punctuality, however, the Europtirails system may rely on the movement records in the central database to provide measurements on Train Performance and because of the IM performance regimes being implemented in many member states, most IMs have their own train punctuality monitoring and management systems in place, but these are not industry systems across multiple IMs (ie for international traffic) and therefore are not included here.

4.5 Path Request Function

Some functionality currently exists for short term path requests within the Europtirails system, but only if there is already a Europtirails train path registered and available in the system. Additionally, Europtirails can be used as a back-office tool for the IM short-term path process and does not provide connectivity with the RUs. It is the responsibility of the IM to report directly to the concerned RU.

The Infrastructure Managers are looking into the possibility of leveraging other systems (i.e. Pathfinder, bi-lateral exchange) to fulfil this requirement. Domestically, this could also be fulfilled with software packages with suitable modules. These software packages include Siemens ROMAN, SMA Viriato and Vossloh TrainPlan.

4.6 Train Movement, Reporting and Disruption Information Function

This functionality can be supported by the Europtirails system as all train event reporting is stored in the database. The Train Running Forecast and Train Running Information as well as Service Disruption messages are also supported on a bi-lateral basis between IMs and IMs and RUs using the UIC 407-1 messaging protocols.

4.7 Train Preparation Function

No functionality currently exists to support this TAF TSI function within an international application, however 407-1 messages exist to exchange this information on a bi-lateral basis between IMs and RUs.

4.8 Main Reference Data

Europtirails provides corridor status information. This corridor status provides information used during the operational phase of a train movement, but it does not cover information used for the train composition as required for the Infrastructure Restriction Notice Database.

The Infrastructure Restriction Notice Database(s) is conceived in the TAF-TSI as being developed, maintained and operated by each Infrastructure Manager. However, synergies and cost-benefit may be found to merit common development. The possibility of using the Europtirails will be explored.

The Keepers' Rolling Stock Register as prescribed in the TAF-TSI does not exist within any international platform, however each keeper currently has extensive Wagon Technical, Administrative and Maintenance data. This issue is addressed in the FRS for Keeper's Rolling Stock Databases in Deliverable 2. It has been suggested that the core TAF-TSI information be incorporated with the Operational Wagon Data in the Wagon and Intermodal Unit Operational Database.

The Rolling Stock database must be developed in harmony with the National Vehicle Register(s) specified in Directive 2001 EC 16.

4.9 Reference Files and Databases

Reference files or coding structures exist for most of the requirements as stated in the TAF. However, the most important centrally stored and administered reference files must be established:

1. LocationIdent, where the existing ENEE database comprises all of the needs as specified in the TAF-TSI requirements
2. CompanyIdent, where the current RICS database comprises all of the needs as specified in the TAF-TSI requirements

Some of the Systems currently support reporting of wagon movement and consignment note data to a database. None of these systems fulfil all of the TAF-TSI requirements as defined in the Wagon and Intermodal Unit Database, but most can be used as starting points on the basis of an RU cluster first step.

4.10 Networking and Communication

Networking and Communication must adhere to the functional requirements of the TSI which specifies an open architecture.

Although the HERMES VPN is widely used, many of its features are also available in more modern, open networks which can exchange and manage inherently secure messages.

There is a general expectation that networking and communication will migrate over time to the internet, a process that most other industries have followed.

TAF TSI Functionality included in Project Functionality RailTrace, CroBit & ISR are driven by Wagon Events not Train Events.

List of TAF TSI Functionality versa Project Functionality

[Y, N, P = Partially, TP = Technically Possible]		**Railtrace**	**Crobit**	**ISR**	**Orfeus**	**Europtirail**	**HERMES**
TSI Chapter	**Functionality**						
4.2.1	**Consignment Note Data**						
4.2.1.1	Customer Consignment Note	Y		P	Y		
4.2.1.2	Wagon orders	Y	P	P	P		
4.2.2	**Path request**						
4.2.2.2	Path request						
4.2.2.3	Path Details						
4.2.2.4	Path Confirmed						
4.2.2.5	Path Details Refused						
4.2.2.6	Path Cancelled						
4.2.2.7	Path Not Available						
4.2.2.8	Receipt Confirmation						
4.2.3	**Train preparation**						
4.2.3.2	Train Composition	Y	TP	Y		Y	Y
4.2.3.3	Train Accepted	TP	TP				
4.2.3.4	Train not Suitable						
4.2.3.5	Train Ready	TP	TP				
4.2.3.6	Train Position	TP	TP				
4.2.3.7	Train at Start	TP	TP				
4.2.4	**Train running Forecast:**						
4.2.4.2	Train running forecast	TP	TP	P		Y	
4.2.4.3	Train running information	Y	TP	P		Y	
4.2.5	**Service disruption**						
4.2.5.2	Train running interrupted	Y	TP	P		Y	
4.2.6	**Train Location**						
4.2.6.2	Enquiry Train Running information	Y	TP	P			
	Response Train Running information	Y	TP	P		Y	

[Y, N, P = Partially, TP = Technically Possible]		Railtrace	Crobit	ISR	Orfeus	Europtirail	HERMES
TSI Chapter	**Functionality**						
4.2.6.3	Enquiry Train delay performance	TP	TP	P			
	Response Train delay performance	TP	TP	P		Y	
4.2.6.4	Enquiry Train identifier	TP	TP	P			
	Response Train identifier	TP	TP	P		Y	
4.2.6.5	Enquiry Train Forecast	TP	TP	P			
	Response Train Forecast	TP	TP	P		Y	
4.2.6.6	Enquiry Trains at reporting location	Y	TP	P			
	Response Trains at reporting location	Y	TP	P		Y	
4.2.7	**Shipment ETI / ETA**						
4.2.7.2	ETI / ETA calculation	Y	Y				
4.2.7.3	Wagon ETI / ETA message	Y	P				
4.2.7.4	Alert message	Y	Y				
4.2.7.5	Enquiry about wagon deviation	Y	P				
	Response wagon deviation	Y	P				
4.2.8	**Wagon movement (incl. WIMO)**						
4.2.8.2	Wagon Release Notice	Y	TP	Y			
4.2.8.3	Wagon Departure Notice	Y	TP	Y			
4.2.8.4	Wagon Yard arrival Notice	Y	TP	Y			
4.2.8.5	Wagon Yard departure Notice	Y	TP	Y			
4.2.8.6	Wagon exception message	Y	Y				
4.2.8.7	Wagon Exception message New ETI / ETA Request	Y	Y				
4.2.8.8	Wagon Arrival notice	Y	Y	Y			
4.2.8.9	Wagon Delivery notice	Y	TP	P			
4.2.9	**Interchange reporting**						
4.2.9.2	Wagon Interchange Notice	Y	TP	Y			
4.2.9.3	Wagon Interchange Notice / Sub	Y	TP				
4.2.9.4	Wagon received At Interchange		TP	Y			
4.2.9.5	Wagon refused At Interchange						

[Y, N, P = Partially, TP = Technically Possible]		**Railtrace**	**Crobit**	**ISR**	**Orfeus**	**Europtirail**	**HERMES**
TSI Chapter	**Functionality**						
4.2.10	**Data Exchange for Quality improvement**	P	P			Y	
4.2.11	**The Main Reference Data**						
4.2.11.2	Infrastructure Restriction Notice Db					Y	
4.2.11.3	Rolling Stock Reference Db	Y	Y				
4.2.11.4	Rolling Stock Operational Data						
4.2.12	**Various Reference files and databases**						
4.2.12.1	Reference Files	Y					
4.2.12.2	Other databases, *Wagon and Intermodal Unit Operational Db,* Wagon Trip PlanDb	Y	Y				
4.2.12.3	Additional Requirements on the Databases	Y	Y				
4.2.13	**Electronic transmission of documents**	Y	Y		Y		
4.2.14	**Networking & Communication**						
4.2.14.2	Network	Y		Y	Y		Y
4.2.14.3	Protocols	Y	Y	Y	Y		Y
4.2.14.4	Security	Y	Y	Y	Y		Y
4.2.14.5	Encryption	Y	TP	Y	Y		Y
4.2.14.6	Central Repository	Y	Y	Y	Y		
4.2.14.7	Common interface	Y	Y	Y	Y		

List of RU / IM involved in the projects

RU / IM involved in Projects	Railtrace	Crobit	ISR	Orfeus	Europtirail	HERMES Connection
B Cargo			Y	Y		Y
CD			Y			Y
CFL			Y	Y		Y
CP		Y				Y
DB Netz					Y	Y
Finnish Railways, VR	Y	Y				Y
Green Cargo			Y	Y		Y
MAV			Y			Y
ÖBB infra					Y	Y
ProRail					Y	Y
Rail Cargo Austria			Y	Y		Y
Railion Denmark			Y	Y		Y
Railion Deutschland			Y	Y		Y
RAILION Netherlands			Y			Y
RENFE			Y			Y
RFF/SNCF					Y	Y
RFI					Y	Y
RZD	Y					
SBB Cargo			Y	Y		Y
SBB Infra					Y	Y
SNCF Fret			Y	Y		Y
SZ			Y			Y
Trenitalia			Y	Y		Y
ZSCS (Slovakia)						Y
ZSS						Y
ZSSK			Y			Y