Technical Framework

TAF/TAP TSI

Example
Path Application and Path Allocation

Exemplary description
of
specification of integration profiles
according to the TAF/TAP TSI

Version 00.01

Verband der Bahnindustrie ó Fachhochschule Technikum Wien ó Fachhochschule St. Pölten

Document Information	
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Description	
Last Changes	
sClassification	WHITE – public

Version History			
Version	**Date**	**Changes from**	**Comment**
0.01	01/2023	Initial Version	Exemplary Specification

Acknowledgements
This paper is a result of the project IRS Cargo funded by the Austrian Research Promotion Agency (FFG) under project number 891459.
The research leading to these results has received funding from the Mobility of the Future program. Mobility of the Future is a research, technology and innovation funding program of the Republic of Austria, Ministry of Climate Action. The Austrian Research Promotion Agency (FFG) has been authorized for the program management.

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About the Technical Framework

The **Technical Framework** implements the communication that the Telematics Applications for Passengers and Freight describes, as defined by the TAP/TAF TSI.

The document shows how the IHE methodology is applied in the field of freight transport. Therefore, the content of the document 'COMMISSION IMPLEMENTING REGULATION (EU) 2021/541' of 26 March 2021 amending Regulation (EU) No 1305/2014 (https://eur-lex.europa.eu/legal-content/DE/TXT/HTML/?uri=CELEX:32021R0541&from=DE) has been reproduced in order to describe the process of path request and path allocation for the EEA (European Economic Area) as an example.

The Technical Framework consists of introductory information about the business domain and application scenarios for which it is intended.
The corresponding integration profiles between well-defined actors are defined in Volume 1.
Volume 2 then specifies transactions between the actors with reference to basic standards. These specifications enable implementers to create software that provides semantic interoperability for the use cases covered in the Technical Framework.

Technical frameworks enable the creation of software. They also enable the development of test concepts, test plans and test tools for interoperability testing of developed software. Interoperability testing contributes significantly to real-world interoperability, both by validating the specifications and the software itself.

The document shows an example of how the IHE methodology is applied in the field of freight transport.

Volume 1: Informative Description of the Domain

1 Domain Overview

The railway system covered by Directive (EU) 2016/797, which includes the subsystem "Telematics applications for Freight users", is an integrated system whose uniformity needs to be verified. This uniformity shall be reviewed in particular with regard to the specifications of the subsystem, its interfaces with the system in which it is integrated, as well as the rules applicable to operation and maintenance.

Functional and technical specifications of the subsystem

In view of the essential requirements, the functional and technical specifications of the subsystem refer to the following parameters:

- Consignment Note data
- Path request and path allocation
- Train preparation
- Train Running Information and Train Running Forecast
- Service Disruption Information
- Wagon/Intermodal unit ETI/ETA
- Wagon movement
- Data Exchange for Quality Improvement
- The Main Reference Data
- Various Reference Files and Databases
- Networking & Communication

The task of the Technical Framework is the description of the functional components in Use Cases and the necessary interface is specified.

For this exemplary description of the Technical Framework TAP/TAF TSI one use Case is specified to show the added value of the IRS methodology to the existing documentation.

2 Use Cases

The functional and technical specifications for the interfaces for data exchange in passenger and freight processes, as described in the TAP/TAF TSI, are brought into a functional context and timing of messages in the use case descriptions.

2.1 Path request and path allocation

The RU/Applicant acting in the role of the Responsible Applicant 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. These requirements are valid for all Short Notice Path Requests and related messages. No minimum timeframe is specified for it at European level. The network statement may specify minimum timeframes.

Due to exceptions during the train running or due to transport demands on a short time basis, a railway undertaking or an Applicant must have the possibility to get an ad hoc path on the network. However, the process sequence of both short-term and long-term path applications is identical.

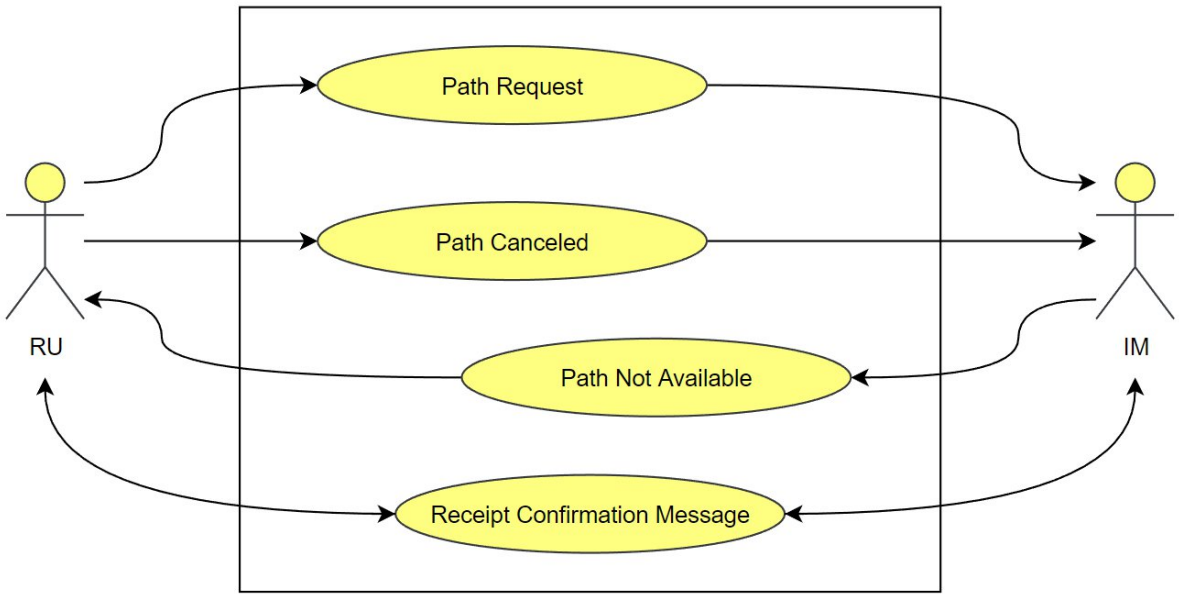

Figure1: Use case diagram of transactions of a path request

The aim of this process is for the RU to receive a path from the IM. As part of this transaction, the RU sends a **Path Request Message** to the IM. In response, the IM sends a possible available path in the form of a **Path Details Message** with the corresponding detailed information (e.g. the country code according to ISO 3166-1). If the proposed path accommodates the conditions of the RU, it is confirmed in the form of **a Path Confirmed Message**. Otherwise, the allocated path from the RU can be rejected by a **Path Details Refused Message**. At this point, the first transaction is completed.

If the path from the RU is no longer needed at a later point in time, it can be cancelled again by a **Path Canceled Message**.

If the path is no longer available after the assignment has been made, the IM ***must*** inform the RU about it by means of **Path Not Available Message**. The **Path Not Available Message** means that the path or part of it cannot be used and no longer exists. One reason for this message may, for example, be the interruption on the path. If an alternate path is available, the IM must send an alternate proposal together with this message, or as soon as this path is known, without the need for a further request from the RU. This is done with the **Path Details Message** with reference to the **Path Not Available Message.** If an alternate proposal is not possible, the IM must inform the RU immediately.

The **Receipt Confirmation Message** is sent by the recipient of a message to the original sender of the message if the desired response is not available within 5 minutes. The ***identifiers*** in this message must match those from the sender. (The same applies to type-of-request and type-of-information.)

3 Integration Profiles

This section describes the integration profiles of the use cases defined in TAP/TAF TSI. For secure communication, it would be necessary to include other actors.

Table 1: Dependencies among Integration Profiles (bundling with external IPs)

Integration	Depends on	Dependency Type	Purpose

Profiles	Integration Profiles		
PRPA		RU, IM must each be grouped with a Secure Node actuator	Process of applying for a path

3.1 Path Application and Path Allocation (PRPA)

The path is defined by the requested, accepted, and actual data assigned to it and the train characteristics for each section of the path.

The following description reflects the information, which must be available to the infrastructure manager (IM) and/or the allocation body (AB). This information must be updated whenever a change occurs. The information of the annual path therefore needs to allow the retrieval of the data for short-term amendments. In particular, the Customer, in case he is impacted, must be informed by LRU. (Lead Railway Undertaking).

3.1.1 Actors & Transactions

Here, the actors and transactions are presented in an Actors Transactions chart in which the

dependencies between the actors and the links to the transactions are visible. Furthermore, all actors and transactions are listed in a table.

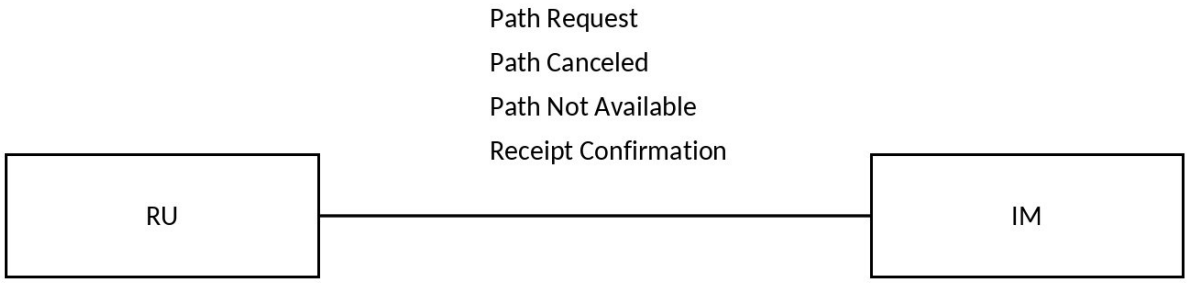

Figure 2: Actors-Transactions Chart for the path request and path allocation

Table 2: PRPA Integration Profile — Actors and Transactions

Actors	Transaction	Optionality	Section
RU, IM	Path Request	R	
RU	Path Cancelled	R	
IM	Path Not Available	R	
RU, IM	Receipt Confirmation	R	

3.1.1.1 Actor Options

Railway undertakings (RU) are companies such as RailCargo Austria. Infrastructure managers (IMs) are companies such as ÖBB INFRA, which plan, build, maintain and deploy rail infrastructure for RUs. In the context of this document, an RU and IM are software modules that are integrated into different software solutions. The task of these modules is to prepare relevant information in a structured and semantical manner as well as to ensure interoperable data exchange between stakeholders.

Table 3: PRPA Integration Profiles — Actors

Actors	Transactions	Description	Optionality
RU, IM	Path Request	Initial transaction for requesting a path by the RU, providing details on an available path by the IM, acceptance, or rejection of the path by the RU.	R
RU	Path Cancelled	Cancellation of the already accepted path by the RU	R
IM	Path Not Available	Cancellation of the already accepted path by the IB	R
RU, IM	Receipt Confirmation	This message is sent by the recipient of a message to the original sender of the message if the desired response is not available within 5 minutes.	R

3.1.2 Information Flow

The following section shows examples of different processes with the existing transactions.

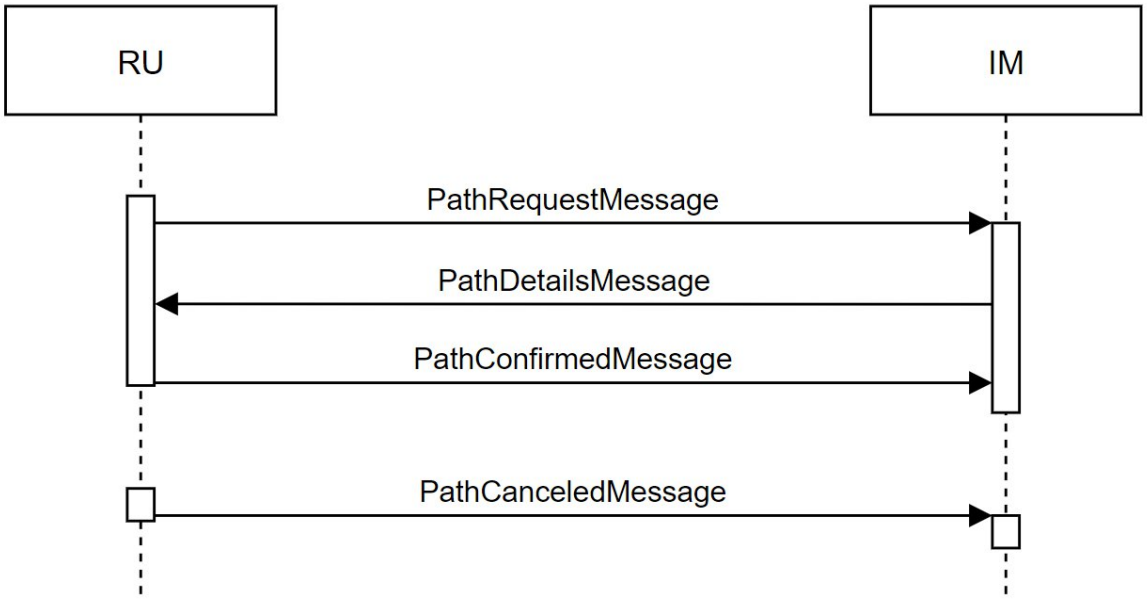

Figure 3: Sequence diagram of a path request with allocation and cancellation

3.1.3 Communication Requirements

(if there is none in the TSI: then mark as “not relevant”, do not delete!)

3.1.4 Security Considerations

To ensure a high level of IT security, the following three principles, the so-called CIA triad, are applied.

Figure 4: Principles of IT Security (CIA Triade)

The principle of confidentiality is the protection of data from unauthorised access. This means that only authorised actors can access certain data and services. It also includes aspects of data protection while processing personal data, to ensure the privacy of individuals. Integrity is the principle of immutability and consistency of data. At the system level, it ensures the functionality and protection against manipulation. The third principle stands for the availability of services and data, as well as the reliability and responsiveness of the IT systems. Other principles of the CIA triad are Authenticity and Accountability. Authenticity in each context means that a data source is verifiably genuine and trustworthy, while accountability means that data cannot be denied; it is legally valid.

Volume 2: Normative Specification of the Transactions

4 Transactions

Here is the detailed description of the individual transactions of the integration profiles.

4.1 Transaction: Path Request

The RU/Applicant assuming the role of Responsible Applicant shall send the 'Path Request message' to the infrastructure manager (IM)/Allocation Body (AB) to request a path. The "PathRequest" transaction (with confirmed path) consists of the following three messages:

- Path Request Message
- Path Details Message
- Path Confirmed Message

The definition of the mandatory structure of the 'Path Request message' and the elements to be followed are described in the document 'TAF TSI – Annex D.2: Appendix F – TAF TSI Data and Message Model' listed in Appendix I.

4.1.1 Scope

The "PathRequest" transaction is part of the process by which an RU can request a path from an IM. During this, the RU sends a message to the IM. In response, the IM sends a possible available path with the details "path details message" (such as the country code according to ISO 3166-1). If the allocated path corresponds to the conditions of the RU, it is confirmed with a "Path Confirmed Message".

4.1.2 Actor Roles

Table2: Actor Roles for Path Request

Actor	Description	Meta-actor
RU	Railway undertakings, such as RailCargo Austria, whose freight transports use the infrastructure	
IM	Infrastructure managers, such as ÖBB INFRA, which provide the infrastructure for freight transport	

4.1.3 Referenced Standards

All detailed requirements are provided by *the European Union Agency for Railways* within the *ERA-TD-105: TAF TSI — ANNEX D.2: Appendix F — TAF TSI DATA AND MESSAGE MODEL defined* in the form of XML schemas:

https://www.era.europa.eu/sites/default/files/filesystem/taf/technical_documents/baseline_2.3.0/taf_cat_complete_0.xsd

4.1.4 Interaction Diagrams

The following interaction diagrams describe the case of a path request to the IM, as well as the procedure if it is not answered within 5 minutes. In this use case, the RU will not receive

a Path Details Message within 5 minutes after the Path Request Message, after which the IM responds with a Receipt Confirmation Message.

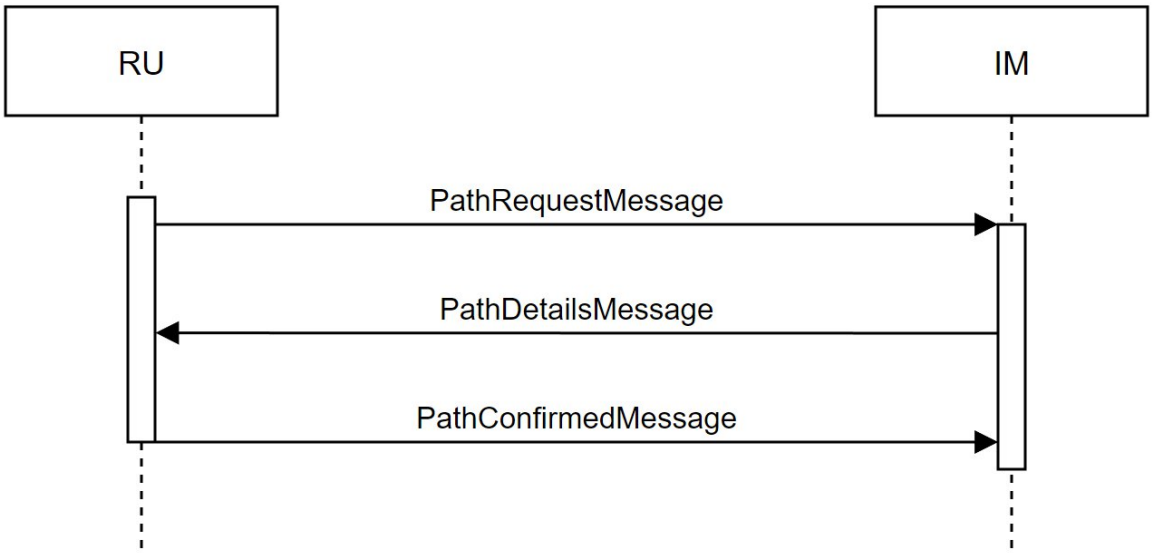

Figure 5: Sequence diagram of an ideal path request

Figure 5 shows the ideal flow of a path request and path allocation in the form of a sequence diagram. There is less than 5 minutes between each transaction.

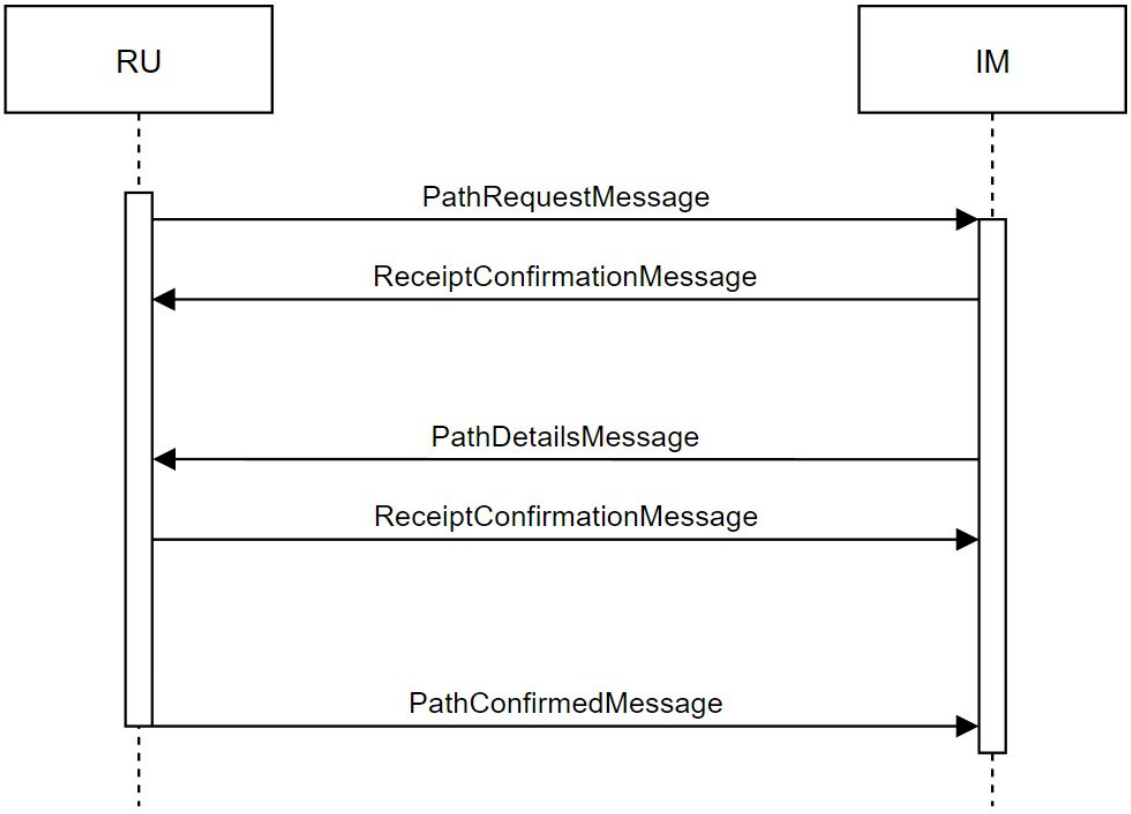

Figure 6: Sequence diagram of a path request with delays

The message ReceiptConformationMessage is sent by the recipient of a message to the original sender of the message if the desired response is not available within 5 minutes. Figure 6 shows the sequence diagram of a path request, path allocation and path confirmation. Between the individual transactions there are delays of more than 5 minutes in this example, after which Receipt Confirmation Messages are sent.

4.1.4.1 PathRequestMessage

This message serves to request a train path. The message is sent from the RU to each IM involved.

ERA_Technical_Document_TAF_D_2_Appendix_F_v2_1 Version 2.1 Page 263/647

4.1.4.1.1 Trigger Events

RU is applying for a path for a freight transport.

4.1.4.1.2 Message Semantics

For the message Path Request Message, the following XML schema for mapping the message semantics applies:

```
&lt;xs:element name=“PathRequestMessage”>
&lt;xs:annotation>
Xs:documentation>This message serves to request a train path. The message is sent from the RU to each IM involved.</xs:documentation>
&/xs:annotation>
&lt;xs:complexType>
&lt;xs:sequence>
&lt;xs:element ref=“MessageHeader”/>
&lt;xs:element ref=“AdministrativeContactInformation”/>
&lt;xs:element ref=“Identifiers” minOccurs=“0”/>
&lt;xs:element ref=“MessageStatus”/>
&lt;xs:element ref=“TypeOfRUHarmonisation” minOccurs=“0”/>
&lt;xs:element ref=“TypeOfIMHarmonisation” minOccurs=“0”/>
&lt;xs:element ref=“CoordinatingIM” minOccurs=“0”>
&lt;xs:annotation>
&lt;xs:documentation>Proposal from the RU, IM’s will decide who will take the role.</xs:documentation>
&/xs:annotation>
&/xs:element>
&lt;xs:element ref=“LeadRU” minOccurs=“0”/>
&lt;xs:element ref=“TypeOfRequest”>
&lt;xs:annotation>
Xs:documentation> 1 Path study 2 Path request 3 Path Modification &lt;/xs:documentation>
&/xs:annotation>
&/xs:element>
&lt;xs:element ref=“TypeOfInformation”/>
&lt;xs:element ref=“TrainInformation”>
&lt;xs:annotation>
Information provided by the RUs as an overview for the whole train journey from origin to destination</xs:documentation>
&/xs:annotation>
&/xs:element>
&lt;xs:element ref=“PathInformation”>
&lt;xs:annotation>
Xs:documentation>Information provided by the RU for a requested journey section or by the IM for an offered/booked of the Path section</xs:documentation>
&/xs:annotation>
&/xs:element>
&lt;xs:element ref=“NetworkSpecificParameter” minOccurs=“0” maxOccurs=“unbounded”>
&lt;xs:annotation>
&lt;xs:documentation>A structured section for specific mandatory attributes for that network. This has to be checked by the applications that network section is contained in journy location only if journy location belongs to PathInformation element &/xs:documentation>
&/xs:annotation>
&/xs:element>
&lt;xs:element ref=“FreeTextField” minOccurs=“0” maxOccurs=“unbounded”/>
&/xs:sequence>
&/xs:complexType>
&/xs:element>
```

4.1.4.1.3 Anticipated Actions

When receiving the message, the IM prepares all necessary information describing an available path in detail. This information is returned to the RU through the transaction.

4.1.4.2 Country specific parts for the Message

4.1.4.2.1 Austria

4.1.4.3 PathDetailsMessage

This message is used by the IM to the RU confirmaing details of the path in response to an RU request.

Namespace: http://www.era.europa.eu/schemes/TAFTSI/2.3

4.1.4.3.1 Trigger Events

Add text

4.1.4.3.2 Message Semantics

Add text

4.1.4.3.3 Anticipated Actions

Add text Information is returned to the RU by means of the transaction.

4.1.4.4 PathConfirmedMessage

This message is used by the RU to confirm the proposed path ofthe IM (PathDetailsMessage) in response to an RUs Original Request

Namespace: http://www.era.europa.eu/schemes/TAFTSI/2.3

4.1.4.4.1 Trigger Events

Add text

4.1.4.4.2 Message Semantics

Add text

4.1.4.4.3 Anticipated Actions

Add text Information is returned to the RU by means of the transaction.

4.1.5 **Security Considerations**

Both when sending and receiving the “path request” transaction, the respective actor i.e. RU/IM must send an audit message to an Audit-Record Repository in accordance with the ATNA scheme. The following information must be included:

- ID of the RU
- ID of the IM
- ID of the user behind the request (train request) or the software that submits the application
- Timestamp

The requirements for secure communication in accordance with the GDPR must be complied with. This includes encryption, mutual identification and authentication based on current standards i.e. TLS 1.2.

4.2 Transaction: Path Not Available (Path Not Available)

4.2.1 Scope

4.2.2 Actor Roles

4.2.3 Referenced Standards

4.2.4 Interaction Diagrams

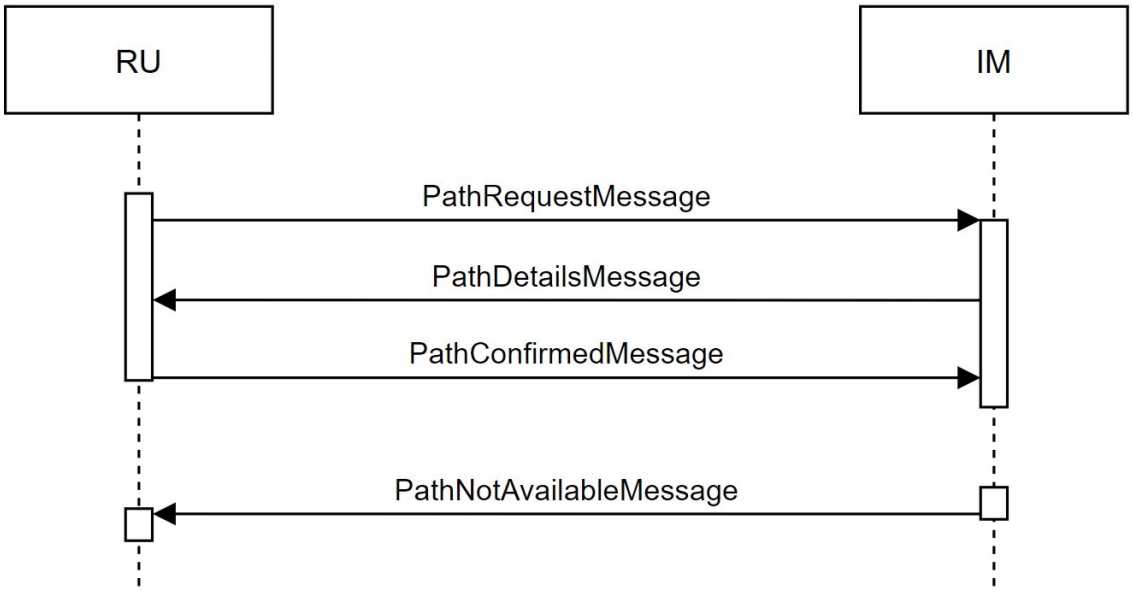

Figure 8: Sequence diagram of a path request with allocation and “non-availability” message

If an already confirmed path can no longer be used, e.g., due to an interruption on the path, the IM sends a message to the RU. This message can be sent at any time between the moment of the path being contracted and the departure of the train.

4.2.5 Security Considerations

4.3 Transaction: Path Canceled (Path Canceled)

4.3.1 Scope

4.3.2 Actor Roles

4.3.3 Referenced Standards

4.3.4 Interaction Diagrams

If a path allocation does not comply with the requested conditions of an RU, this allocation may be rejected with a corresponding transaction (see Figure 9).

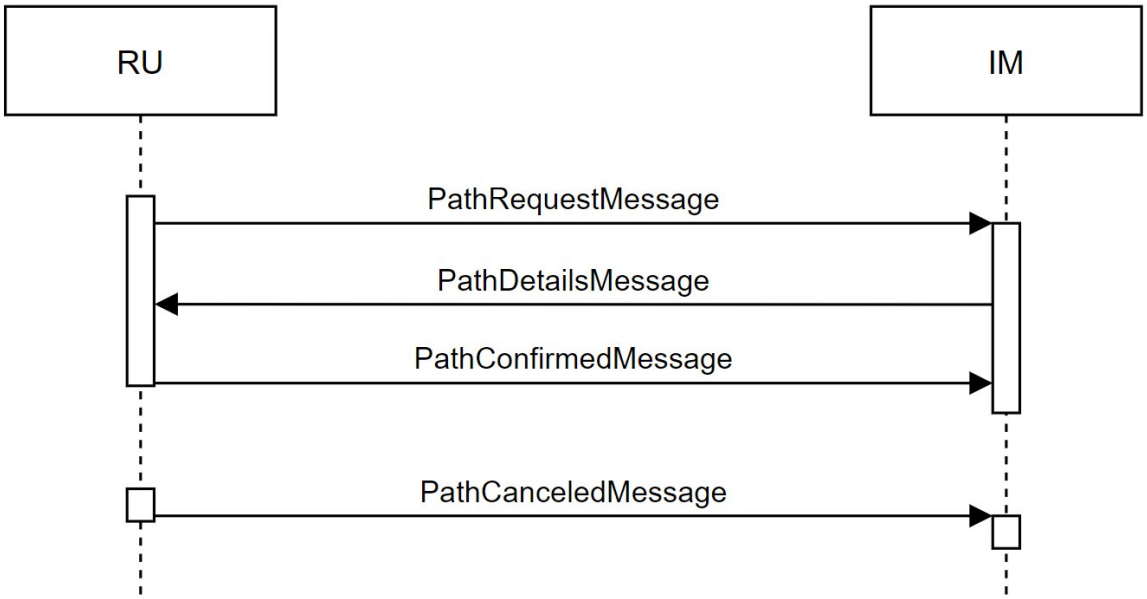

Figure 9: Sequence diagram of a path request with allocation and cancellation

After confirmation of a path by the RU, the path can be cancelled again with a "PathCancelledMessage" transaction if necessary (see Figure 9).

4.3.5 Security Considerations

Definitions

Actor
is a functional software component of a system that executes Transactions with other Actors as defined in an Integration Profile.

Business Case
is the economic viable application of an idea or technology.

Business Function
is a feature required to run a Business Case.

Conformance Testing
is a standalone process to ensure that the implementation conforms to specified standards and profiles, i.e. the implementations outputs and response are checked against rules and patterns.

Integration Profile
is the specification required to realise a part of a Business Function (or combination thereof) in an interoperable fashion (normalised).

Interoperability Testing
is a process to check whether the system interacts effectively with foreign systems, i.e. when different vendors meet to test their interfaces against each other (e.g. Connectathon).

Interoperability Use Case
is a part of a Business Function that relies on data exchange between different actors according to an Integration Profile (i.e. where interoperability is required).

Meta-Actor
joins Actors in order to fulfil all the functionalities required for a Business Function (grouping).

Transaction
is the specification of a set of messages (1..n) exchanged between a pair of Actors that realise the Use Case specific information exchange (in one or both directions, in a strict or loose order) as specified by an Integration Profile.

Operational Use Case
is a part of a Business Function that describes an activity not involving any data exchange between actors. This kind of use cases are mentioned in the IRS Technical Framework, but not considered in Integration Profiles because per se they do not raise interoperability problems.

Abbreviations

Each abbreviation used in the technical framework are explained in this section.

IEC	International Electrotechnical Commission
IHE	Integrating the Healthcare Enterprise
OMG	Open Management Group
SCD	Substation Configuration Description
UML	Unified Modelling Language

References

All references used in the Technical Framework are mentioned here.

Acknowledgement and Disclaimer

Acknowledgements

This paper is a result of the work in several projects:

- IES – Integrating the energy system (IES-Austria, FFG Number 853693)
- IRS – Integrating the Railway System (IRS-Cargo, FFG Number 891459)
- SONDER, ERA-Net SES 2018 joint call RegSys

The Project **IES- Austria** was funded by the Austrian Climate and Energy Fund, administrated by the Austrian Research Promotion Agency (FFG) under contract number 853693. The project was part of the 'e!MISSION' program's 2nd call of the Climate & Energy Fund within the program 'Energy Research 2015'.

The project **IRS-Cargo** was funded by the Austrian Research Promotion Agency (FFG) under project number 891459. The research leading to these results has received funding from the Mobility of the Future programme.

The Project **SONDER** has been funded by partners of the ERA-Net SES 2018 joint call RegSys (www.eranet-smartenergysystems.eu) - a network of 30 national and regional RTD funding agencies of 23 European countries. As such, this project has received funding from the European Union's Horizon 2020 research and innovation programe under grant agreement no. 775970."
Bestenfalls mit Logo an geeigneter Stelle https://www.eranet-smartenergysystems.eu/global/images/cms/Logos/SmartEnergySystems_2018_rgb.png

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