

Moving Europe towards a sustainable and
safe railway system without frontiers.

Figures and sequence diagrams of the telematics TSI messages

Telematics TSI - Technical document - TD100

Version 4.0

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A. Document management

A.1 Document properties

- *File name: ERA_TD_100.docx*
- *Subject and document type: Telematics TSI - Technical Document - 100*
- *Author: European Railway Agency*
- *Version: 4.0*

A.2 Change management

Updates to this technical document shall be subject to Change Control Management procedure managed by the Agency pursuant:

- *the applicable requirements in the reference TSI*
- *Art. 23(2) of the Agency Regulation*

If necessary, working groups are created in line with Art. 5 of the Agency Regulation.

A.3 Configuration management

A new version of the document will be created if new changes are considered following the Change Control Management Process led by ERA.

More specifically:

- *if there is a change in the requirements which influences the implementation*
- *if information is added to or deleted from the technical document*
- *adding test cases to the field checking in messages or databases.*

Modifications will have to be highlighted, so they can be easily identified.

Disclaimer:

Specific legal references to technical documents and legal acts shall be revised after the enter into force of the Telematics TSI. In some sections this text can be highlighted.

A.4 Availability

The version in force of this document is available on Agency's Gitlab repository. Any printed copy is uncontrolled.

- **Intended Audience**

This document is one of the references to be used by designers and engineers responsible for the proper implementation of the Telematics TSI requirements regarding message exchange according to chapter 4.2 of the technical specification for interoperability relating to the telematics applications for freight subsystem of the rail system in the European Union.

A.5 Application and actors in the scope

Date of entry into force of reference TSI.

This document applies to all the actors in the scope of the reference TSI.

- **Important note**

The present document belongs to the set of Technical Documents listed in Appendix I ‘List of technical documents’ of the Commission Regulation (EU) No 2021/541 of 26 March 2021.

A.6 Document history

Table 1 - Document history

<i>Version</i>	<i>Date</i>	<i>Comments</i>
1.0	04.02.2011	Initial version
2.1	10.02.2015	Revision of Sequence Diagram and deletion of Train Position message as it was requested by ERA TAF TSI CCM Board on 10.02.2015, Published 18.03.2018
3.0	26.05.2021	Deletion of wagon interchange messages
4.0	12.12.2023	TBD

B. Acronyms, definitions and external references

B.1 Acronyms

Table 2 - Acronyms

<i>Abbreviation</i>	<i>Description</i>
IM	Infrastructure Manager
PRM	Person with reduced mobility
PRR	Passenger Rights Regulation
RU	Railway Undertaking
SM	Station Manager
TV	Ticket vendor
UML	Unified Modeling Language
XML	Extensible Markup Language
XSD	XML Schema Definition

B.2 Definitions

Terms contained in this document are defined in the ERA Ontology.

B.3 External references

The referenced documents listed in Table 2 are indispensable for the application of this document:

- *For dated references, only the edition cited applies;*
- *For undated references, if any, the latest edition of the referenced document (including any amendments) applies.*

Table 2 Reference documents

<i>Reference</i>
0. Directive 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union 11.05.2016
1. Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area (OJ L 343, 14.12.2012, p. 32). 21.11.2012
2. Directive (EU) 2016/798 of the European Parliament and of the Council of 29 11 April May 2004 2016 on railway safety on the Community's railways and amending Council Directive 95/18/EC on the licensing of railway undertakings and Directive 2001/14/EC on the allocation of railway infrastructure capacity and the levying of charges for the use of railway infrastructure and safety certification (Railway Safety Directive) (OJ L 164, 30.4.2004, p. 44). 28.11.2009
3. Telematics TSI - Applicable version

1 Introduction

1.1 Purpose

This document is the collection of the figures and sequence diagrams to which the Telematics TSI refer. It gives support for the right understanding of the processes and functionality prescribed in the Telematics TSI.

This is particularly important, as the information exchange must be clearly governed identifying:

- *involved actors – i.e. by whom, to whom;*
- *timing and steps of the process;*
- *type of information to transmitted;*
- *in which format / content.*

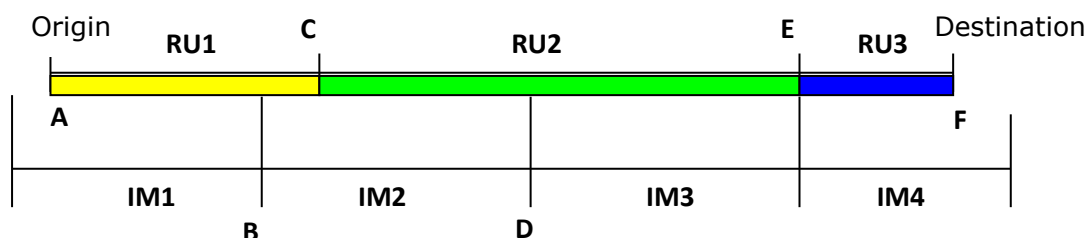
0.1 Reference documents

See section B.3

Freight services and RU-IM communication

2 Figures

2.1 Example for train Path request and RU / IM Communication



With B, D and E as handover points between IMs and C and E as interchange points between RUs the situation is as follows:

- › RU1 has to request a train path A-B from IM1 and B-C from IM2;
- › RU2 has to request a train path C-D from IM2 and D-E from IM3;
- › RU3 has to request a train path E-F from IM4.

The communication during the train running between RU and IM must always be based on train and path number, whereby the IM communicates with the RU, who has booked the train path on his infrastructure. This means for the example above:

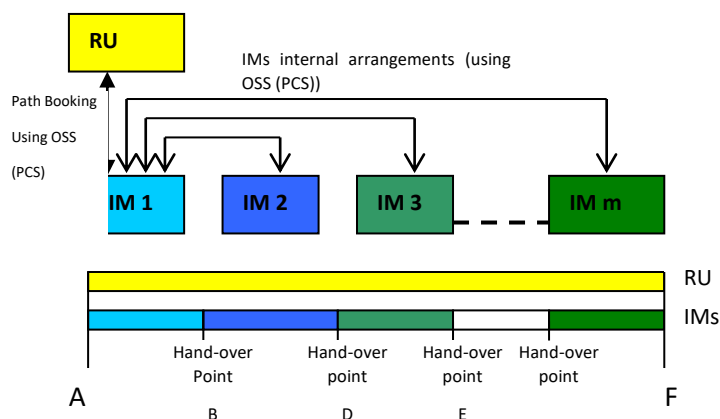
- › For the journey section A-B, IM1 communicates with RU1;
- › For the journey section B-C, IM2 communicates with RU1;
- › For the journey section C-D, IM2 communicates with RU2;
- › For the journey section D-E, IM3 communicates with RU2;
- › For the journey section E-F, IM4 communicates with RU3.

If an RU provides the complete journey A – F (Open Access by RU, no other RUs are involved), then each IM involved communicates directly with this RU only. This “open access” by the RU can be realised by booking the train path via “One Stop Shop” or in sections with each IM directly. The TSI takes account both cases.

2.2 Scenarios for path booking

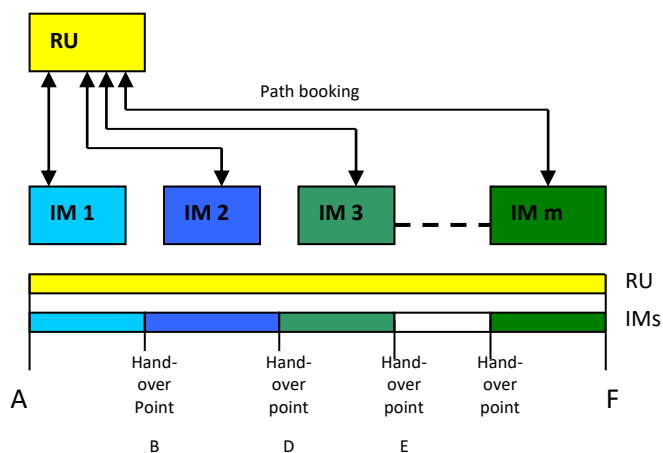
Scenario A: The RU contacts all involved IMs directly or via the OSS (for example PCS) to organise the paths for the complete journey. In this case the RU has also to operate the train on the complete journey according to [Article 38 of the Directive 2012/34/EU \[3\]](#).

a) Path booking via OSS by the RU for Transport Journey from A to F:



One RU is booking via OSS the complete path assembly from A to F. The train must be operated by the RU for the complete journey, therefore no interchange points exist.

b) Direct path booking by the RU for Transport Journey from A to F:

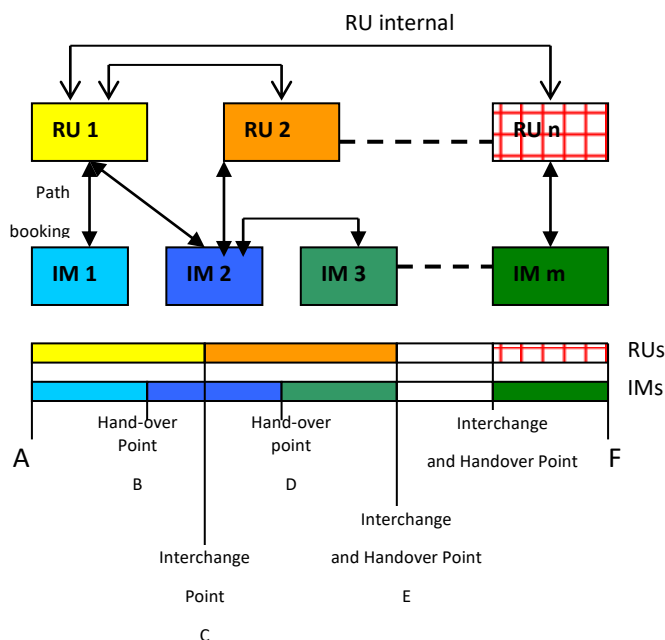


One RU is booking directly from the various IMs the several paths from A to F - section by section - between two handover points. The train must be operated by the RU for the complete journey, therefore no interchange points exist.

Scenario B: Each RU involved in the Transport Journey from A to F contacts the local IMs directly or via OSS (for example PCS) to request a path for the journey section on which it operates the train:

In this example:

RU 1 is the LRU to co-ordinate the involved RUs



Various RUs request from the various IMs or via OSS only the path(s) for a journey section between two interchange points of the complete journey for a train from A to F. The RUs operate the train on its booked path.

In this example RU1 is booking the paths from A to the interchange point C directly, whereas RU2 is booking the paths from the interchange point C to the next interchange point E via OSS.

Remark: In the execution mode, the IM will always communicate with the RU which has booked the path. Therefore the “path ownership” is important for the message exchange during operation of the train.

2.3 Examples for ETI and handovers

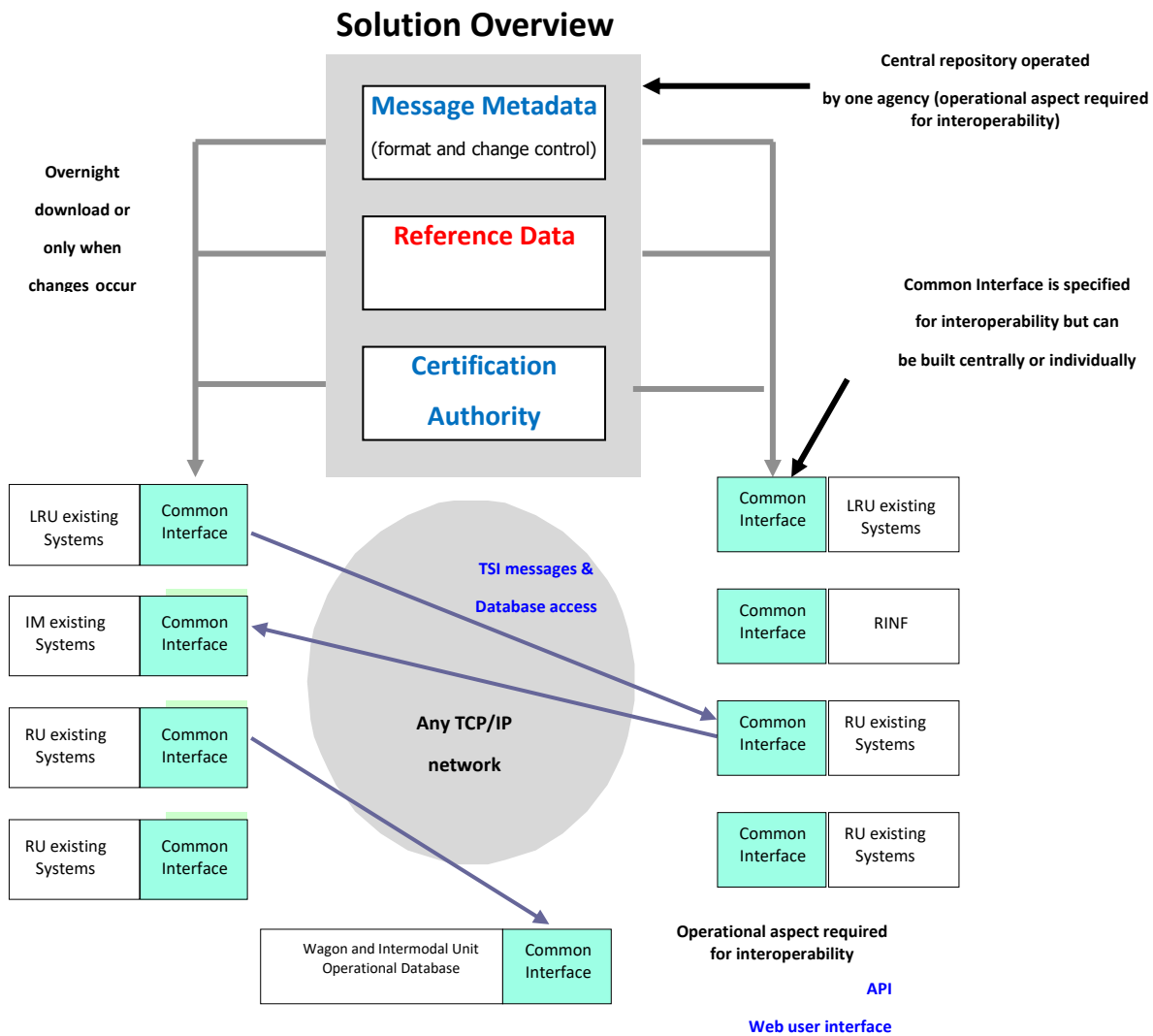
The various types of handovers and interchanges for trains and wagons are described in the TSI and can be summarized as follows:

- **Train Handovers at Points of Handover:** Infrastructure Managers (IMs) send Train Running Information messages to report real-time train positions when responsibility shifts between consecutive IMs or between IMs and operators of rail freight service facilities at a point of handover.
- **Train Interchanges at Points of interchange:** where responsibility for train operation changes between railway undertakings (RUs) or other operators, RUs send Train Running Information (originally sent by the IM) or Train Running Forecast messages to report disruptions or changes.
- **Wagon Handovers at Interchange Points:** Wagon handovers occur when responsibility for a wagon's movement shifts between successive RUs at a point of interchange, with the undertaking of arrival sending a Wagon Handed Over message to confirm the physical transfer.
- **CT Operator in Train Handovers:** Operators of rail freight service facilities send Train Running Information messages (or Train Running Forecast messages if deviations occur) for block trains arriving at or departing from their facilities, using the train's reference ID to confirm handovers.

Detailed presentation of above handovers and interchanges can be found in chapter 6.

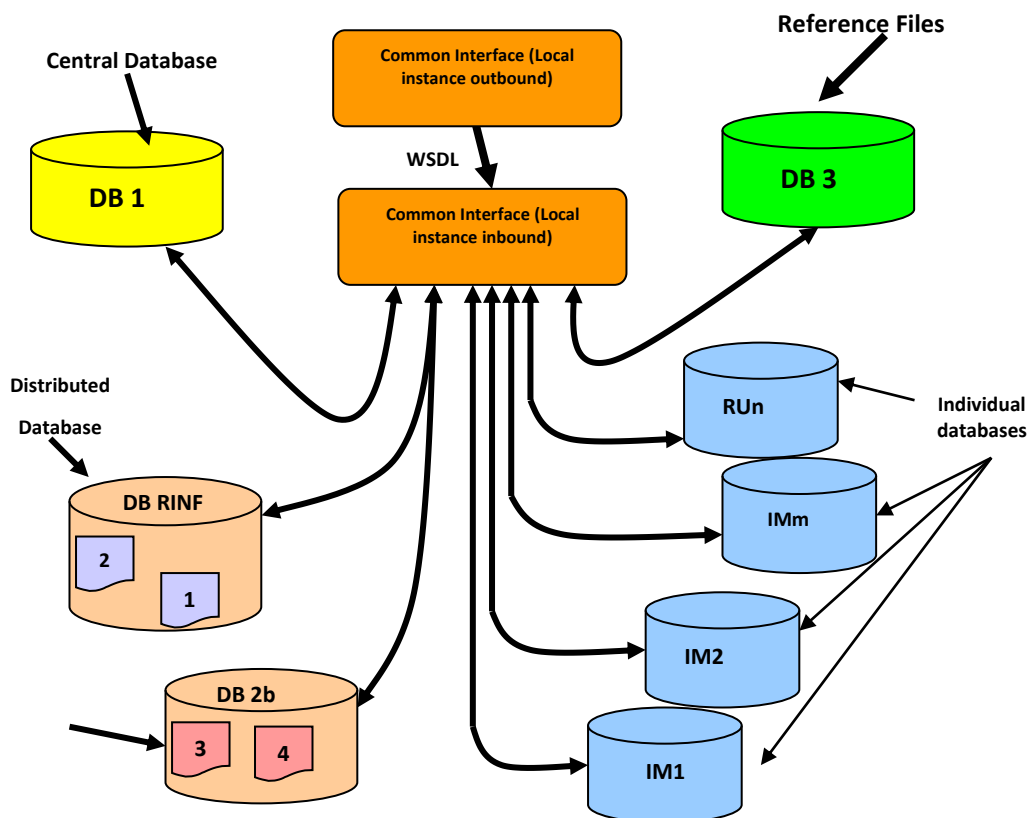
2.4 General Architecture Solution Overview

The General Architecture will support various manners to share data such as peer-to-peer, common IT tool, API, Web User Interface, RINF, common reference files, specific freight databases, Knowledge Graph.



2.5 Access method to the different types of Databases using the common interface

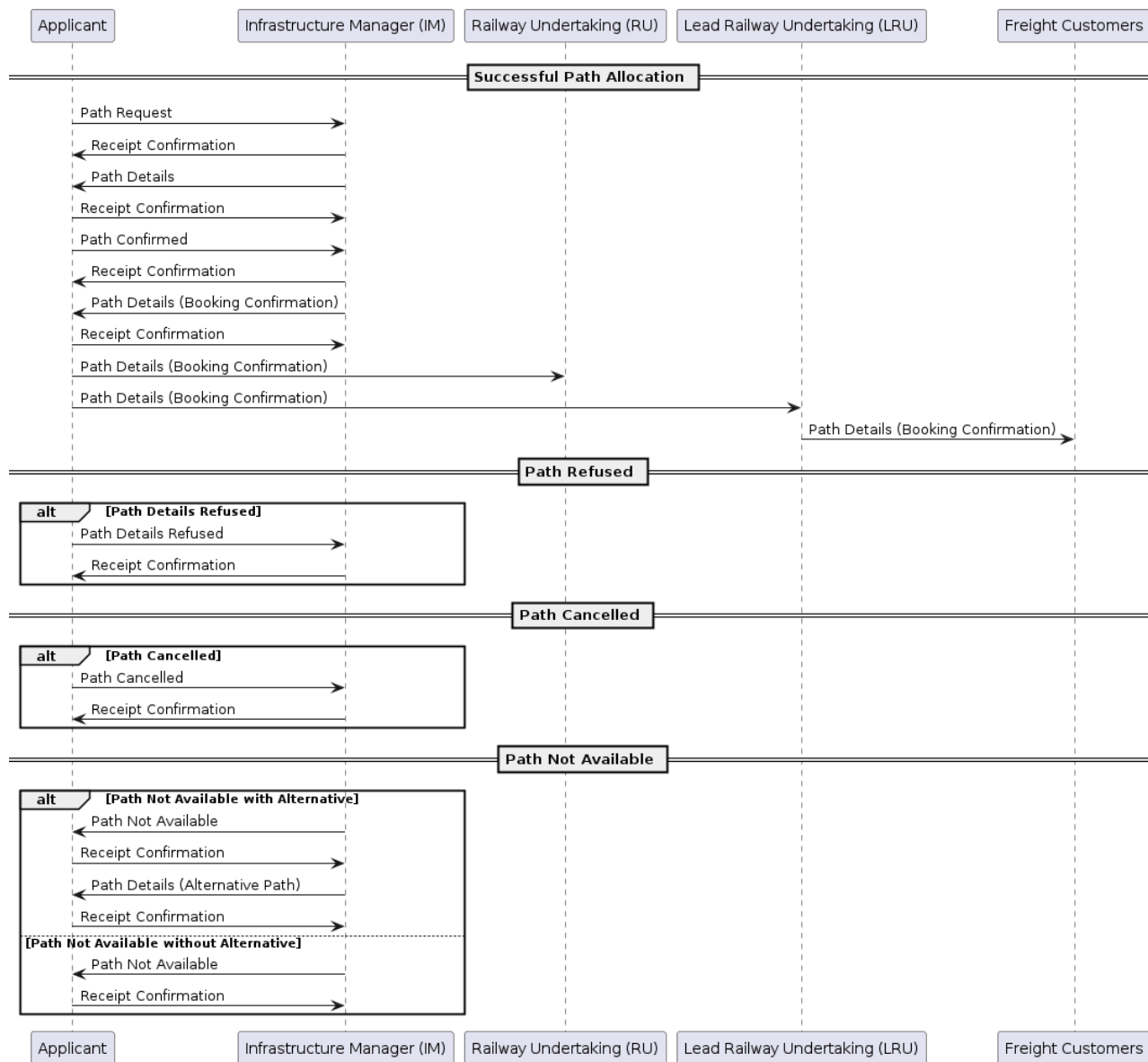
Each instance of the remote LI of the Common Interface will have access to all the data required according the TSI within each RU, IM, etc, whether the relevant Databases are central or individual.



3 Sequence Diagram: Path request

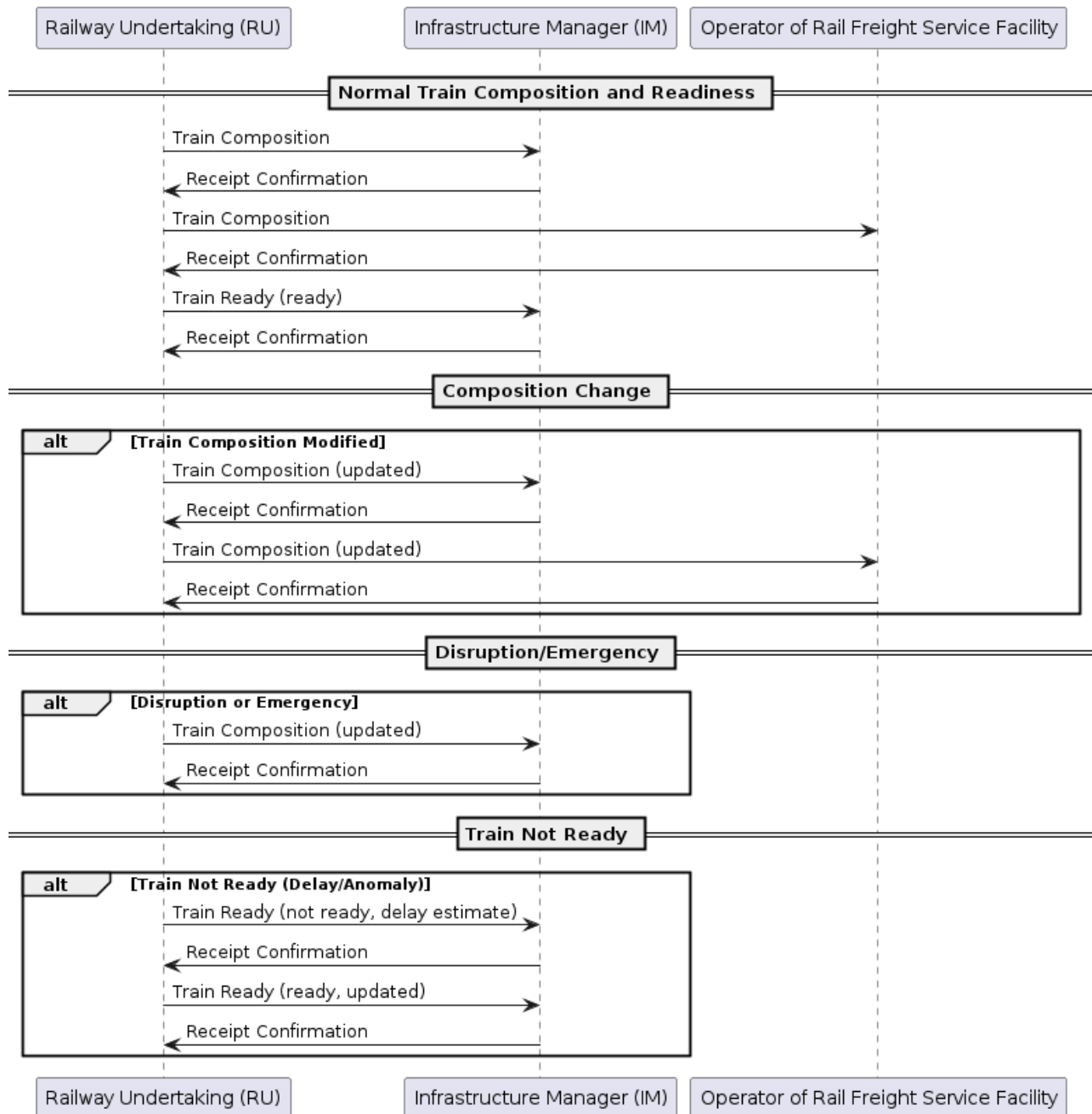
3.1 Sequence diagram path request, path refused, path cancelled and path not available

This Diagram demonstrates the various alternatives which may occur during the lifecycle of a path:



4 Sequence Diagram: Train Preparation

This Diagram is also valid for Open Access (Responsible RU n is LRU) and OSS with IM 1 as OSS



5 Sequence diagram: Train running forecast

5.1 Process Description.

For Train Running Forecast and Train Running Information different scenarios are considered, taking into account the various communication relations between RUs and IMs according to the path booking scenarios for chapter 2.3.2 – Path request of the Telematics TSI - Annex:

- **Train Approaching a Handover Point between IM n1 and his neighbour IM n2**

It is supposed that the handover point is not also an interchange (only scenario B) nor a handling Point. Thus, the handover point is a point on the booked paths of one Responsible RU and the RU has already sent the train composition to IM n2, whilst simultaneously sending this message to IM n1.

IM n1, after departure from the departure point, must send a train running forecast message to IM n2 with the estimated handover time (ETH). This message is simultaneously sent to the Responsible RU.

When the train leaves the infrastructure of IM n1 at the handover point this IM sends a Train running information with the actual handover time at this point to its path contracted Responsible RU.

When the train arrives on the infrastructure of IM n2 at the handover point this IM sends a Train running information with the actual handover time from this point to its path contracted Responsible RU.

- **Train Approaching an Interchange Point between RU 1 and the next RU 2 (only scenario B)**

In the path contract an interchange point must always be defined as a reporting point. .

For this point the IM in charge sends, once the train left the previous reporting point, a train running forecast message with the TETA for this interchange point to the RU which has contracted the path with him (e.g. RU 1). RU 1 transfers this message to the next RU (e.g. RU 2) supposed to take over the train. Additionally, this message is also sent to the Lead RU (LRU) for the transport if there is one and if this is defined in the co-operation contract between both RUs.

If the interchange point is also a handover point (e.g. Interchange and Handover Point E) sends the train running forecast message already after departure from the departure point or from the previous interchange point to IM n2 with the estimated handover time (ETH). This message is also sent to the RU having contracted the path e.g. RU 1. For the RU the ETH is equal to the TETA at the interchange point. RU 1 transfers this message to its neighbour RU 2 and to the Lead RU or the transport if there is one and if this is defined in the co-operation contract between both RUs.

When the train arrives at an interchange point, the IM must send a Train running information to his path contracted RU, for example RU 1, with the actual time of the arrival at that point.

Before the train leaves the interchange point, RU 2 must send a new train composition message to the IM having allocated the path and follow the departure procedure as defined in Article 2(5) of the Telematics TSI - Annex (Train Preparation).

- **Train Approaching a Handling Point of an RU (scenario A)**

A Handling Point must always be defined in the path contract as a reporting point.

For this point the IM in charge must send a train running forecast message with a TETA only if this is specified in contract between IM and RU.

But if the Handling Point is also a handover point between, for example, IM n1 and IM n2, IM n1 must send the train running forecast message after departure from the departure point or from the

previous interchange to IM n2 with the estimated handover time (ETH). This message is also sent to the RU. For the RU the ETH is equal to the TETA at the Handling Point.

When the train arrives at the Handling Point, the IM must send a Train running information with the actual time of arrival at this point to the RU.

Before the train leaves the Handling Point the RU and IM must follow the departure procedure as defined in Article 2(5) of the Telematics TSI - Annex (Train Preparation).

- **Train arrival at Destination**

When the train arrives at its destination the IM responsible sends a Train running information message with the actual arrival time to the RU which contracted the path.

Remark: In the path contract other locations may also be defined for which a train running forecast with TETA and train running information messages with the actual time are requested. For these points the IM in charge sends these messages as specified in the contract. The further evaluation and processing of the delivered ETHs and TETAs is described in the [chapter 4.2.6](#) (Shipment ETI / ETA).

In the following examples the logical sequence message exchange of the “Train Running Forecast” and “Train Running Information” messages relating to the different communication scenarios are shown with the remark, that regarding the communication relation between RU and IMs for train running, the two path request scenarios A - case A and A - case B ([chapter 4.2.2.1](#): Path Request, Preliminary remarks) are identical, because in both cases the IMs know only one RU e.g. RU1 (Responsible RU) which operates the complete path and is also responsible for new train composition at the handling points. The detailed formats of the messages are defined in [Annex II, Annex A index 1](#).

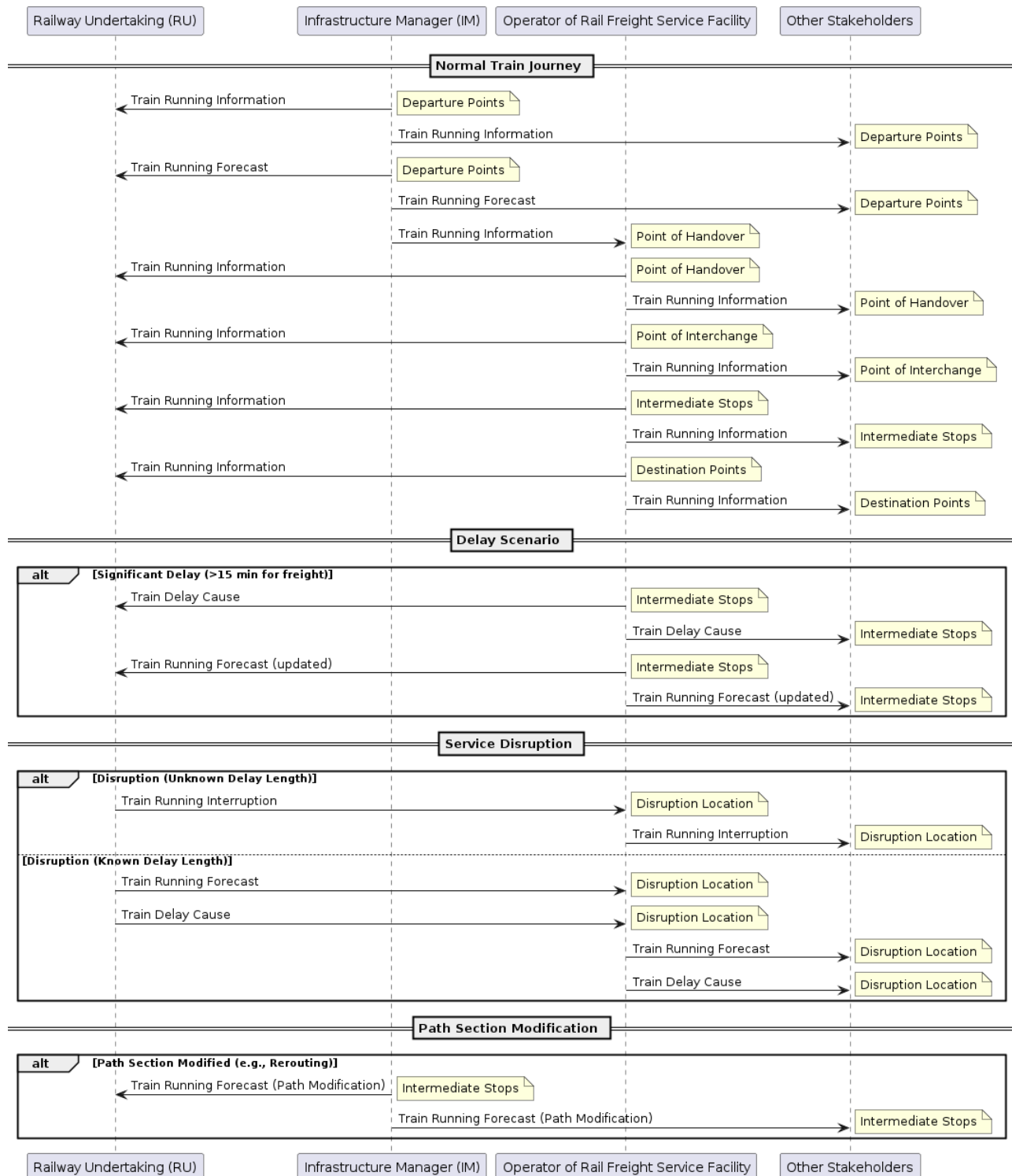
- **Additional remarks**

Under contractual agreement, the Lead RU will provide Customer the Train Running Forecast and Train Running Information.

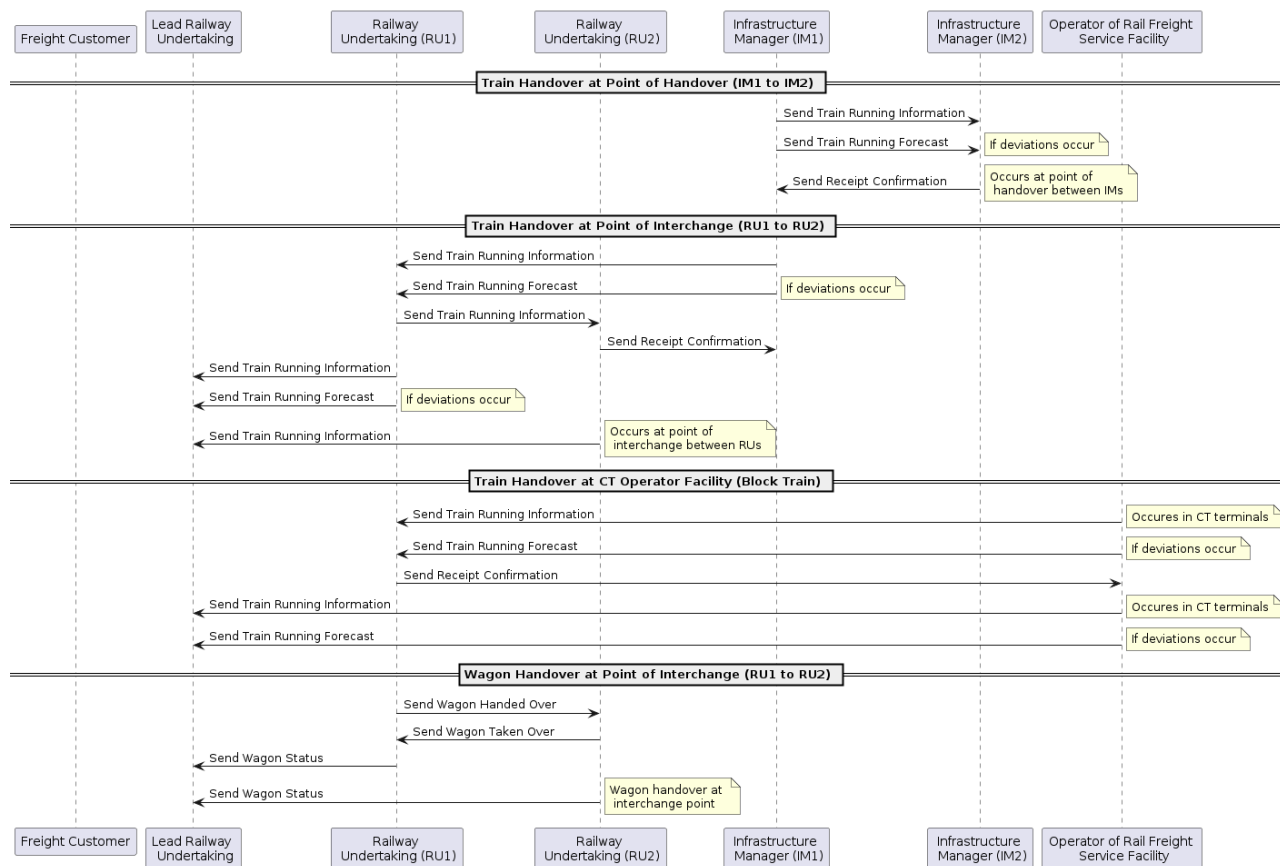
In the case of combined transport under contractual agreement, the Lead RU/Responsible RU shall ensure the ‘Train Running Forecast’ message is provided to the Terminal Operator.

In the case of combined transport under contractual agreement, the Lead RU/Responsible RU shall ensure the ‘Train Running Interruption’ message is provided to the Terminal Operator.

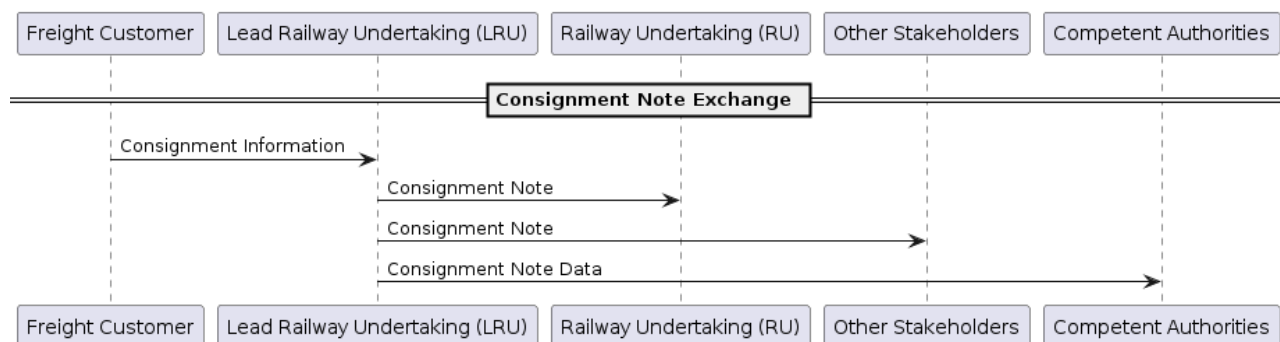
5.2 Examples



6 Sequence ETI and handovers



7 Consignment Orders



8 Movement of freight wagons

8.1 Wagon status

The railway undertaking operating a wagon shall share a ‘wagon status’ with

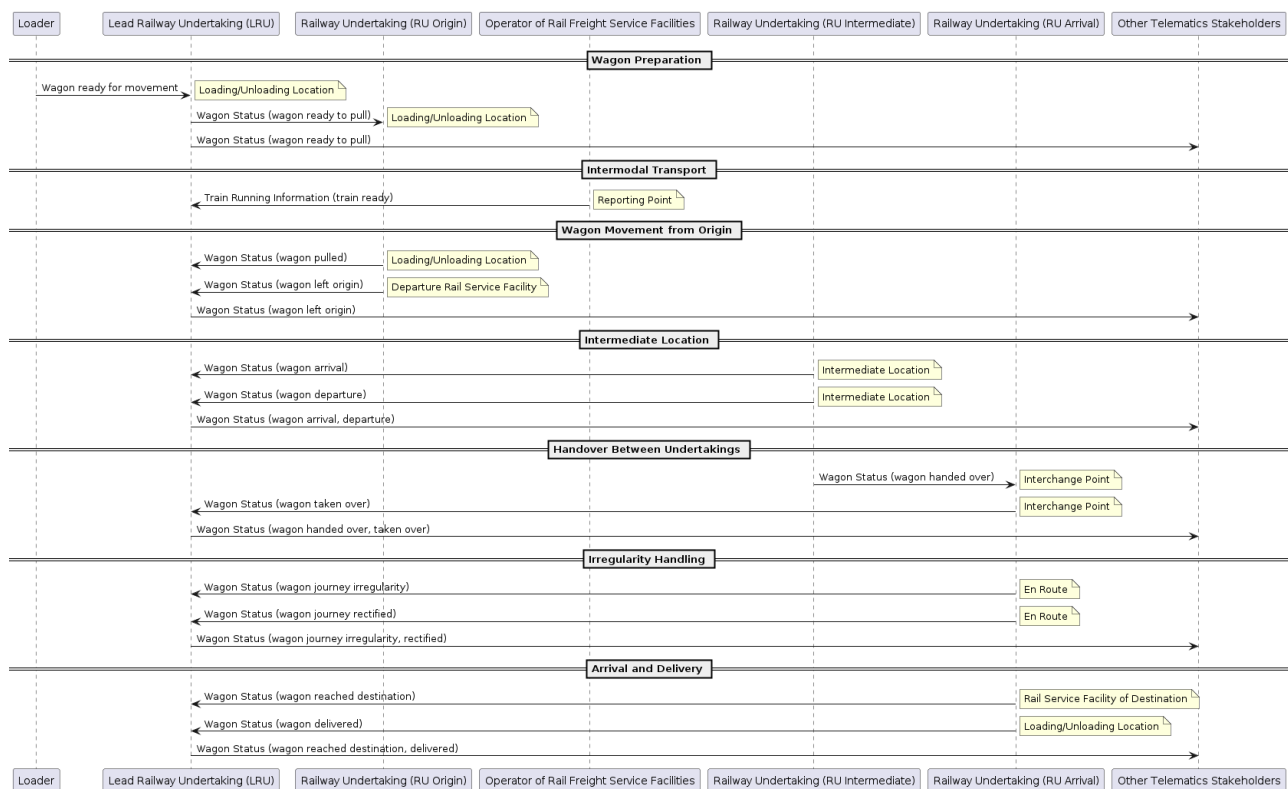
- › the lead railway undertaking as contractual carrier,
- › the previous and next railway undertaking(s) involved in the transport.

When agreed by the involved parties, the railway undertaking shall also share wagon status data with terminals, combined transport operators, and operator(s) of service facility(ies) involved and identified in the transport chain.

‘Wagon status’ can have the following event types:

- › Wagon ready to pull
- › Wagon pulled
- › Wagon departure from origin
- › Wagon arrival at intermediate station
- › Wagon departure from intermediate station
- › Wagon handed over
- › Wagon taken over
- › Wagon journey irregularity
- › Wagon journey recovered
- › Wagon arrival at destination
- › Wagon delivered.

Above actors and the exchange of the ‘Wagon status’ message (including the event types) are described in the diagram below.

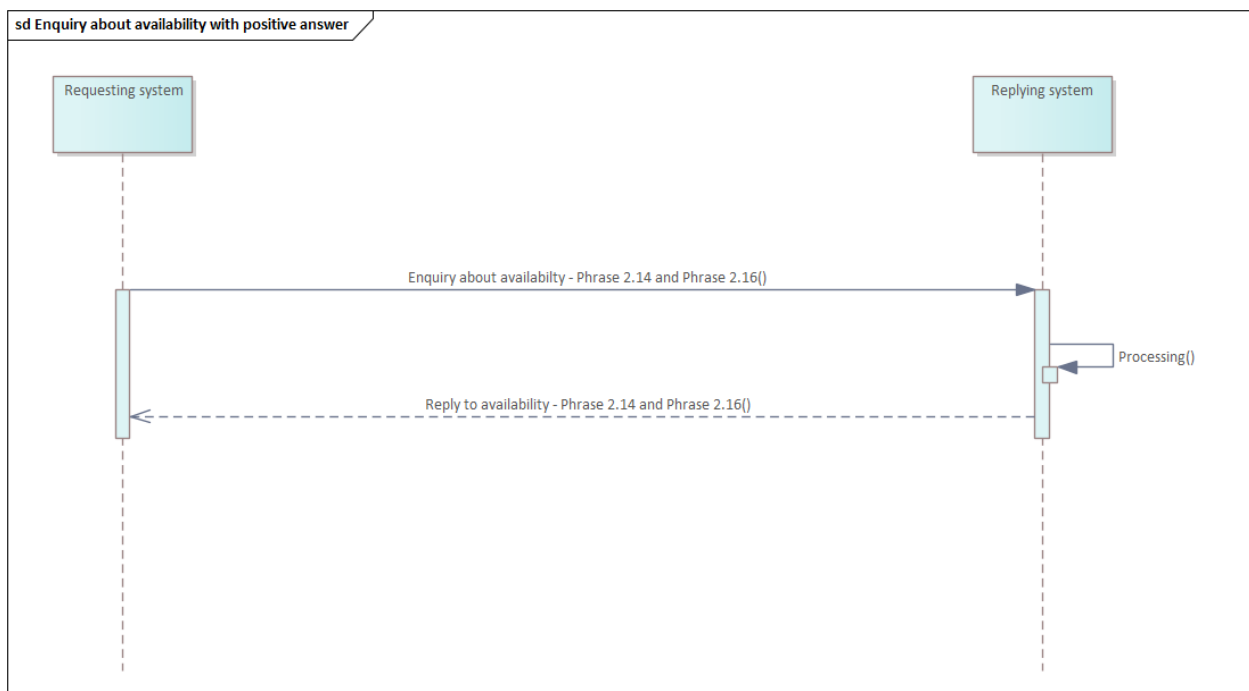


Passenger services

9 Reservations

This chapter describes how distributors and their requesting distribution system enable the sharing of the requests from customers (retailers or clients) for availability or reservation or cancellation of a specified rail product with the railway undertakings concerned through their attributing systems. The chapter further describes how replying attributing systems of the respective railway undertaking shall share a response with the requesting distribution system of the distributor including possible error scenarios. Further explanation including additional sequence diagrams can be found in the respective chapters of Appendix C, index [B.5] and its Annexes.

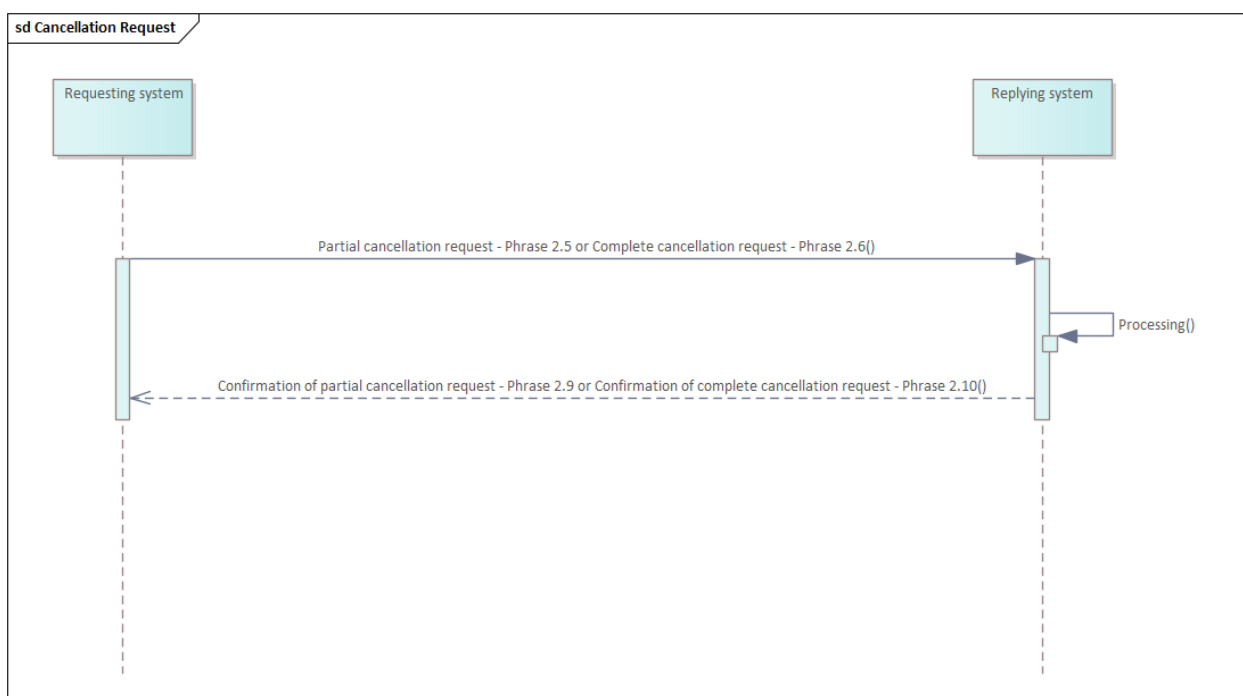
9.1 Enquiry about availability with positive answer



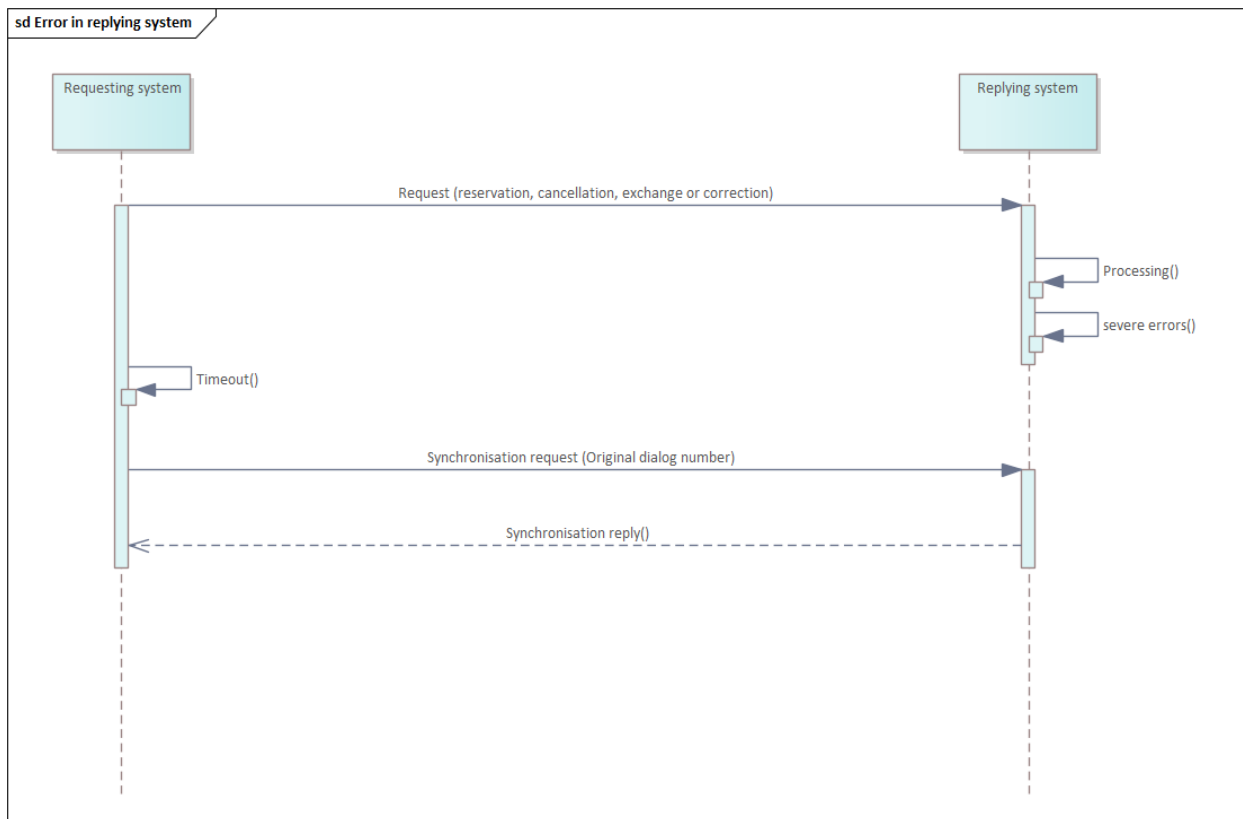
9.2 Reservation request with positive answer



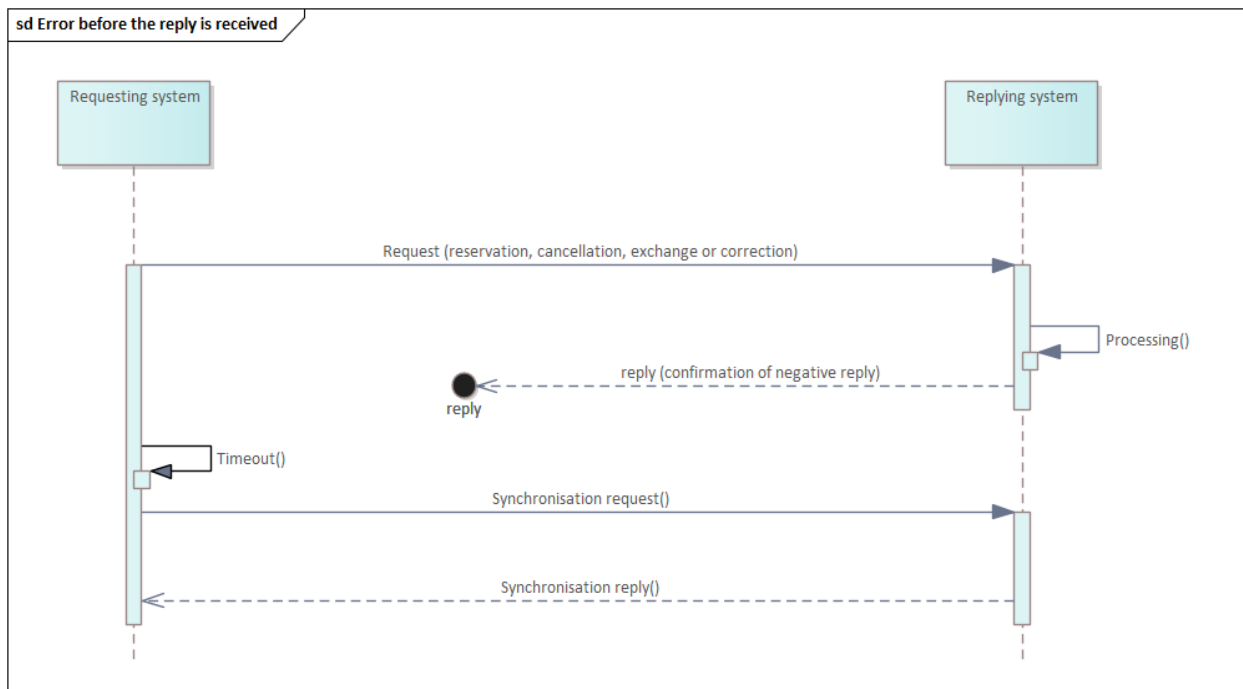
9.3 Cancellation Request



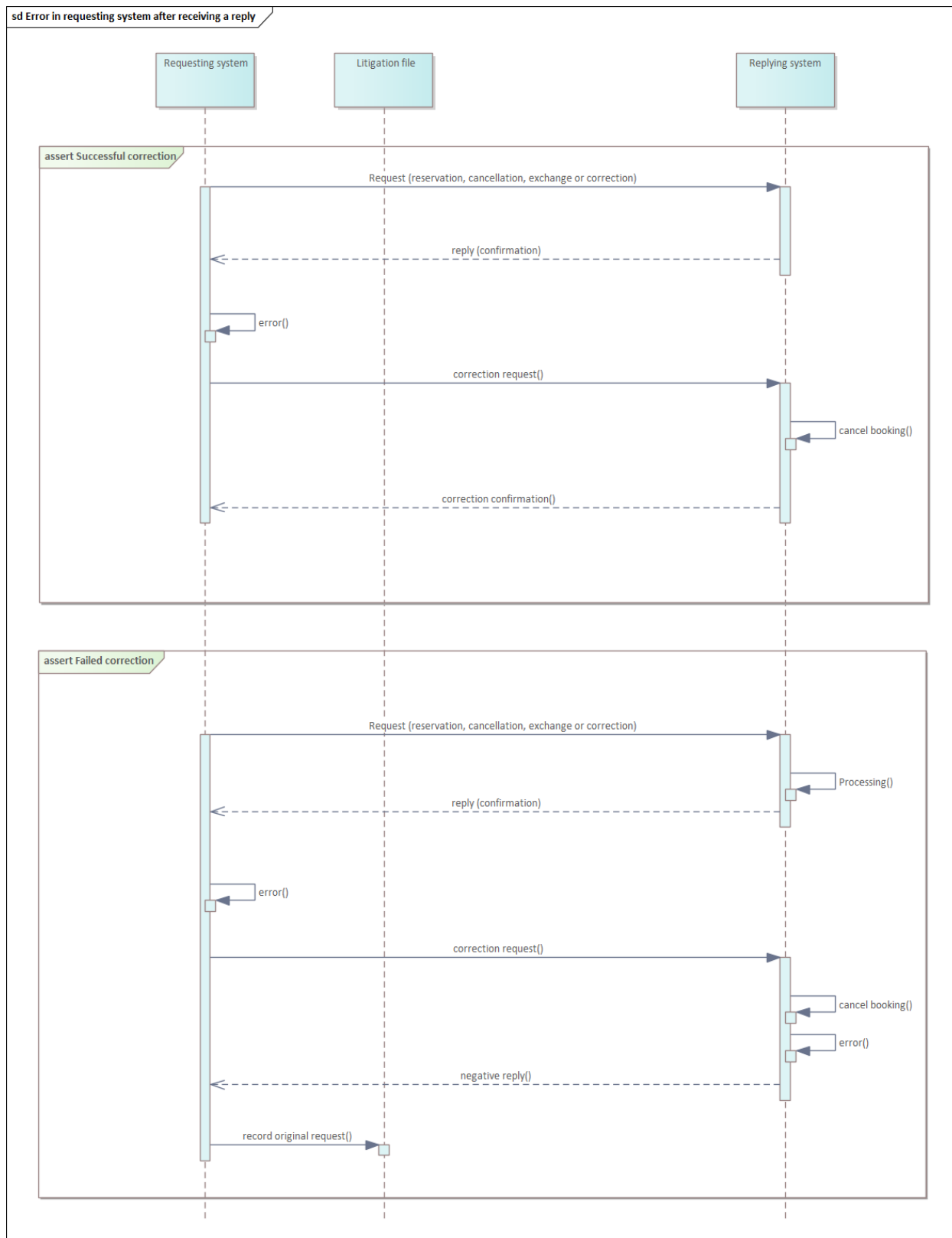
9.4 Error in replying system



9.5 Error before the reply is received



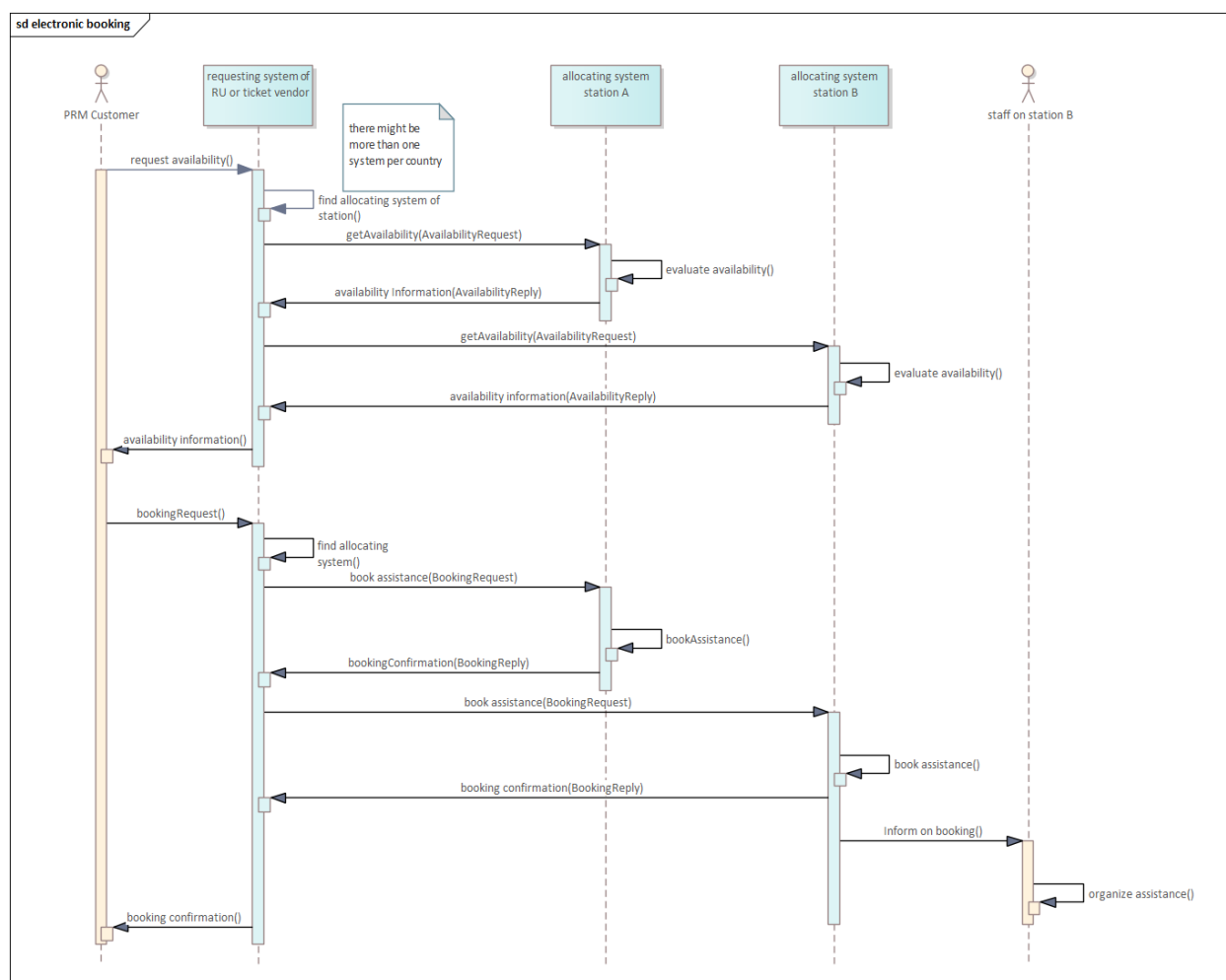
9.6 Error in requesting system after receiving a reply



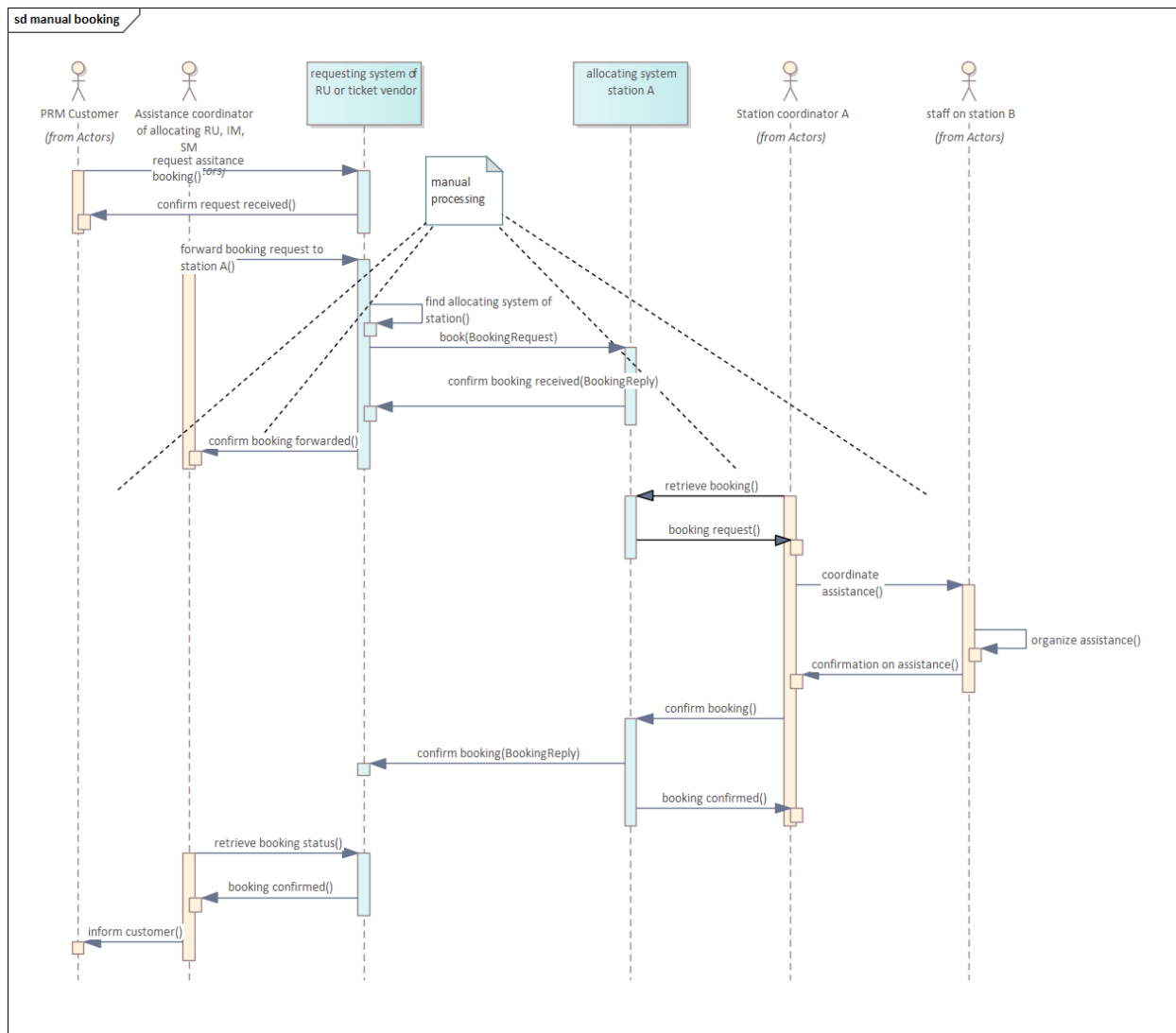
10 Assistance for Passengers with Reduced Mobility (PRM)

This chapter describes the exchange of messages between actors that have to book assistance for persons with reduced mobility (PRM) at stations. These exchanges take place between the Railway Undertaking requesting assistance for a PRM at a station managed by another Railway Undertaking, Infrastructure Manager or Station Manager. The chapter further describes how replying booking system of the respective railway undertaking shall share a response with the requesting system of the Railway Undertaking / Ticket Vendor including possible error scenarios. Further explanation including additional sequence diagrams can be found in the respective chapters of Appendix C, index [B.10].

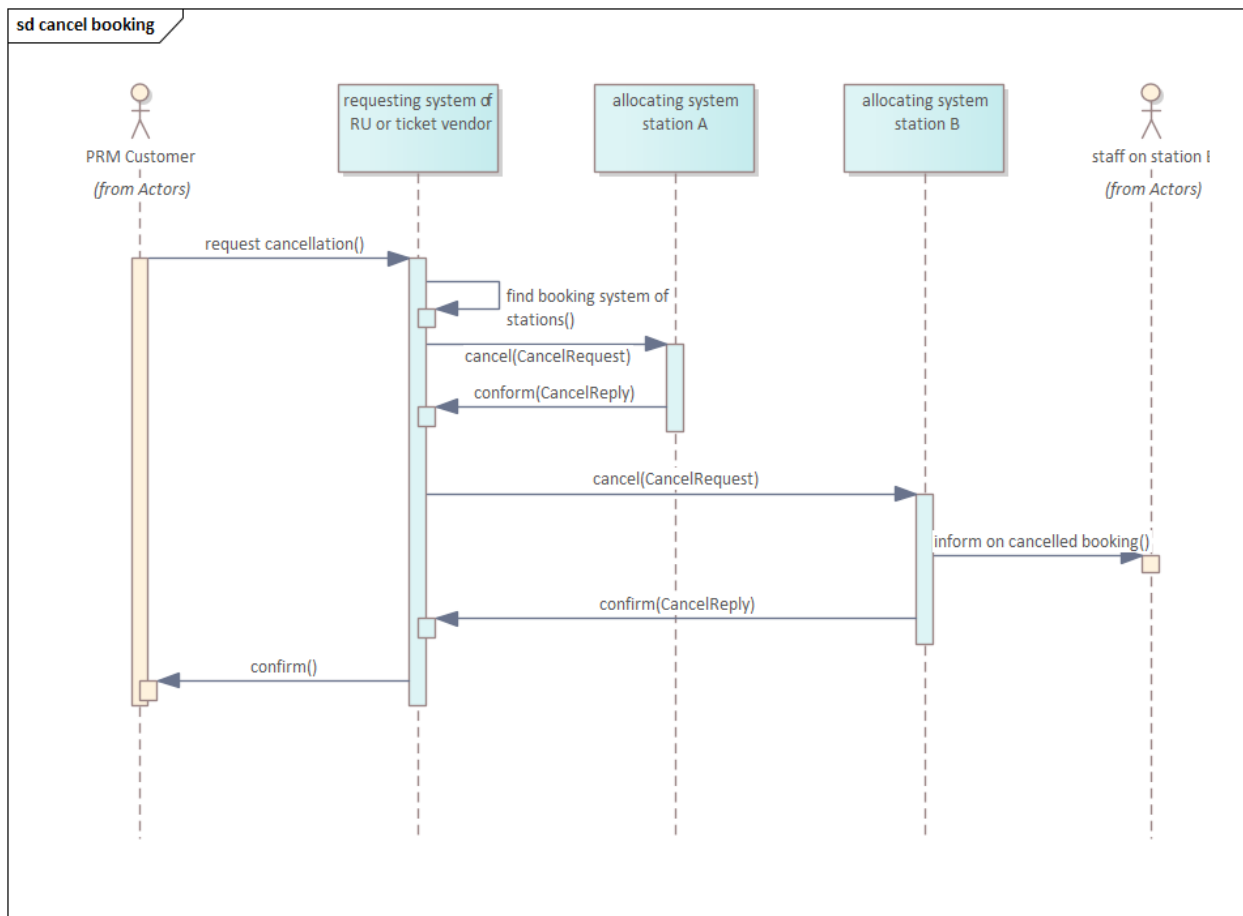
10.1 Electronic booking



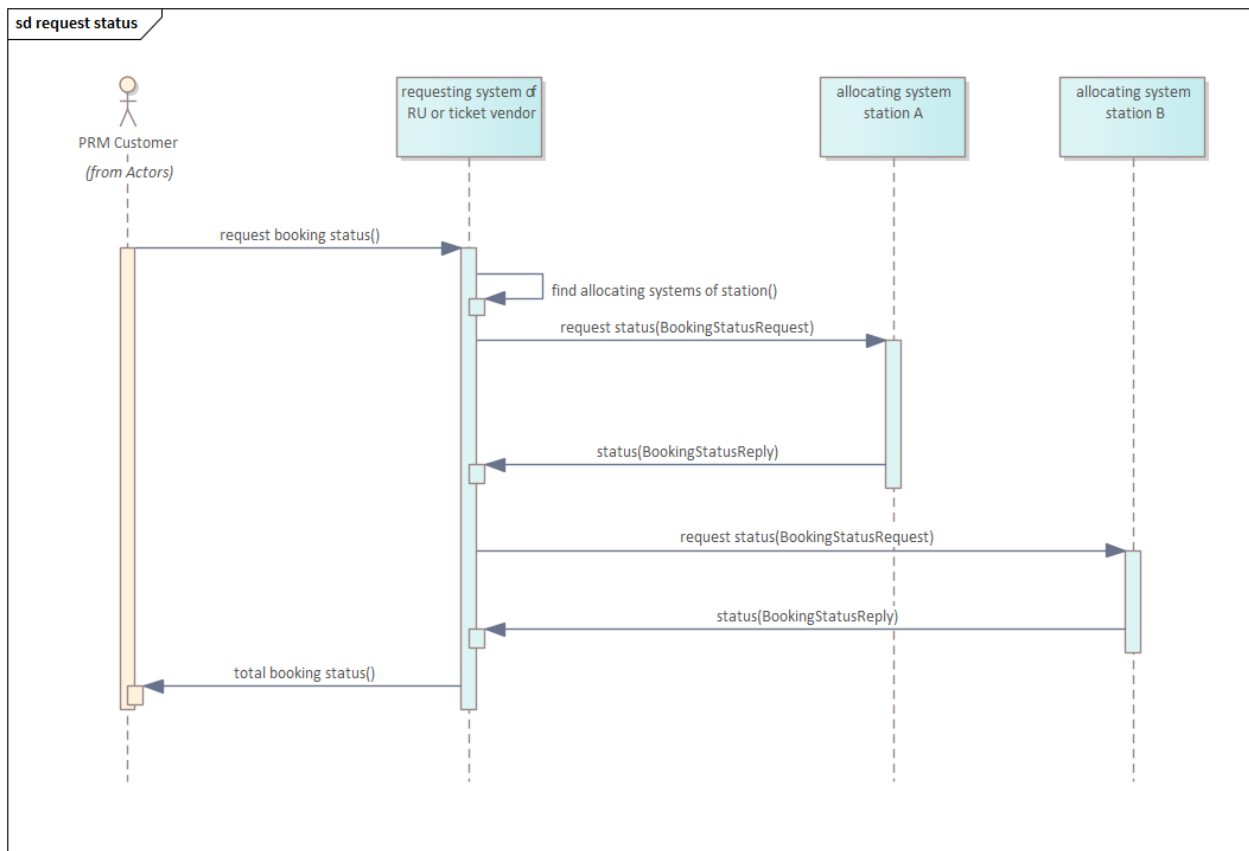
10.2 Manual Booking



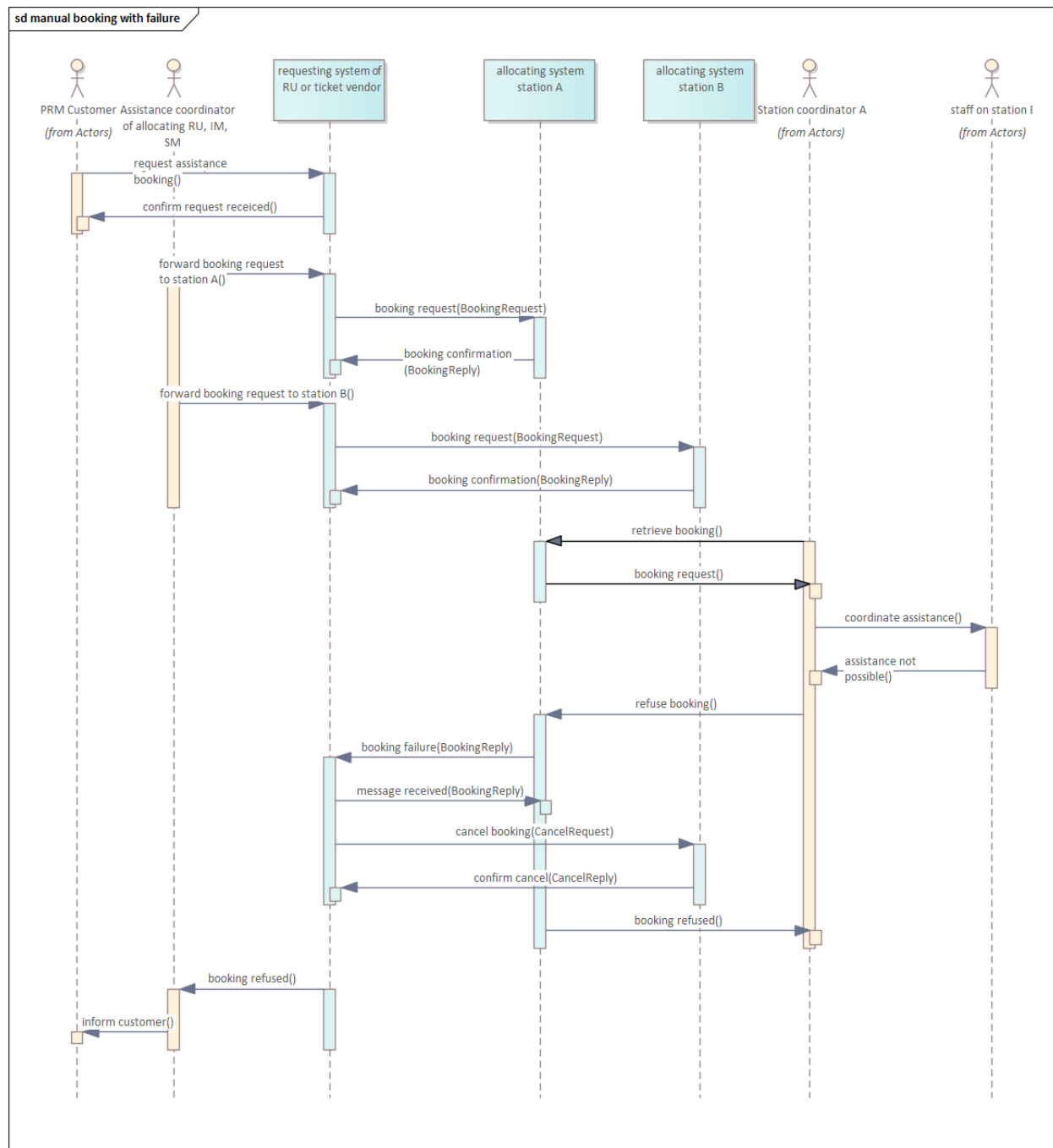
10.3 Cancel Booking



10.4 Request Status



10.5 Manual Booking with Failure



10.6 Error Scenario - Lost Communication

