Interfaces for a traffic operator

Rail transport

Finnish Transport Agency 2017 Helsinki

Change log

Version	Date	Author	Description of the change
2.0.	25 September 2017	JP	Translated into English
2.0.	16 August 2017	JP	Updated the document based on comments made. Version 2.0. will be translated into English, after which the document in English will become the primary document.
1.6.	9 June 2017	JP	Updated the document based on the comments of the RAMO Theme 6 project group.
1.5	7 April 2017	JP	Updated the entire document to correspond to the situation in 2017.
1.1	4 February 2016	JP	Supplemented the document with the require-ments for the information system for border traffic, i.e. added Chapter 5.
1.0	4 December 2015	JP	Version to be published
0.91	6 October 2015	JP	Changes due to the commenting round
0.9	11 June 2015	JP	Comments from the RAMO meeting 4 taken into account
0.5	13 May 2015	JP	Interim version of the document sent to the project group for comments
0.4	7 May 2015	JP	Added technology requirements
0.3	4 May 2015	JP	Changed the structure to reflect the perspective of information system services
0.2	7 April 2015	JP	Production of content

0.1	25 March 2015	JP[1]	Defining the structure of the document

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Table of contents

Tables

Abbreviations and labels

Abbreviation	Explanation
APMS	APMS sends messages that contain pictures of pantographs
ArchiMate	Architecture modelling language and notation
CSV	Comma-Separated Values is a file format for saving simple tabular information in a text format
CTC	Centralised Traffic Control, i.e. remote control means the centralised control of safety devices, in the traffic operating points of a railway section, from a single traffic control point
DAS	Driver Assistance Systems provide driving instructions for the KUPLA application
Enne	The Finnish Transport Agency's prediction and optimisation system for rail traffic (under procurement)
FTP	File Transfer Protocol, a method that uses the TCP protocol to transfer files between two computers
HÄVIÄJÄ	The Finnish Transport Agency's information system for distributing incident information
INFRA-API	As part of the rata.digitraffic.fi service, INFRA-API acts as the search interface for open event data concerning the details of the railway network
JETI	Finnish Transport Agency's advance report system JETI is an information system used for creating, distributing and maintaining advance reports and information on the operability of the track. The system is also used for creating and approving works and advance plans concerning the railway network. JETI is used for maintaining information on changes that affect traffic. Such changes are reported to the drivers of units, and would otherwise have to be given via a traffic control notification.

JETI-API	As part of the rata.digitraffic.fi service, JETI-API is acts as the search interface for open event data concerning information on maintenance work on the railway network
ATP	Automatic train protection system
JSON	JavaScript Object Notation JavaScript Object Notation is a simple, open-standard file format for the exchange of information.
KUPLA	Installed in the driver's data terminal and managed by the Finnish Transport Agency, KUPLA is an application for transmitting timetable information and advance announcements. KUPLA is also a server-level solution and a general name for the drivers' data terminal.
LAKU	LAKU sends messages that contain wagon temperature data
LIIKE	LIIKE is a system for managing the rail network capacity in an environment where there is more than one railway undertaking. The system contains up-to-date information on the capacity allocated for trains, shunting operations and track work, including actuals and forecasts.
LIIKE Reaali	The real-time graphics of the LIIKE system that are used to describe up-to-date information on the capacity allocated to trains, shunting operations and track work in the selected railway line section in graphical format. The system also displays the actual running and running forecasts of units, based on the automatic or manual actuals received by the system.
TC notification	A traffic control notification created and documented in the LOKI application, which forwards the notification to the KUPLA application in one or more units. LOKI shows traffic control whether a notification is being delivered or whether a driver has acknowledged it.
MIKU	A passenger information and announcement system maintained by the Finnish Transport Agency. The system is used for managing the control and automation of displays and PA systems in passenger traffic stations and at stopping points. The system uses the timetable and track information of trains, based on the timetable information included in the LIIKE system. The system receives control information from sources such as traffic control systems, and running information and track information messages. In the case of faults in messaging or safety systems, account must be taken of incompleteness or lack of control information.

POHA	System for monitoring and reporting deviations on the state railway network. The POHA system is also linked to reason entries made by traffic control in association with incidents and fault repairs performed by the maintenance organisation. In the future, the POHA system will be used for maintaining situational awareness of incidents and for bringing together maintenance systems to improve the real-time monitoring of fault repair.
RAHKAT	The RAHKAT registry contains information on the rolling stock on the railways, and is maintained by Trafi (Finnish Transport Safety Agency). The registry contains entries on the owner of the rolling stock unit that has been granted a commissioning licence, the holder of the unit, the department responsible for maintenance, usage restrictions of the rolling stock and references to the commissioning licence of the rolling stock unit.
RAILI	The RAILI network is an integrated railway communications network that consists of the GSM-R network, the VIRVE network and the communications network for traffic controllers (LOV). The communications network for traffic controllers consists of a telephone exchange and terminals attached to it. The terminals are Dicora or URCA terminals. The RAILI network covers the entire Finnish railway network, excluding some separate track sections. In the separate track sections, a reserve connection must be used for communications. Communications in the RAILI network are recorded for the purpose of monitoring and investigation by the authorities.
RAISA	A real-time message exchange system for border stations between Finland and Russia (Imatra, Niirala, Vainikkala and Vartius). The system is created for the automation of the preparation, processing and sending of train traffic information, and provides information-based support for the arrival and dispatching of trains. The system is used in Finland and Russia by the traffic controllers of the border stations, persons with viewing permissions and system administrators.
RAMI	RAMI is a rail transport passenger information system that is currently being procured. The system enables the sending and reception of incident notifications. RAMI will replace the MIKU system in the future.
RAMO	The Finnish Transport Agency's project, 'Operating Models for a Multi-Actor Environment in Local Railway Traffic.'
rata.digitraffic.fi	This website draws together information from different open interfaces on the timetables, locations, compositions and punctuality information of trains in the Finnish railway network. The service is owned by the Finnish

	Transport Agency and the data source is the Agency's Liike family of applications for track capacity and traffic control.
RataDW	A data repository owned by the Finnish Transport Agency, used by reporting systems in particular
RATO	Technical instructions for track maintenance
RFID	RFID tags send messages that contain the identifying information of wagons
RZD	Russian railways
SANTRA	Railway integration service of the Finnish Transport Agency. This messaging service collects data from other information systems and modifies it for transmission to various service interfaces that forward it to other systems and organisations. The messaging service is purchased as a service.
TURI	The Finnish Transport Agency's information system that stores information on accidents and close calls, i.e. safety deviation information.
VALTSU	An information system for monitoring rolling stock.
VEKU	VEKU sends messages that are associated with the recognition of wheel flats in wagons
VIRIATO	Reservation planning system for the railway network. A tool used by traffic planners to match track capacity applications to other railway network reservations and any changes. VIRIATO Receives rail capacity applications from LIIKE. Returns the matched data back to LIIKE.
VIRVE	A radio network for public authorities' communications, based on the TETRA standard. The purpose of using VIRVE in a railway environment is to transmit information on events with a major impact on railway traffic to all stakeholders that need it, based on a single contact.
WSDL	Web Service Description Language, an XML-based language defined by W3C for describing a web technology-based service offered within a network.

XML	An XML schema is a technology standardised by W3L for describing the structure of XML documents. XML schemas can be used to describe a glossary, with a precision that allows computers to understand it. In other words, an XML schema is a standardised way of referring to XML.
XSD	XML Schema Definition is one of the applications of an XML Schema. Its file extension is usually. "xsd". The language itself is sometimes referred to as XSD. XSD can also mean the datatype of the XML schema itself.

1 Introduction

Opening up rail transport to competition will enable more railway operators to operate on the Finnish railway network. The Finnish Transport Agency's project, 'Operating Models for a Multi-Actor Environment in Local Railway Traffic' (RAMO) investigated which technical capabilities an operator must have in order to connect to the Finnish Transport Agency's information systems.

Railway operator refers to Railway Undertakings, railway maintenance companies, Infrastructure Managers operating on the railway network, and museum train operators. Other companies or associations operating on the railway network, whose operations on the railway network are not part of their core activities, are also referred to as railway operators[2]. The information systems administered by the Finnish Transport Agency have basic capabilities for adding new railway operators to the scope of the Agency's services.

This document describes – to the extent necessary for operating on the railway network – the services, functions, information system interfaces, application services and required technology components for a railway operator operating on the railway network. The exchange of information between a traffic operator and the Finnish Transport Agency is associated with various information system and information technology requirements, which are categorised in this document as mandatory and optional.

This document describes current (09/2017) and planned future functionalities at functional and technical level, with references to systems under development. These are expressed in the document at the heading level.

[2] Manual for railway traffic control LIVI/5348/07.02.00/2015

2 Requirements related to information system services

The operator's information system services are, of course, associated with the functional needs arising from train services on the railway network. The information systems, services and interfaces described in this chapter are those that the traffic operator should implement for train services on the railway network. Some of the requirements are mandatory and some optional.

This document draws together all functional, information system, technology and data requirements central to the enterprise architecture. The document is supported by a description of the interface for rail traffic operators and other background materials referred to herein.

- Description of the interface for traffic operators
  - *File: Architechture_Interfaces_for_a_traffic_operator_v2.0*
  - Enterprise architecture expressed with ArchiMate notation
  - Includes a business level, information system level, application level and technology level description of the services and data between the operator, the Finnish Transport Agency and other players.

The following subsections discuss the requirements for a traffic operator interface from the perspective of the information system services described in the ArchiMate model (see Description of interface for traffic operators), the associated functional services, information systems and transmitted messages.

2.1 Timetable

Timetable data is associated with retrieving regular capacity from the LIIKE system (Table 1). The LIIKE-SANTRA messaging interface forwards the *PathDetails* message to the operator's own system.

Table 1 Timetable

Information system service	Timetable
Type of information system service	From one information system to another information system
Related to a business service	Requests for rail capacity for regular services

Message type	XML[3]
Message name	PathDetails, AikataulуPoimintaPyynto.wsdl and AikataulуPoimintaVastaus.wsdl
Source system	LIIKE
Target system	Operator
Information system interface	LIIKE-SANTRA message interface
Mandatory requirement?	No
Reference	aikataulupalvelu.xsd

The timetable service offers information on the day-specific train offering (extending into the near future) for individual trains, new approved ad hoc extra trains, ad hoc cancellations, partial cancellations on a stretch and new timetable plans which are not yet track capacity. LIIKE offers a day-specific train offering by answering an *AikataulуPoimintaPyynto* message[4]. The message is answered by first transferring timetables by FTP and acknowledging the transfer with an *AikataulуPoimintaVastaus*[5] message. Information about an individual train can be retrieved from LIIKE by an *YksittäisAikataulуPyynto* message, to which LIIKE replies with an *YksittäisAikataulуVastaus* message. LIIKE notifies SANTRA of ad hoc changes to capacity and new timetable plans by means of a *KiireellinenKapasiteettiIlmoitus* message. The message may contain an approved or planned timetable, an ad hoc cancellation of the timetable, or an ad hoc partial cancellation of the timetable on a certain stretch.

The timetable service can also be used when assembling a collection of timetable messages. This *junatarjonta.zip* file contains information on approved trains in line with regular and ad hoc capacity.

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[3] Extensible Markup Language

[4] AikataulуPoimintaPyynto.wsdl

[5] AikataulуPoimintaVastaus.wsdl

2.2 Train running messages

Monitoring of train running messages is based on a user service for monitoring the usage of allocated track capacity. Train running information is also transmitted from the remote control system or LIIKE to various target systems, such as MIKU or LIIKE. The messages are in XML format. Table 2).

Table 2 Train running messages

Information system service	**Train running messages**	
Type of information system service	User service	From one information system to another information system
Related to a business service	Monitoring the use of allocated rail capacity	- or using Open event data
Message type	–	XML
Message name	–	RouteSet, TrackSet, TrainRunning
Source system	CTCs	CTCs, LIIKE
Target system	LIIKE Reaali	MIKU, LIIKE
Information system interface	LIIKE Reaali user interface	LIIKE-SANTRA message interface
Mandatory requirement?	No	No
Reference	LIIKE user manual	• RouteSetMessage 2.01.doc • TrackSetMessage20091110.doc • TrainRunningMessage(2 01).doc

The LIIKE Reaali user interface shows the real-time running of trains based on train-specific train running messages obtained from remote control systems (and in the future, GPS data from trains). The operator can monitor the running of its rolling stock via the graphic. Implementing or using this functionality is not mandatory, but it does offer a channel for obtaining real time situational data. Although the described functionality is internal to the Finnish Transport Agency, it is described in this document as additional information for the traffic operator.

The transmitted messages are described in the aforementioned reference documents. After the creation of a train route, CTC sends a *RouteSet* message to SANTRA, which forwards the message to the necessary target systems such as MIKU or LIIKE. The receiving system analyses the contents of the message and can use the data for forwarding information on the traffic situation at that time. This message is also used for track change notifications in the passenger information.

Every time a route has been created and secured, CTC sends a *TrackSet* message to SANTRA, which forwards the message to the necessary target systems, such as MIKU or LIIKE. The content of the message remains the same, regardless of whether the route is as planned or has been modified. Once again, the receiving system determines whether any changes have occurred on tracks.

A *TrainRunning* message contains information on trains and rolling stock units, without a train number, running on the railway network. The aim is to transmit the location and running data of all rolling stock units on the railway network via SANTRA to the LIIKE system. Of course, this can only be achieved on track sections that have the CTC system. In practice, the *TrainRunning* message is created every time a train or rolling stock unit moves within the area monitored by the remote control system, reserving or releasing a track circuit.

2.3 Requests for rail capacity for regular services

It is possible to create a plan for regular traffic and attach it to the electronic rail capacity application in LIIKE, or by means of a Viriato file (Table 3).

Table 3 Requesting regular capacity

Information system service	Requests for rail capacity for regular services
Type of information system service	User service

Related to a business service	Requests for rail capacity for regular services
Message type	Viriato file
Message name	–
Source system	LIIKE or the operator's timetable planning system
Target system	LIIKE
Information system interface	LIIKE capacity interface
Mandatory requirement?	No
Reference	LIIKE user instructions (use of Viriato is optional.)

The operator creates timetable plans in LIIKE in its own separate timetable planning system (the end result is currently a Viriato file), which is entered into the LIIKE system via the LIIKE capacity interface. The Viriato file is converted (VLIIKE) at this point, so that LIIKE understands its contents.

2.4 Requesting and cancelling ad hoc capacity

Requesting and cancelling ad hoc capacity can occur via a user service or a service between information systems (Table 4).

Table 4 Requesting and cancelling ad hoc capacity

Information system service	**Requesting and cancelling ad hoc capacity**	
Type of information system service	From one information system to another information system	User service
Related to a business service	Requesting and cancelling ad hoc capacity	

Message type	XML (ad-hoc)	–
Message name	PathRequest and PathCancelled	–
Source system	Operator	–
Target system	LIIKE	
Information system interface	LIIKE-SANTRA messaging interface	LIIKE capacity interface
Mandatory requirement?	Yes, alternatives exist	
Reference	XML_Megafile_3_EN.pdf	LIIKE user manual

In the case of automatic messaging between systems, requests for and cancellation of ad hoc capacity occur via an XML message (ad-hoc) transmitted from the operator to SANTRA and from there to LIIKE. When requesting capacity, the message is *PathRequest* and when cancelling capacity, the message is *PathCancelled*. *PathRequest* is always the first message associated with the created train and the capacity reserved by it. *PathCancelled* cancels the previous reservation. A more detailed description is included in the XML Megafile document[6].

Within the user service, the operator can use the LIIKE capacity user interface to submit or cancel an ad hoc capacity application. The procedure is described in the LIIKE user guide.

2.5 Rolling stock registration

A prerequisite for operating on the railway network is the registration of rolling stock (Table 5). At present, registration information of rolling stock is delivered to Trafi (Finnish Transport Safety Agency) as PDF files, and Trafi enters the information manually into the RAHKAT system.

[6] XML_Megafile_3_EN.pdf

Table 5 Rolling stock registration

Information system service	Rolling stock registration
Type of information system service	User service
Related to a business service	Registration of rolling stock
Message type	PDF
Message name	–
Source system	–
Target system	RAHKAT
Information system interface	–
Mandatory requirement?	Yes
Reference	In Finnish: • http://www.trafi.fi/rautatiet/rekisterit/kalustorekisteri • http://www.trafi.fi/rautatiet/rekisterit/kalustorekisteri/kaluston_rekisterointi In English: • https://www.saantelyelin.fi/en • https://www.trafi.fi/en

The RAHKAT registry contains information on the rolling stock on the railways. The registry contains entries on the owner of the rolling stock unit that has been granted a commissioning licence, the holder of the unit, the department responsible for maintenance, usage restrictions of the rolling stock and references to the commissioning licence of the rolling stock unit.

2.6 Composition

The composition information system service sends the train composition from the operator via SANTRA to LIIKE as an XML message (Table 6).

Table 6 Composition

Information system service	Composition
Type of information system service	From one information system to another information system
Related to a business service	Sending train composition
Message type	XML
Message name	TrainComposition
Source system	Operator
Target system	LIIKE
Information system interface	LIIKE-SANTRA message interface
Mandatory requirement?	Yes, optional with the user service
Reference	XML_Megafile_3_EN.pdf

The *TrainComposition* message contains detailed composition information about the locomotive and wagons of the train for the timetable-specific capacity reservation made for long distance trains, freight trains and local trains. The functionality of the composition information system described above can be implemented as a user service in LIIKE (see chapter 2.7).

2.7 Entering compositions

Entering compositions fulfils the mandatory requirement for sending the train composition (Table 7). Entering the compositions and the composition information system service have

been separated in the model, since a system interface is not required from smaller operators with less rolling stock. Instead, the information may be entered at the user interface.

Table 7 Entering compositions

Information system service	Entering compositions
Type of information system service	User service
Related to a business service	Sending train composition
Message type	–
Message name	–
Source system	–
Target system	LIIKE
Information system interface	LIIKE capacity interface
Mandatory requirement?	Yes, an alternative exists
Reference	LIIKE user manual

The operator can use the LIIKE capacity interface to enter the train-specific composition information into the LIIKE system. The procedure is described in more detail in the LIIKE user guide. An alternative method of entering the composition is described in Chapter 2.6.

2.8 Forecasts

Forecasts associated with the carriage of a train or rolling stock unit are implemented as a system service (Table 8) that aggregates the data arriving from different source systems into an XML message and sends it to the target systems via the LIIKE SANTRA messaging interface.

Table 8 Forecasts

Information system service	Forecasts
Type of information system service	From one information system to another information system
Related to a business service	Carriage of a train or rolling stock
Message type	XML
Message name	Common Forecast Message
Source system	CTCs[7], MIKU[8], LIIKE
Target system	Operator
Information system interface	LIIKE-SANTRA message interface
Mandatory requirement?	No
Reference	CommonForecastMessage20091110.doc

Common Forecast Message aggregates the data from the various source systems into a single format. The source systems are the remote control systems (CTCs), MIKU and LIIKE. Forecasts are received from the source systems as automatic messages.

A remote control forecast is obtained by automatic calculation: the CTC calculates the difference between the planned timetable and the actuals for the train number. The actuals are obtained from the timestamps of traffic points that the train has passed. The forecast is calculated automatically for the next traffic point within the remote control area. The calculated forecast is sent from CTC to SANTRA.

[7] Centralized traffic control, i.e. the remote control system

[8] Rail transport passenger information system

MIKU can calculate the difference between the actual arrival and departure times and those in the timetable. The operator may also manually enter the delay time of a train at a given station. Based on this manual change in the data, MIKU generates forecasts for the remaining route of the train. MIKU receives a *Common Forecast Message* from either CTC or LIIKE, and generates the resulting arrival time forecasts for the remaining route of the train. MIKU then sends *Common Forecast Message*s to SANTRA, which determines the systems the messages are sent to.

Users of the LIIKE system have the opportunity to increase the delay in arrival or departure time manually per train and per station. In such a case, LIIKE sends a *Common Forecast Message* to SANTRA, which forwards the message to the necessary target systems.

2.9 Driver timetable

Used by the train driver, the driver timetable is a combined route list and timetable printout that contains the advance announcements that apply to the train. The driver timetable is a PDF document that is generated in the JETI system and sent to the operator via SANTRA (Table 9). This PDF document is used as a backup system for the driver timetable and advance announcements offered by the KUPLA application.

Table 9 Driver timetable

Information system service	Driver timetable
Type of information system service	From one information system to another information system
Related to a business service	Carriage of a train or rolling stock
Message type	PDF
Message name	–
Source system	JETI
Target system	Operator
Information system interface	–

Mandatory requirement?	No
Reference	Printout of the timetable

2.10 Driver timetable and announcements

The terminal application for drivers [9] (KUPLA) must be used as the primary option for viewing the information needed to drive the unit. The Railway Network Statement contains detailed descriptions on the requirements for the use of KUPLA in various situations (train traffic, shunting operations, traffic associated with track works, etc.).

The driver's terminal displays driver schedules and announcements as part of the internal functionality of the application. Paper printouts are no longer used as primary driver schedules, but as backups (described in chapter 2.9).

Table 10 Driver timetable and announcements

Information system service	Driver timetable and announcements
Type of information system service	User service
Related to a business service	Carriage of a train or rolling stock
Message type	–
Message name	–
Source system	KUPLA
Target system	Operator

[9] A terminal application for drivers that enables the electronic transfer of information between the railway traffic management system and the driver.

Information system interface	KUPLA user interface
Mandatory requirement?	Yes
Reference	KUPLA user instructions

The KUPLA application works on a terminal device whose procurement and operating costs are fully the responsibility of the railway operators. The KUPLA application requires a Windows tablet (Windows 8.1 or later) equipped with a touchscreen and GPS, and a commercial GPS-based internet connection. This is described in more detail in chapter 3.1.

2.11 Fetching a driver timetable and announcements during system faults

The systems and procedures associated with incidents in the KUPLA system are described in the Finnish Transport Agency's Guideline 'Junaliikenteen ja vaihtotyön turvallisuussäännöt (Jt)' (Safety Rules for Train Traffic and Shunting Work), and in a separate guideline (Table 11).

Table 11 Fetching a driver timetable and announcements during system faults

Information system service	**Fetching a driver timetable and announcements during system faults**
Type of information system service	User service
Related to a business service	Carriage of a train or rolling stock
Message type	PDF
Message name	–
Source system	JETI-vara
Target system	Operator

Information system interface	JETI-vara user interface[10]
Mandatory requirement?	Yes
Reference	JETI-vara user instructions[11]

2.12 KUPLA data

KUPLA data is offered to the DAS application for determining the target speed (keeping to the timetable). DAS calculates an estimate of the travel speed based on the target points and returns the information to the KUPLA application, which presents the data to the driver (Table 12).

Table 12 KUPLA data

Information system service	KUPLA data
Type of information system service	From one information system to another information system
Related to a business service	Carriage of a train or rolling stock
Message type	–
Message name	–
Source system	KUPLA application
Target system	DAS application
Information system interface	–

[10] https://jeti.rata.liikennevirasto.fi/jeti-vara/

[11] JETI_VARAJÄRJESTELMÄ_OHJE_201701.pdf

Mandatory requirement?	No
Reference	DAS integration architecture

The KUPLA application sends the following data to the DAS application: KUPLA's status, train speed and location data.

2.13 DAS driving guidance

DAS (Driver Assistance Systems) at the operator's system, which provides the driving instructions to the KUPLA application. The actual DAS application runs on the driver terminal, alongside the KUPLA application.

Table 13 DAS driving guidance

Information system service	DAS driving guidance
Type of information system service	From one information system to another information system
Related to a business service	Carriage of a train or rolling stock
Message type	–
Message name	–
Source system	DAS application
Target system	KUPLA application
Information system interface	–
Mandatory requirement?	No
Reference	DAS integration architecture

The DAS driving guidance informs the operator's driver of the speed at which the train should be driven in any given location. The KUPLA application offers the DAS application information about the target speed of the train and the gradient profile of the route.

2.14 Track allocation change in an operational situation

A track allocation change announcement can be passed from the operator to the Finnish Transport Agency on a paper document. The Finnish Transport Agency checks the announcement, approves it and sends an acknowledgement as a response to the track change request. The recommended option is to use the information system service that implements the track allocation change in an operational situation (Table 14).

Table 14 Track allocation change

Information system service	Operational track allocation change
Type of information system service	From one information system to another information system
Related to a business service	Operative track change
Message type	XML
Message name	–
Source system	Operator
Target system	LIIKE
Information system interface	LIIKE-SANTRA message interface
Mandatory requirement?	No
Reference	LIIKE user manual

Track changes are sent in XML format. The operator makes the plan in its own system and forwards the track change message to the LIIKE SANTRA messaging interface.

2.15 Track change request

The operator can make a track change request by using the track tool that forms part of the LIIKE application. The change request is forwarded to traffic control.

Table 15 Track change request

Information system service	Track change request
Type of information system service	User service
Related to a business service	Operative track change
Message type	–
Message name	–
Source system	–
Target system	LIIKE
Information system interface	LIIKE track tool user interface
Mandatory requirement?	No
Reference	LIIKE user manual

2.16 Track usage CSV download

The track arrangement of a certain traffic point on a given day, or several track changes at once, can be entered by means of a separate tabular CSV file. The download of a track usage CSV is associated with changes to requests for regular capacity, or the planning of track allocations in a more general manner. The CSV files are stored manually in LIIKE (using the track tool that forms part of the LIIKE application) (Table 16). Currently, the operator creates the track usage CSV files along with the request for regular capacity.

Table 16 Track usage CSV download

Information system service	Track usage CSV download
Type of information system service	User service
Related to a business service	• Requesting and modifying regular capacity • Planning of track allocations
Message type	CSV
Message name	–
Source system	Operator
Target system	LIIKE
Information system interface	LIIKE capacity interface
Mandatory requirement?	Yes
Reference	LIIKE user manual

The operator can make weekday-specific track changes. For example, a given train number can be configured to use certain tracks from Monday to Friday, and on Sundays. This is made into a track CSV file and entered into LIIKE via the LIIKE capacity interface (i.e. track tool). One CSV file contains the passenger traffic information for one traffic point. Traffic control, on the other hand, makes date-specific individual changes.

2.17 Operational schedule (in the future)

In 2017, the Finnish Transport Agency will launch a project for implementing a forecasting and optimisation system for rail traffic (Enne). The Enne system will consist of four logical components: drive time accounting, resource conflict identification, resource conflict resolution and plan publication. ‘Drive time accounting’ refers to the forecasting of the running of an individual train, based on timetables, network topology, geometry and restrictions. A resource conflict arises when two different parties reserve the same block of track at the same time, for instance

because of a timetable deviation. Conflict resolution involves timetable coordination in operations in order to maximise the number of services running on time. The plan publication functionality communicates the new operational schedule created as a result of conflict resolution to the operators, among other recipients (Table 17).

Table 17 Operational schedule

Information system service	Operational schedule
Type of information system service	From one information system to another information system
Related to a business service	Handling of the operational schedule
Message type	does not exist yet
Message name	does not exist yet
Source system	Enne
Target system	Operator
Information system interface	does not exist yet
Mandatory requirement?	No
Reference	does not exist yet

2.18 Safety deviation

The obligation to notify of safety deviations is laid down in the access agreements made with the railway traffic operators: *”A Railway Undertaking shall, by the end of the timetable period 2017, adopt an operating model, whereby the Undertaking shall deliver -- information on accidents and risks of accidents (safety deviation information) to the Finnish Transport Agency’s TURI system. --- If the Railway Undertaking intends to deliver the information as a data transfer between systems and is renovating its source system in such a way that it goes live no later than in the timetable period 2018, the schedule for transferring the data to the TURI system*

can be discussed separately among the participants. In such a case, the Railway Undertaking must contact the Finnish Transport Agency."

Table 18 Safety deviation

Information system service	Safety deviation
Type of information system service	User service
Related to a business service	Notification of a safety deviation
Message type	TXT
Message name	–
Source system	–
Target system	TURI
Information system interface	TURI user interface
Mandatory requirement?	Yes
Reference	The Finnish Railway Network Statement and access agreements

In addition to the model described above, the operators have their own systems for recording safety exceptions, which are not described here. If safety deviation information is not imported via integration, the operator must enter the information directly into TURI during 2017.

2.19 Incident information for passengers (in future)

RAMI, the new railway passenger information system and target system for passenger information produced by a railway operator, is in the procurement phase. The system enables the sending and reception of incident notifications.

Table 19 Incident information for passengers

Information system service	Incident information for passengers
Type of information system service	From one information system to another information system
Related to a business service	Producing passenger information
Message type	–
Message name	–
Source system	Operator
Target system	RAMI
Information system interface	–
Mandatory requirement?	No
Reference	RAMI specification[12]

2.20 Distributing incident information

In addition to POHA, the HÄVIÄJÄ system is also used for distributing incident information (Table 20).

Table 20 Distributing incident information

Information system service	Distributing incident information

[12] RAMI_Specification_version_1_05 (002).docx

Type of information system service	User service
Related to a business service	Infrastructure incident notifications
Message type	TXT
Message name	Häviäjä
Source system	HÄVIÄJÄ
Target system	Operator
Information system interface	HÄVIÄJÄ user interface
Mandatory requirement?	No
Reference	LIIKE user manual

The incident message is typed as text in the HÄVIÄJÄ user interface and transmitted by email or SMS to the necessary parties.

2.21 Viewing and supplementing incident information (in the future)

The user service of the future POHA system is described in the table below (Table 21). Incident information means infrastructure or operations functionality that differs from the normal situation.

Table 21 Viewing and supplementing incident information

Information system service	Viewing and supplementing incident information
Type of information system service	User service
Related to a business service	• Infrastructure incident notifications • Managing incidents

Message type	–
Message name	–
Source system	POHA
Target system	Operator
Information system interface	The operator POHA interface
Mandatory requirement?	Yes
Reference	*Under development*

The project for enhancing incident management is developing new tools and processes for managing traffic-related incidents between parties (railway infrastructure manager, traffic control, infrastructure management companies, operators, etc.). In the target state, the operators are obliged to generate the required information on traffic deviations from their side. As a rule, this occurs directly via the POHA user interface, or alternatively via interfaces.

2.22 Rolling stock fault alarm

VALTSU receives messages on train passes sent by the monitoring equipment within the Finnish railway network. Monitoring devices in the same physical location are bundled up as pass locations, and have been named according to the nearest train station and/or location. Messages from the monitoring devices associated with a pass location are bundled up as passes.

VALTSU enables the user to monitor passes in real time (taking account of delays in message transfer and processing), including individual monitoring devices or even all passes, history data and almost any combination thereof, by means of search criteria.

VALTSU analyses the messages received and creates alarms (Table 22) based on the configured alarm rules. Limits for alarm rules can be configured for all monitoring device types. VALTSU recognises rolling stock units and matches their RFID data to the information in the Finnish Transport Agency's rolling stock registry.

Table 22 Rolling stock fault alarm

Information system service	Rolling stock fault alarm
Type of information system service	User service
Related to a business service	Monitoring of rolling stock
Message type	XML
Message name	TrainObservation
Source system	APMS, LAKU, RFID and VEKU
Target system	VALTSU
Information system interface	–
Mandatory requirement?	No
Reference	VALTSU's message specification[13]

VALTSU aggregates data from several systems:

- APMS sends messages that contain pictures of pantographs
- LAKU sends messages that contain wagon temperature data
- RFID tags send messages that contain the identifying information of wagons
- VEKU sends messages that are associated with the recognition of wheel flats in wagons

VALTSU combines monitoring device data from the aforementioned systems, creates passes and forwards pass data to other parties. For example, every LAKU sensor has an RFID sensor. Every LAKU−RFID pair forms a pass location. Let's assume that a train passes through such a pass location: the train first passes by an RFID sensor and passes a LAKU sensor slightly

[13] ValtsuTrainObservationService.wsdl

later. VALTSU receives the RFID message first, but the pass is still incomplete, since it only contains an identifier from a single sensor. A few seconds later, VALTSU receives a LAKU message. VALTSU sends a *TrainObservationMessage* message that other systems can use.

2.23 Reporting

Reports are assembled in the Finnish Transport Agency's RataDW system. Use of the system is voluntary, and can be agreed upon separately. (Table 23)

Table 23 Reporting

Information system service	Reporting
Type of information system service	User service
Related to a business service	Reporting
Message type	–
Message name	–
Source system	RataDW
Target system	Operator
Information system interface	–
Mandatory requirement?	No
Reference	Can be agreed upon separately

2.24 Timetable search

An open interface service [14] also enables the operator to search for timetable information with this service (Table 24). The use of open event data is based on a JSON message offered by the source system.

Table 24 Timetable search

Information system service	Timetable search
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON[15]
Message name	–
Source system	rata.digitraffic.fi
Target system	Operator
Information system interface	rata.digitraffic.fi
Mandatory requirement?	No
Reference	rata.digitraffic.fi

The train timetable searches only return timetable data, no forecasts or actuals. The operator may search timetable data in different use cases.

- Search all times on a given time interval
    - The search returns timetable data for all trains on the desired day.

[14] rata.digitraffic.fi
[15] JavaScript Object Notation

- Search a single train
  - Returns the timetable data of a single train.
- Route-based search
  - Returns the trains that run via the *departure_station_code* and *arrival_station_code* stations and stop at the stations. The search returns only direct train connections, no connecting trains etc. In other words, the search result will not contain route options offered by the operator in which the passenger has to change the train. By default, the search only returns trains that stop at the station. The parameter *include_nonstopping* can also be used to return those trains that run through the station without stopping.

2.25 History search

This service implements an open interface and [16] enables the operator to search history data (Table 25). The use of open event data is based on a JSON message offered by the source system.

Table 25 History search

Information system service	History search
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON
Message name	–
Source system	rata.digitraffic.fi
Target system	Operator
Information system interface	rata.digitraffic.fi

[16] rata.digitraffic.fi

Mandatory requirement?	No
Reference	rata.digitraffic.fi

History search can be used to search for information on all trains, in which case the search for train timetables and actuals returns the trains that run during the given day. If the search includes the current day, the query also returns the currently running trains and trains that depart later today. Likewise, a search containing yesterday might return night trains that are still running. The service also enables searches based on train number, in which case the search returns the timetable and actuals information of a single train for the desired day.

2.26 Composition for passenger trains

This service implements an open interface[17] and enables the sending of the composition of passenger trains (Table 26). The use of open event data is based on a JSON message offered by the source system.

Table 26 Composition information

Information system service	Composition for passenger trains
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON
Message name	–
Source system	rata.digitraffic.fi
Target system	Operator

[17] rata.digitraffic.fi

Information system interface	rata.digitraffic.fi
Mandatory requirement?	No
Reference	rata.digitraffic.fi

Train composition search returns the composition data of a single train on a given date. Search for train compositions within a time interval returns information on train compositions within the desired day.

2.27 Metadata

The search interface for the metadata of open event data is implemented in the metadata section of the rata.digitraffic.fi (Table 27).

Table 27 Metadata

Information system service	Metadata
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON
Message name	–
Source system	rata.digitraffic.fi
Target system	Operator
Information system interface	rata.digitraffic.fi
Mandatory requirement?	No

Reference	rata.digitraffic.fi

Metadata searches can be performed for traffic points, operators, reason codes and train types. *Liikennepaikkatiedot* returns the traffic point data contained in the service, and *Operaattoritiedot* returns the operator information contained in the service. This data is currently static, and changes rarely occur. *Syyluokat* returns a list of reason categories used in the service. Reason categories are general categories for reason information, and they are published through the AvoinData service. *Syykoodit* returns a list of reason codes used in the service. Every reason category is divided into reason codes, i.e. a reason code is a sub-level of a reason class. Not all reason codes are published. *Junatyypit* returns a list of train types used in the service (for example IC, S, P). Each train type has a parent category, train class (for example local train, long-distance train, freight train).

2.28 Real-time monitoring

The rata.digitraffic.fi service can be used for monitoring the actuals and forecasts of trains in real time. A single train or all running trains can be monitored in real time. In addition, it is possible to monitor trains arriving to and departing from a certain station.

Some actuals are based on manual entries made by traffic control, which is why some actuals entries are entered 0–5 minutes later than the actual occurrence, i.e. into the history. For example, actuals are not obtained automatically at the Tampere and Seinäjoki traffic points, but all their actuals data is based on manual entries (Table 28).

Table 28 Real-time monitoring

Information system service	Real-time monitoring
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON
Message name	–

Source system	rata.digitraffic.fi
Target system	Operator
Information system interface	rata.digitraffic.fi
Mandatory requirement?	No
Reference	rata.digitraffic.fi

The ‘arriving and departing trains of traffic point’ request returns the most recent trains that have departed or arrived at the station, or the trains departing or arriving next. It is possible to monitor either a single train or all trains; in the latter case, the query returns data on all trains that will run in the near future. A running train is defined as a train that has a timetable event (planned, forecast or actuals at a traffic point along the route) that has occurred less than four hours ago compared to the current time.

2.29 INFRA data

As part of the rata.digitraffic.fi service, INFRA-API acts as the search interface for open event data concerning the details of the railway network (Table 29).

Table 29 INFRA data

Information system service	INFRA data
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON
Message name	–
Source system	rata.digitraffic.fi

Target system	Operator
Information system interface	rata.digitraffic.fi
Mandatory requirement?	No
Reference	rata.digitraffic.fi[18]

The INFRA data system service can be used to show a multitude of details concerning the railway network:

- Infrastructure management areas
- Maintenance areas
- Traffic planning areas
- Account track sections
- Fields of activity

- Axle counters
- Balises
- Hot box detectors
- Traffic point border markers
- Signals
- Buffers
- Wheel-flat detectors
- Rail isolations
- Derailers
- RFID readers
- Grouping insulators
- End of electrification
- Stop disks
- Switches
- Pantograph monitoring cameras

- Level crossings
- Tracks
- Intervals between traffic points
- Railway traffic locations
- Kilometre signs

[18] https://rata.digitraffic.fi/infra-api/

- Location signs
- Tracks

2.30 Rail network maintenance

As part of the rata.digitraffic.fi service, JETI-api acts as the search interface for open event data concerning information on maintenance work on the railway network (Table 30).

Table 30 Rail network maintenance

Information system service	Rail network maintenance
Type of information system service	From one information system to another information system
Related to a business service	Using open event data
Message type	JSON
Message name	–
Source system	rata.digitraffic.fi
Target system	Operator
Information system interface	rata.digitraffic.fi
Mandatory requirement?	No
Reference	rata.digitraffic.fi[19]

The ‘rail network maintenance’ system service offers information on annual plans, advance plans and advance announcements in JSON format.

[19] https://rata.digitraffic.fi/jeti-api/

3 Technology requirements

In addition to the requirements relating to information systems, the traffic operator is also subject to requirements concerning the technology interface. This chapter discusses the key technology requirements for train traffic operations.

3.1 Tablet

The locomotive driver has a personal tablet as the driver's terminal. The tablet is used as the primary data communications channel between the driver and the traffic controller (voice communications use terminals that conform to the applicable guidelines, i.e. RAILI or VIRVE phones). Critical data for driving the train is relayed to the tablet (including timetable, advance notification and TC notifications). The driver can view this information prior to and during his/her shift. In the future, the tablet will also be used for sending data, such as 'train ready' notifications, from the driver to traffic control. (Table 31)

Table 31 Tablet

Technology interface	**Tablet**
Finnish Transport Agency's technology component	–
Related to a business service	• Train ready notification • Carriage of a train or rolling stock
Source system	KUPLA application
Target system	KUPLA
Mandatory requirement?	Yes

Reference	KUPLA user instructions[20], technical properties of the tablet[21] and trainready.wsdl[22]

The *TrainReady* message is used for sending the Train ready notification[23].

3.2 VIRVE terminal (in the future)

The future voice communications system on the railways will be based on VIRVE terminals (Table 32).

Table 32 VIRVE terminal

Technology interface	VIRVE terminal
Finnish Transport Agency's technology component	–
Related to a business service	Carriage of a train or rolling stock
Source system	–
Target system	Operator
Mandatory requirement?	Yes
Reference	Waiting for an exceptional permit

[20] http://portal.liikennevirasto.fi/sivu/www/f/ammattiliikenteen_palvelut/rataverkolla_liikennointi/rataka-pasiteetin_hallinta/KUPLA

[21] http://portal.liikennevirasto.fi/portal/page/portal/f/ammattiliikenteen_palve-lut/rataverkolla_liikennointi/ratakapasiteetin_hal-linta/KUPLA/Veturip%E4%E4tevaatimukset%20%96%20Kopio.pdf

[22] TrainReady.wsdl

[23] TrainReady.wsdl

Communications associated with railway safety will be moved away from the national RAILI (GSM-R) radio network from 2017. Communication between trains and traffic control will be transferred to the national VIRVE network used by the authorities. In addition to VIRVE, communications between shunting work managers and traffic control, and persons in charge of track work and traffic control will seek to create suitable conditions for using commercial networks by means of an application that helps users to log in.

3.3 ATC (automatic train control) unit in rolling stock

The ATC unit in rolling stock communicates with a balise that is an ATC track device. Using energy it receives from the locomotive's ATC device, a balise sends a message, pre-programmed or received via a telecommunications cable, to the locomotive's ATC unit (Table 33).

Table 33 ATC unit in rolling stock

Technology interface	ATC (automatic train control) unit in rolling stock
Finnish Transport Agency's technology component	Balise
Related to a business service	Automatic train protection (ATP)
Source system	–
Target system	Operator
Mandatory requirement?	Yes
Reference	Railway Engineering Guidelines[24]

The ATC system monitors the speed of the train. Locomotives running on the State railway network must have an ATC locomotive device that conforms to the specifications of Finnish

[24] http://www2.liikennevirasto.fi/julkaisut/pdf3/lo_2012-09_rato10_jkv_web.pdf

Class B (ATP-VT/RHK) or a combination of an European TCS locomotive device and telecommunications adapter module (ETCS+STM) that offers equivalent functionality.

3.4 RFID tag

All rolling stock in the rail network must have an RFID tag used for monitoring rolling stock (Table 34).

Table 34 RFID tag

Technology interface	**Tablet**
Finnish Transport Agency's technology component	RFID tag
Related to a business service	Monitoring of rolling stock
Source system	–
Target system	VALTSU
Mandatory requirement?	Yes
Reference	Network Statement, TrainObservation.wsdl

Equipping rolling stock with RFID tags that are compatible with the system used by the Finnish Transport Agency enables a quick match between monitoring information and the correct rolling stock unit and its maintenance manager. Compatibility requirements are specified in more detail in the Finnish Transport Agency's publication RATO 21[25].

The technical control centre of the Finnish Transport Agency monitors and maintains a monitoring device network. The control centre uses a system called VALTSU that collects all measurements generated by the monitoring devices, combines them with an available RFID reading

[25] http://www2.liikennevirasto.fi/julkaisut/pdf3/lo_2012-21_rato_21_web.pdf

and forwards this information to the actors that need it. The monitoring device data is forwarded as a *TrainObservation* message[26]. VALTSU sends these messages to the operator. SANTRA has a filter that only forwards messages concerning an operator's own trains. Rolling stock alarms related to the RFID tag are described in more detail in Chapter 2.22.

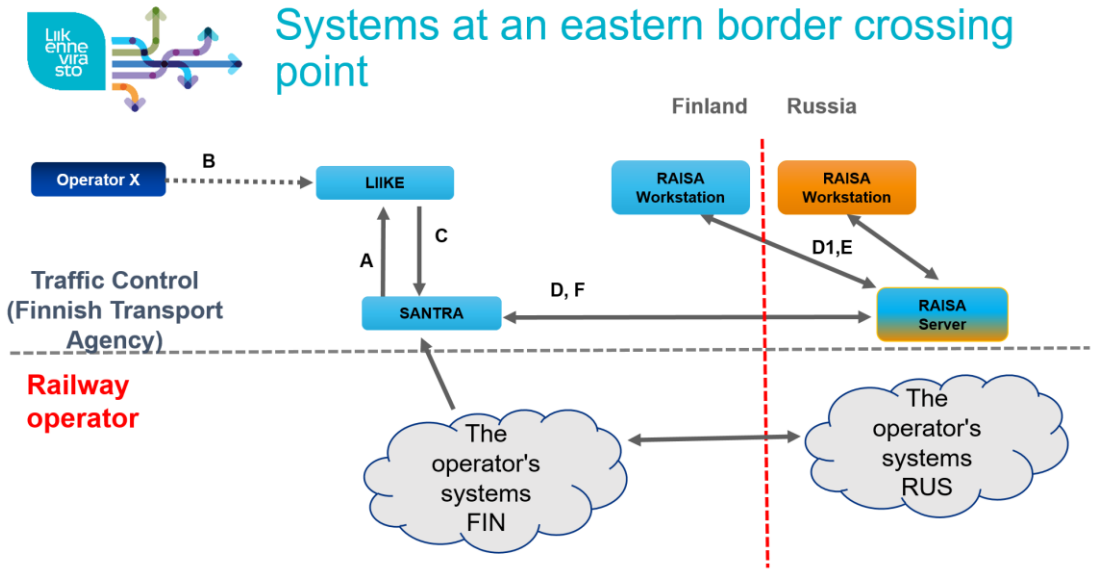
[26] TrainObservation.wsdl

4 Requirements for cross-border traffic

This section describes the functional requirements for an operator's information systems in cross-border traffic.

4.1 Information systems in cross-border traffic

The Finnish rail network is connected to Sweden via Tornio, and to Russia via Vainikkala, Imatrankoski, Niirala and Vartius. Cross-border traffic is associated with various requirements that are presented in this chapter. Traffic travels through the border stations from the Finnish Transport Agency's rail network to the Russian railway network (RZD, i.e. Russian Railways). The figure below shows which information systems of the Finnish Transport Agency and RZD exchange information at eastern border crossing points, and how the operator's systems relate to these.



Picture 1 Systems at an eastern border crossing point

4.2 Data streams and content requirements

Data stream descriptions are listed below and are associated with the previous picture (Picture 1):

A. SANTRA[27] forwards the operator's composition to the LIIKE system.
B. The operator's data is sent to the LIIKE system via SANTRA.
C. LIIKE sends the operator's composition information to SANTRA (if they have been entered manually into the LIIKE system)
D. SANTRA forwards the operator's composition to the RAISA system
E. Composition is sent to the RAISA[28] server and displayed in the RAISA user interface.
F. RAISA sends the composition (running information, timetable) of a freight train coming from Russia as a message via SANTRA to the LIIKE system.

Figure 1 also shows RZD's systems that are not listed in the data flow description above. The operators will agree among each other on any necessary information system solutions and interfaces that are beyond the scope of information exchange that is the responsibility of the Infrastructure Manager.

[27] SANTRA is the Finnish Transport Agency's message forwarding service

[28] RAISA is the message exchange system for border-crossing stations

5 Appendix: target state projects and systems

This document mainly describes the current status, but for the sake of clarity and to ensure continuity, it also includes entities that are associated with the target state in the future, but have not yet been implemented. The table below lists future systems and projects (Table 35).

Table 35 Future systems and projects

Project/system	Reference to a chapter in the document/comment
Enne	Operational schedule
RAMI	Incident information for passengers
POHA	Viewing and supplementing incident information
VIRVE terminal	Waiting for an exceptional permit to transfer from RAILI to VIRVE.