PD CEN/TS 16614-3:2020



BSI Standards Publication

Public transport — Network and Timetable Exchange (NeTEx)

Part 3: Public transport fares exchange format

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National foreword

This Published Document is the UK implementation of CEN/TS 16614-3:2020. It supersedes PD CEN/TS 16614-3:2016, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/278, Intelligent transport systems.

A list of organizations represented on this committee can be obtained on request to its secretary.

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TECHNICAL SPECIFICATION

SPÉCIFICATION TECHNIQUE

TECHNISCHE SPEZIFIKATION

CEN/TS 16614-3

April 2020

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Supersedes CEN/TS 16614-3:2016

English Version

Public transport - Network and Timetable Exchange (NeTEx) - Part 3: Public transport fares exchange format

Transport Public - Echanges des informations planifiées (NeTEx) - Partie 3: Echange des informations tarifaires pour le transport public

Öffentlicher Verkehr - Netzwerk- und Fahrplan Austausch (NeTEx) - Teil 3: Austauschformat für das Fahrgeld im öffentlichen Verkehr

This Technical Specification (CEN/TS) was approved by CEN on 2 March 2020 for provisional application.

The period of validity of this CEN/TS is limited initially to three years. After two years the members of CEN will be requested to submit their comments, particularly on the question whether the CEN/TS can be converted into a European Standard.

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European foreword

This document (CEN/TS 16614-3:2020) has been prepared by Technical Committee CEN/TC 278 "Intelligent transport systems", the secretariat of which is held by NEN.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes CEN/TS 16614-3:2016.

This document presents Part 3 of the European Technical Specification known as "NeTEx". NeTEx provides a framework for specifying communications and data exchange protocols for organisations wishing to exchange scheduled Information relating to public transport operations.

This Technical Specification is made up of three parts defining a single European Standard series, which provides a complete exchange format for public transport networks, timetable description and fare information.

- Part 1 is the description of the public transport network topology exchange format. It also contains use cases shared with part 2, and modelling rules and the description of a framework shared by all parts.
- Part 2 is the description of the scheduled timetables exchange format.
- Part 3 is the description of the fare information exchange format.

Part 1 is fully standalone, and part 2 and 3 rely on part 1.

The XML schema can be downloaded from http://netex-cen.eu, along with available guidance on its use, example XML files, and case studies of national and local deployments.

This document is highly technical, and a special care has been taken to keep the text readable. In particular a set of formatting conventions is followed that enhances the usual CEN writing rules in order to distinguish references to elements of the formal models within text:

- Transmodel terms and NeTEx conceptual model elements are in capital letters (JOURNEY PATTERN for example).
- NeTEx physical model names are in bold italic font and use camelcase style with no spaces (***JourneyPattern*** for example).
- NeTEx physical model attribute types are in italic style and use camelcase style with no spaces (*TypeOfEntity* for example).

According to the CEN/CENELEC Internal Regulations, the national standards organisations of the following countries are bound to announce this document: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

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Introduction

Public transport services rely increasingly on information systems to ensure reliable, efficient operation and widely accessible, accurate passenger information. These systems are used for a range of specific purposes: setting schedules and timetables; managing vehicle fleets; publicising fares, issuing tickets and receipts; providing real-time information on service running, and so on.

The first two parts of the European Technical Specification NeTEx specify a Network and Timetable Exchange for Public Transport. It is intended to be used to exchange data relating to scheduled public transport between the systems of PT organisations. It can also be seen as complementary to the SIRI (Service Interface for Real-time Information) standard, as SIRI needs a prior exchange of reference data from NeTEx's scope to provide the necessary context for the subsequent exchange of a real-time data.

This document (NeTEx – Part 3) specifies exchanges of Public Transport fares between systems and organisations. It is a complement to Part 1 and Part 2 in the sense that it uses a subset of concepts defined there.

Well-defined, open interfaces have a crucial role in improving the economic and technical viability of Public Transport Information Systems of all kinds. Using standardised interfaces, systems can be implemented as discrete pluggable modules that can be chosen from a wide variety of suppliers in a competitive market, rather than as monolithic proprietary systems from a single supplier. Interfaces also allow the systematic automated testing of each functional module, vital for managing the complexity of increasing large and dynamic systems. Furthermore, individual functional modules can be replaced or evolved, without unexpected breakages of obscurely dependent function.

This standard will improve a number of features of public transport information and service management: Interoperability – the standard will facilitate interoperability between information processing systems of the transport operators by: (i) introducing common architectures for message exchange; (ii) introducing a modular set of compatible information services, (iii) using common data models and schemas for the messages exchanged for each service; and (iv) introducing a consistent approach to data management.

Technical advantages include the following: a modular reusing of a common communication layer shared with SIRI for all the various technical services enables cost-effective implementations, and makes the standard readily extensible in future.

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1 Scope

1.1 General

NeTEx is dedicated to the exchange of scheduled data (network, timetable and fare information). It is based on Transmodel V5.1 (EN 12986), IFOPT (EN 28701) and SIRI (CEN/TS 15531-4/5 and EN 15531-1/2/3[1]) and supports the exchange of information of relevance for passenger information about public transport services and also for running Automated Vehicle Monitoring Systems (AVMS).

NOTE NeTEx is a refinement and an implementation of Transmodel and IFOPT; the definitions and explanations of these concepts are extracted directly from the respective standard and reused in NeTEx, sometimes with adaptations in order to fit the NeTEx context. Although the data exchanges targeted by NeTEx are predominantly oriented towards provisioning passenger information systems and AVMS with data from transit scheduling systems, it is not restricted to this purpose and NeTEx can also provide an effective solution to many other use cases for transport data exchange.

1.2 Fares scope

This Part 3 of NeTEx, is specifically concerned with the exchange of fare structures and fare data, using data models that relate to the underlying network and timetable models defined in Part 1 and Part 2 and the Fare Collection data model defined in Transmodel V51. See the use cases below for the overall scope of Part 3. In summary, it is concerned with data for the following purposes:

(i) To describe the many various possible fare structures that arise in public transport (for example, flat fares, zonal fares, time dependent fares, distance-based fares, stage fares, pay as you go fares, season passes, etc., etc.).

(ii) To describe the fare products that may be purchased having these fare structures and to describe the conditions that may attach to particular fares, for example if restricted to specific groups of users, or subject to temporal restrictions. These conditions may be complex.

(i) To allow actual price data to be exchanged. Note however that NeTEx does not itself specify pricing algorithms or how fares should be calculated. This is the concern of Fare Management Systems. It may be used may be used to exchange various parameters required for pricing calculations that are needed to explain or justify a fare.

(iii) To include the attributes and the text descriptions necessary to present fares and their conditions of sale and use to the public.

NeTEx should be regarded as being 'upstream' of retail systems and allows fare data to be managed and integrated with journey planning and network data in public facing information systems. It is complementary to and distinct from the 'downstream' ticketing and retail systems that sell fares and of the control systems that validate their use. See 'Excluded Use Cases' below for further information on the boundaries of NeTEx with Fare Management Systems.

[1] Under preparation.

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1.3 Transport modes

All mass public transport modes are taken into account by NeTEx, including train, bus, coach, metro, tramway, ferry, and their submodes. It is possible to describe airports, air journeys, and air fares, but there has not been any specific consideration of any additional requirements that apply specifically to air transport.

1.4 Compatibility with existing standards and recommendations

The overall approach for the definition of fares within NeTEx Part 3 follows the approach used by Transmodel V5.1, namely the definition of access rights rather than of just products.

This approach, used in Transmodel V5.1 (Fare Collection data model) to specify the access rights related to the urban public transport (for all urban modes) has been extended to cover access rights for long-distance rail.

NOTE The concepts from Transmodel V5.1 and IFOPT used and/or modified by NeTEx are incorporated into Transmodel V6 to guarantee compatibility and coherence of standards.

Concepts covered in NeTEx Part 1 and 2 that relate in particular to long-distance train travel include; rail operators and related organizations; stations and related equipment; journey coupling and journey parts; train composition and facilities; planned passing times; timetable versions and validity conditions and train routing restrictions.

In the case of long distance train access rights, NeTEx takes into account the requirements formulated by the ERA (European Rail Agency) – TAP/TSI (Telematics Applications for Passenger/ Technical Specification for Interoperability, entered into force on 13 May 2011 as the Commission Regulation (EU) No 454/2011), based on UIC directives. These relate in particular to the B1 (Non Reservation Tickets), B2 (Integrated Reservation Tickets) and B3 (Special Fares) along with various UIC Leaflets.

As regards the other exchange protocols for network and timetable exchanges, a formal compatibility is ensured with TransXChange (UK), VDV 452 (Germany), NEPTUNE (France), BISON (The Netherlands) and NOPTIS (Nordic Public Transport Interface Standard).

The exchange of data in NeTEx format can be undertaken using a variety of protocols. For example: through dedicated web services, through data file exchanges, or by using the SIRI exchange protocol as described in part 2 of the SIRI documentation. NeTEx adds additional services using the common SIRI transport mechanism.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

CEN/TS 16614-1, *Public transport — Network and Timetable Exchange (NeTEx) — Part 1: Public transport network topology exchange format*

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3 Terms and definitions

For the purposes of this document, the terms and definitions given in CEN/TS 16614-1:2019 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at https://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

NOTE A lot of definitions are shared with Transmodel (EN 12896): special attention was paid to the consistency of definitions, keeping exactly the same wording. The italic bracket name at the beginning of the definition is a package name that will help the reader to find the related concept in the UML data model.

3.1

access right in product

(Fare Product MODEL)

VALIDABLE ELEMENT as a part of a PRE-ASSIGNED FARE PRODUCT, including its possible order in the set of all VALIDABLE ELEMENTs grouped together to define the access right assigned to that PRE-ASSIGNED FARE PRODUCT

3.2

access right parameter assignment

(Validity Parameters MODEL)

assignment of a fare collection parameter (referring to geography, time, quality or usage) to an element of a fare system (access right, validated access, control mean, etc.)

3.3

amount of price unit

(Fare Product MODEL)

FARE PRODUCT consisting in a stored value of PRICE UNITs: an amount of money on an electronic purse, amount of units on a value card etc.

3.4

blacklist

(Fare Contract MODEL)

list of identified TRAVEL DOCUMENTs or CONTRACTs the validity of which has been cancelled temporarily or permanently, for a specific reason like loss of the document, technical malfunction, no credit on bank account, offences committed by the customer, etc.

3.5

border point

(Fare Zone MODEL)

POINT on the Network marking a boundary for the fare calculation

Note 1 to entry: May or may not be a SCHEDULED STOP POINT

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3.6

cancelling

(Cancelling Usage Parameters MODEL)

Parameter giving conditions for cancelling of a purchased access right

3.7

capped discount right

(Fare Product MODEL)

specialisation of SALE DISCOUNT RIGHT where the discount is expressed as a rule specifying a ceiling for a given time interval

Note 1 to entry: For example, the London Oyster card fare, which charges for each journey until travel equivalent to a day pass has been consumed after which further travel is free at that day

3.8

capping rule

(Fare Product MODEL)

capping limit for a given time interval, where the capping is expressed by another product

Note 1 to entry: For example, the London Oyster card fare, which charges for each journey until travel equivalent to a day pass for the mode of travel has been consumed

3.9

capping rule price

(Fare Product MODEL)

set of all possible price features of a CAPPING RULE: default total price, discount in value or percentage etc.

3.10

cell

(Fare Table MODEL)

unique individual combination of features within a FARE TABLE, used to associate a FARE PRICE with a fare element

3.11

charging moment

(Fare Product MODEL)

classification of FARE PRODUCTs according to the payment method and the account location: pre-payment with cancellation (throw-away), pre-payment with debit on a value card, pre-payment without consumption registration (pass), post-payment etc.

3.12

charging policy

(Charging Usage Parameters MODEL)

Parameter governing minimum amount and credit allowed when consuming a FARE PRODUCT

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3.13

commercial profile

(Eligibility Usage Parameters MODEL)

category of users depending on their commercial relations with the operator (frequency of use, amount of purchase etc.), often used for allowing discounts

3.14

companion profile

(Eligibility Usage Parameters MODEL)

number and characteristics of the persons entitled to travel in a group or as companions to another USER PROFILE

3.15

controllable element

(Validable Element MODEL)

smallest controllable element of public transport consumption, all along which any VALIDITY PARAMETER ASSIGNMENT remains valid

3.16

controllable element in sequence

(Validable Element MODEL)

CONTROLLABLE ELEMENT as a part of a FARE STRUCTURE ELEMENT, including its possible order in the sequence of CONTROLLABLE ELEMENTs grouped together to form that FARE STRUCTURE ELEMENT, and its possible quantitative limitation

3.17

controllable element price

(Validable Element MODEL)

set of all possible price features of a CONTROLLABLE ELEMENT: default total price, discount in value or percentage etc.

3.18

customer

(Fare Contract MODEL)

identified person or organisation involved in a fare process

Note 1 to entry: There may be a CONTRACT between the CUSTOMER and the OPERATOR or the AUTHORITY ruling the consumption of services

3.19

discounting rule

(Fare Calculation Parameters MODEL)

price calculation rule determined by a set of discounts, depending upon a USAGE PARAMETER, to be applied to a FARE PRICE

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3.20

distance matrix element

(Distance Matrix Element MODEL)

cell of an origin-destination matrix for TARIFF ZONEs or STOP POINTs, expressing a fare distance for the corresponding trip: value in km, number of fare units etc.

3.21

distance matrix element price

(Distance Matrix Element MODEL)

set of all possible price features of a DISTANCE MATRIX ELEMENT: default total price etc.

3.22

distribution assignment

(Sales Offer Package MODEL)

assignment of the COUNTRY and/or DISTRIBUTION CHANNEL through which a product may or may not be distributed

3.23

distribution channel

(Sales Distribution MODEL)

type of outlet for selling of a product

3.24

eligibility

(Use Case)

required characteristics of a customer to be able to purchase a product

3.25

eligibility change policy

(Eligibility Parameters MODEL)

Parameter indicating the action to be taken when a user's eligibility status changes

3.26

entitlement constraint

(Entitlement Parameters MODEL)

Constraints on choices for an dependent entitled product relative to the required choices for the prerequisite entitling product

3.27

entitlement given

(Entitlement Parameters MODEL)

Parameter indicating whether a particular FARE PRODUCT provides an entitlement to buy or use an access right

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3.28

entitlement product

(Fare Product MODEL)

precondition to access a service or to purchase a FARE PRODUCT issued by an organisation that may not be a PT operator (e.g.military card)

3.29

entitlement required

(Entitlement Parameters MODEL)

Parameter indicating whether a particular FARE PRODUCT requires an entitlement to by or use an access right

3.30

exchanging

(Booking Usage Parameters MODEL)

Whether and how the access right may be exchanged for another access right

3.31

fare

(Use Case)

From the customer perspective: the amount that a customer has to pay for a journey or for acquiring a product

3.32

fare day type

(Fare Calculation Parameters MODEL)

type of day used in the fare collection domain, characterised by one or more properties which affect the definition of access rights and prices in the fare system

3.33

fare demand factor

(Quality Fare Structure MODEL)

named set of parameters defining a period of travel with a given price, for example off peak, peak, super off peak, etc.

3.34

fare element in sequence

(Common Fare Structure MODEL)

FARE ELEMENT as a part of an ELEMENT, including its possible order in the sequence of FARE ELEMENTs

3.35

fare frame

(Fare Frame MODEL)

set of all fare data defined for a specific VEHICLE MODE to which the same VALIDITY CONDITIONs have been assigned

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3.36

fare frame defaults

(Fare Frame MODEL)

Set of pricing parameters and values to apply to an individual element in the frame if no explicit value is specified on the element

3.37

fare interval

(Common Fare Structure MODEL)

interval based aspect of the fare structure

3.38

fare point in pattern

(Fare Zone MODEL)

POINT IN PATTERN which represents the start or end of a FARE SECTION, or a point used to define a SERIES CONSTRAINT

3.39

fare price

(Fare Price MODEL)

Price features DEFINED BY DEFAULT characterizing different PRICE GROUPs

3.40

fare product

(Fare Product MODEL)

immaterial marketable element (access rights, discount rights, etc.), specific to a CHARGING MOMENT

3.41

fare product price

(Fare Product MODEL)

set of all possible price features of a FARE PRODUCT: default total price, discount in value or percentage etc.

3.42

fare quota factor

(Quality Fare Structure MODEL)

named set of parameters defining a number of quota fares available of a given denomination

3.43

fare scheduled stop point

(Fare Zone MODEL)

specialisation of SCHEDULED STOP POINT describing a stop with fare accounting and routing characteristics

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3.44

fare section

(Fare Zone MODEL)

subdivision of a JOURNEY PATTERN consisting of consecutive POINTs IN JOURNEY PATTERN, used to define an element of the fare structure

3.45

fare structure

(Use Case)

Set of parameters that determine the basic tariffs

3.46

fare structure element

(Fare Structure Element MODEL)

sequence or set of CONTROLLABLE ELEMENTs to which rules for limitation of access rights and calculation of prices (fare structure) are applied

3.47

fare structure element in sequence

(Fare Structure Element MODEL)

FARE STRUCTURE ELEMENT as a part of a VALIDABLE ELEMENT, including its possible order in the sequence of FARE STRUCTURE ELEMENTs forming that VALIDABLE ELEMENT, and its possible quantitative limitation

3.48

fare structure element price

(Fare Structure Element MODEL)

set of all possible price features of a FARE STRUCTURE ELEMENT: default total price, discount in value or percentage etc.

3.49

fare structure factor

(Common Fare Structure MODEL)

factor influencing access rights definition or calculation of prices

3.50

fare table

(Fare Table MODEL)

grouping of prices (specialization of PRICE GROUP) that may be associated with all or any of DISTANCE MATRIX ELEMENT, FARE STRUCTURE ELEMENT GEOGRAPHICAL INTERVAL, GROUP OF ACCESS RIGHT PARAMETER, CLASS OF USE, OPERATOR, VEHICLE MODE, FARE PRODUCT

3.51

fare unit

(Common Fare Structure MODEL)

unit associated with a FARE STRUCTURE FACTOR

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3.52

fare zone

(Fare Zone MODEL)

specialization of TARIFF ZONE to include FARE SECTIONs

3.53

frequency of use

(Travel Usage Parameters MODEL)

limits of usage frequency for a FARE PRODUCT (or one of its components) or a SALES OFFER PACKAGE during a specific VALIDITY PERIOD

Note 1 to entry: There may be different tariffs depending on how often the right is consumed during the period

3.54

fulfilment method

(Sales Distribution MODEL)

means by which the ticket is delivered to the CUSTOMER, e.g online, collection, etc.

3.55

fulfilment method price

(Sales Distribution MODEL)

set of all possible price features of a FULFILMENT METHOD default total price etc.

3.56

generic parameter assignment

(Validity Parameters MODEL)

VALIDITY PARAMETER ASSIGNMENT specifying generic access rights for a class of products (e.g. a time band limit - 7 to 10 a.m - for trips made with a student pass)

3.57

geographical interval

(Geographical Fare Structure MODEL)

geographical interval specifying access rights for the FARE STRUCTURE ELEMENTs within the range of this interval: 0-5 km, 4-6 zones etc.

3.58

geographical interval price

(Geographical Fare Structure MODEL)

set of all possible price features of a GEOGRAPHICAL INTERVAL: default total price etc.

3.59

geographical structure factor

(Geographical Fare Structure MODEL)

value of a GEOGRAPHICAL INTERVAL or a DISTANCE MATRIX ELEMENT expressed by a GEOGRAPHICAL UNIT

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3.60
geographical unit
(Geographical Fare Structure MODEL)
unit for calculating geographical graduated fares

3.61
geographical unit price
(Geographical Fare Structure MODEL)
set of all possible price features of a GEOGRAPHICAL UNIT: default total price etc.

3.62
group of distance matrix elements
(Distance Matrix Element MODEL)
grouping of DISTANCE MATRIX ELEMENTS

Note 1 to entry: May be used to provide reusable Origin / Destination pairs (and associate them with a PRICE)

3.63
group of distribution channels
(Sales Distribution MODEL)
grouping of DISTRIBUTION CHANNELs

3.64
group of sales offer packages
(Sales Offer Package MODEL)
grouping of SALES OFFER PACKAGEs

3.65
group ticket
(Eligibility Usage Parameters MODEL)
number and characteristics of persons entitled to travel in addition to the holder of an access right

3.66
interchanging
(Travel Usage Parameters MODEL)
Limitations on making changes within a trip

3.67
limiting rule
(Fare Calculation Parameters MODEL)
Rule for limiting the results of a price calculation

3.68
luggage allowance
(Luggage Usage Parameters MODEL)
number and characteristics (weight, volume) of luggage that a holder of an access right is entitled to carry

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3.69

minimum stay

(Travel Usage Parameters MODEL)

Details of any minimum stay at the destination required to use the product

3.70

month validity offset

(Fare Calculation Parameters MODEL)

Days before (negative) or after (positive) the start of the month that a product with a calendar period driven activation becomes valid

3.71

network validity parameter

(Validity Parameters MODEL)

type of VALIDITY PARAMETER related to the network structure

3.72

organisational validity parameter

(Validity Parameters MODEL)

type of VALIDITY PARAMETER related to organisational issues

3.73

parking charge band

(Parking Tariff MODEL)

Parking charges that describe the cost of using a PARKING or PARKING AREfor a given period

3.74

parking price

(Parking Tariff MODEL)

specialisation of FARE PRICE that defines the price of a PARKING CHARGE BAND

3.75

parking tariff

(Parking Tariff MODEL)

set of parking CHARGE BANDs that describe the cost of using a PARKING or PARKING AREA

3.76

parking tax rate

(Parking Tariff MODEL)

DISCOUNTABLE FARE PRICE that may be associated with all or any of a USAGE PARAMETER, DISTANCE MATRIX ELEMENT, FARE STRUCTURE ELEMENT or GROUP OF ACCESS PARAMETERs

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3.77

fare contract

(Fare Contract MODEL)

contract with a particular (but possibly anonymous) customer, ruling the consumption of transport services (and joint services)

Note 1 to entry: FARE CONTRACT may be designed for a fixed SALES OFFER PACKAGE (e.g. ticket) or to allow successive purchases of SALES OFFER PACKAGEs

3.78

fare contract entry

(Fare Contract MODEL)

log entry describing an event referring to the life of a FARE CONTRACT: initial contracting, sales, validation entries, etc.

Note 1 to entry: subset of a FARE CONTRACT ENTRY is often materialised on a TRAVEL DOCUMENT

3.79

penalty policy

(Charging Usage Parameters MODEL)

Policy regarding different aspects of penalty charges, for example repeated entry at the same station, not having a ticket etc.

3.80

post-paid ticketing

(Use Case)

user is charged sometime after using the transport service (detailed description of process see below)

3.81

pre-assigned fare product

(Fare Product MODEL)

FARE PRODUCT consisting of one or several VALIDABLE ELEMENTs, specific to a CHARGING MOMENT

3.82

prepaid ticketing

(Use Case)

user is charged for either a fare product (ticket) or a deposit prior to riding (detailed description of process see below)

3.83

price

(Use Case)

Value of fare or tariff

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3.84

price group

(Fare Price MODEL)

grouping of prices, allowing the grouping of numerous possible consumption elements into a limited number of price references, or to apply grouped increase, in value or percentage

3.85

price unit

(Fare Calculation Parameters MODEL)

unit to express prices: amount of currency, abstract fare unit, ticket unit or token etc.

3.86

priceable object

(Fare Price MODEL)

element which may have a FARE PRICE

3.87

pricing parameter set

(Fare Calculation Parameters MODEL)

set of parameters controlling pricing calculations

3.88

pricing rule

(Fare Calculation Parameters MODEL)

rule used for the calculation of FARE PRICE, determined either by a set of parameters to be applied to a reference price or by a more complex algorithm

3.89

pricing service

(Fare Calculation Parameters MODEL)

web service used to provide prices dynamically at time of booking or purchase

3.90

product validity parameter

(Validity Parameters MODEL)

type of VALIDITY PARAMETER linked to fare products and/or their distribution

3.91

purchase window

(Booking Usage Parameters MODEL)

Period in which the product shall be purchased

3.92

quality structure factor

(Quality Fare Structure MODEL)

factor influencing access rights definition or calculation of prices, based on the quality: traffic congestion threshold, early/late reservation etc.

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3.93
quality structure factor price
(Quality Fare Structure MODEL)
set of all possible price features of a QUALITY STRUCTURE FACTOR, e.g. default total price etc.

3.94
refunding
(Booking Usage Parameters MODEL)
Whether and how the product may be refunded

3.95
replacing
(Booking Usage Parameters MODEL)
whether and how the access right may be replaced

3.96
reselling
(Booking Usage Parameters MODEL)
Common resale conditions (i.e. for exchange or refund) attached to the product

3.97
reserving
(Booking Usage Parameters MODEL)
indicating whether the access right requires reservation

3.98
residential qualification
(Eligibility Usage Parameters MODEL)
parameter providing an authorisation to consider a user as being characterised by a USER PROFILE

3.99
retail consortium
(Retail MODEL)
group of ORGANISATIONs formally incorporated as a retailer of fare products

3.100
retail device
(Retail MODEL)
retail device used to sell fare products

Note 1 to entry: Its identity can be used to record fulfilment and support security processes

3.101
round trip
(Travel Usage Parameters MODEL)
Properties relating to single or return trip use of an access right

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3.102
rounding
(Fare Calculation Parameters MODEL)
Parameters directing the rounding of values that are the result of calculations

3.103
rounding step
(Fare Calculation Parameters MODEL)
rounding step to use to round a range of values

Note 1 to entry: If step stable rounding is used, any value larger than the step key and smaller that the next step key should be rounded to this value

3.104
routing
(Travel Usage Parameters MODEL)
Limitations on routing of an access right

3.105
routing validity parameter
(Validity Parameters MODEL)
type of VALIDITY PARAMETER linked to specific routing

3.106
sale discount right
(Fare Product MODEL)
FARE PRODUCT allowing a customer to benefit from discounts when purchasing SALES OFFER PACKAGEs

3.107
sale transaction
(Sales Transaction MODEL)
SALE of a FIXED PACKAGE or a SALE of a RELOADABLE PACKAGE

3.108
sales notice assignment
(Sales Offer Package MODEL)
assignment of a NOTICE to a SALES OFFER PACKAGE or a GROUP OF SALES OFFER PACKAGEs

3.109
sales offer entitlement given
(Sales Offer Entitlement Parameters MODEL)
Parameter indicating whether a particular SALES OFFER PACKAGE provides an entitlement to buy or use an access right

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3.110

sales offer entitlement required

(Sales Offer Entitlement Parameters MODEL)

Parameter indicating whether a particular SALES OFFER PACKAGE requires an entitlement to by or use an access right

3.111

sales offer package

(Sales Offer Package MODEL)

package to be sold as a whole, consisting of one or several FARE PRODUCTs materialised thanks to one or several TRAVEL DOCUMENTs

Note 1 to entry: FARE PRODUCTs may be either directly attached to the TRAVEL DOCUMENTs, or may be reloadable on the TRAVEL DOCUMENTs

3.112

sales offer package element

(Sales Offer Package MODEL)

assignment of a FARE PRODUCT to a TYPE OF TRAVEL DOCUMENT in order to define a SALES OFFER PACKAGE, realised as a fixed assignment (printing, magnetic storage etc.) or by the possibility for the FARE PRODUCT to be reloaded on the TYPE OF TRAVEL DOCUMENT

3.113

sales offer package price

(Sales Offer Package MODEL)

set of all possible price features of a SALES OFFER PACKAGE: default total price etc.

3.114

sales offer package substitution

(Sales Offer Package MODEL)

Information on the preferred substitution of packages with other packages if a quota restricted product is no longer available

3.115

sales transaction frame

(Sales Transaction Frame MODEL)

set of SALES TRANSACTION data elements (SALES TRANSACTIONs, etc.) to which the same VALIDITY CONDITIONs have been assigned

3.116

scoping validity parameter

(Validity Parameters MODEL)

Grouping of assignments to elements

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3.117

series constraint

(Fare Zone MODEL)

extension of a DISTANCE MATRIX ELEMENT (a cell of an origin-destination matrix for TARIFF ZONEs or SCHEDULED STOP POINTs) expressing a fare distance for the corresponding trip (value in km, number of fare units etc.), constrained to specific routes.SERIES CONSTRAINTs are mainly used for rail fares

3.118

series constraint price

(Fare Zone MODEL)

set of all possible price features of a SERIES CONSTRAINT: default total price etc.

3.119

service access right

(Fare Product MODEL)

immaterial marketable element dedicated to accessing some services

3.120

service validity parameter

(Validity Parameters MODEL)

type of VALIDITY PARAMETER related to service characteristics (e.g. class)

3.121

specific parameter assignment

(Sales Transaction MODEL)

VALIDITY PARAMETER ASSIGNMENT specifying practical parameters during a TRAVEL SPECIFICATION, within a given fare structure (e.g. the origin or destination zone in a zone-counting system)

3.122

start time at stop point

(Quality Fare Structure MODEL)

time at which a Fare time band (time band peak, off peak) is deemed to begin for trips starting at a particular station

3.123

step limit

(Travel Usage Parameters MODEL)

Geographical parameter limiting the access rights by counts of stops, sections or zones

3.124

subscription

(Ue Case)

Purchase of a product by staged payments made on a regular basis

3.125

subscribing

(Charging Usage Parameters MODEL)

Parameter specifying conditions relating to paying for a product by subscription

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3.126

supplement product

(Fare Product MODEL)

PRE-ASSIGNED FARE PRODUCT that will provide additional right when used with (as a complement of) another (reserved seat, second to first class upgrade, etc.)

Note 1 to entry: SUPPLEMENT PRODUCT also usually means supplement price

3.127

suspending

(Travel Usage Parameters MODEL)

Parameter specifying conditions relating to suspending use of a season pass

3.128

tariff

(Fare Structure Element MODEL)

particular tariff, described by a combination of parameters

Note 1 to entry: From a planner perspective: the set of discrete elements to be used according to the fare calculation rules to calculate the fare

3.129

temporal validity parameter

(Validity Parameters MODEL)

Grouping of temporal validity parameters

3.130

third party product

(Fare Product MODEL)

FARE PRODUCT that is marketed together with a Public Transport FARE PRODUCT

3.131

time interval

(Time Fare Structure MODEL)

time-based interval specifying access rights for the FARE STRUCTURE ELEMENTs within the range of this interval: 0-1 hour, 1-3 days etc.

3.132

time interval price

(Time Fare Structure MODEL)

set of all possible price features of a TIME INTERVAL, e.g. default total price etc.

3.133

time structure factor

(Time Fare Structure MODEL)

value of a TIME INTERVAL expressed by a TIME UNIT

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3.134
time unit
(Time Fare Structure MODEL)
unit for calculating time-based graduated fares

3.135
time unit price
(Time Fare Structure MODEL)
set of all possible price features of a TIME UNIT: default total price etc.

3.136
transferability
(Booking Usage Parameters MODEL)
number and characteristics of persons entitled to use the public transport service instead of the original customer

3.137
travel document
(Travel Document MODEL)
particular physical support (ticket, card, etc.) to be held by a customer, allowing the right to travel or to consume joint-services, to proof a payment (including possible discount rights), to store a subset of the CONTRACT liabilities or a combination of those

3.138
travel specification
(Sales Transaction MODEL)
recording of a specification by a customer of parameters giving details of an intended consumption (e.g. origin and destination of a travel)

3.139
type of concession
(Usage Parameters MODEL)
classification of USER PROFILE by type of person eligible to use it

3.140
type of fare product
(Fare Product MODEL)
classification of FARE PRODUCTs

3.141
type of fare contract
(Fare Contract MODEL)
classification of FARE CONTRACT

3.142
type of fare contract entry
(Fare Contract MODEL)
classification of FARE CONTRACT ENTRYs

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3.143
type of retail device
(Retail MODEL)
classification of RETAIL DEVICEs

3.144
type of sales offer package
(Sales Offer Package MODEL)
classification of SALES OFFER PACKAGEs

3.145
type of tariff
(Fare Structure Element MODEL)
classification of TARIFFs to express the different classes of fares

3.146
type of travel document
(Travel Document MODEL)
classification of TRAVEL DOCUMENTs expressing their general functionalities and local functional characteristics specific to the operator

Note 1 to entry: Types of TRAVEL DOCUMENTs like e.g. throw-away ticket, throw-away ticket unit, value card, electronic purse allowing access, public transport credit card etc. may be used to define these categories

3.147
type of usage parameter
(Usage Parameters MODEL)
classification of USAGE PARAMETERs to express the nature of parameters

3.148
usage discount right
(Fare Product MODEL)
FARE PRODUCT allowing a customer to benefit from discounts when consuming VALIDABLE ELEMENTs

3.149
usage parameter
(Usage Parameters MODEL)
parameter used to specify the use of a SALES OFFER PACKAGE or a FARE PRODUCT

3.150
usage parameter price
(Usage Parameters MODEL)
set of all possible price features of a USAGE PARAMETER: discount in value or percentage etc.

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3.151

usage validity period

(Travel Usage Parameters MODEL)

time limitation for validity of a FARE PRODUCT or a SALES OFFER PACKAGE

Note 1 to entry: It may be composed of a standard duration (e.g. 3 days, 1 month) and/or fixed start/end dates and times

3.152

user profile

(Eligibility Usage Parameters MODEL)

social profile of a passenger, based on age group, education, profession, social status, sex etc., often used for allowing discounts: 18-40 years old, graduates, drivers, unemployed, women etc.

3.153

validable element

(Validable Element MODEL)

sequence or set of FARE STRUCTURE ELEMENTs, grouped together to be validated in one go

3.154

validable element price

(Validable Element MODEL)

set of all possible price features of a VALIDABLE ELEMENT: default total price, discount in value or percentage etc.

3.155

validity parameter assignment

(Validity Parameters MODEL)

ACCESS RIGHT PARAMETER ASSIGNMENT relating a fare collection parameter to a theoretical FARE PRODUCT (or one of its components) or a SALES OFFER PACKAGE

4 Symbols and abbreviations

For the purposes of this document, the symbols and abbreviations given in CEN/TS 16614-1:2019 apply.

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5 Use Cases for Fare Exchange

5.1 Purpose

This section describes possible use cases for the application of NeTEx Part 3. The use cases should help a more precise understanding of the scope of the standardization work for fare exchange. Use cases contained in this section depend on the concepts from NeTEx Part 1 and 2.

5.2 Business context

5.2.1 Fare planning process

5.2.1.1 Fare structures and fare products

The fare planning use cases are divided into two main functional areas, depending on the type of business process or the type of information that is involved:

- Provision of **Fare Structure** information:
  This considers the creation of information regarding the Fare Structure, i.e. the rules and their parameters used to determine the qualitative, quantitative and pricing conditions for accessing public transport.
  A distinction is made between distance, geographic unit and time-based fares. Together they can be regarded as the addition of the notion of fares to the PT network, and may involve some network related elements, for example the choice of Tariff Zones or border points. In addition, specific use cases are presented that consider the creation and setting of general concessionary fares.
- Provision of **Fare Product** information:
  This considers the creation of Fare Product information.
  A Fare Product is generic description of a set of marketable access rights, e.g. single way ticket from A to B or free travel in 3 adjacent zones. The generic description could be defined in a form of product templates that are used to market access rights.
  Fare Products are entities that can be marketed and sold to and used by PT travellers to obtain access rights and by PT operators to validate access to PT services. Fare Product determined fares are based on the Fare Structure. Possession of a Fare Product gives a specific right to access a PT service. A Fare Product defines when a traveller is charged, either when buying the product, when enacting the access right or a combination of both. I.e. the possession of a Fare Product enables the traveller to use PT services and to be charged for this use.

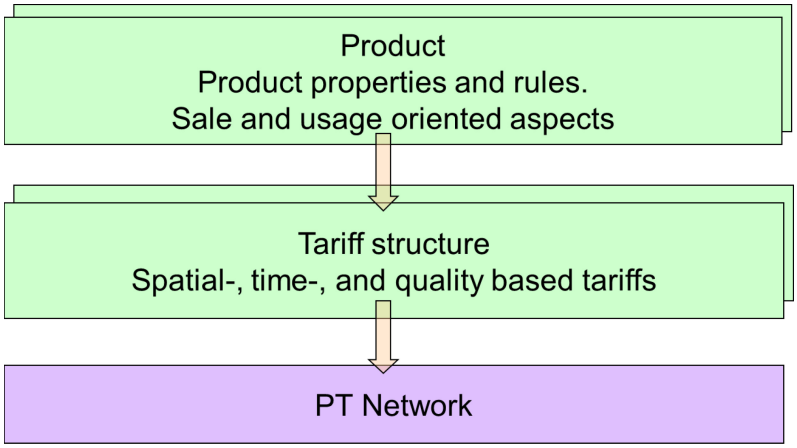


Figure 1 — PT fare overview (Schematic)

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Separating the concerns of Fare Structure and Fare Product has significant advantages both for business processes and for technical implementation:

- It enables PT authorities and operators to define and utilise marketable travel products that are based on a reusable Fare Structure, but distinct. It decouples the maintenance of fare products from the maintenance of the fare structure. E.g. annual changes in Fare Structure do not cause a need for drastic changes in products. Special event related products that provide a reduction with respect to the Fare Structure can be defined, sold and used without a need to change the Fare Structure itself at all.
- It enables the definition of simple fare structures and simple fare products that in combination are able to support a wide variety of business requirements.

5.2.1.2 Fare price

In both the Fare Product and the Fare Structure the actual price values are kept logically distinct from the elements that they price. This permits the use of successive revised prices sets with the same fare product and fare structure, and the separate exchange of prices and price updates.

Depending on national or regional law or business models that can be specific to operator or travel mode (e.g. heavy rail), prices can either have a static or dynamic nature.

5.2.1.2.1 Static prices

The tariffs and prices have a static nature and are publicised along with the underlying structure. This information has a fixed start and end date validity within which tariffs and prices are static. Depending on the use case, either the discrete prices of underlying features may be exchanged along with the pricing parameters, or a complete set of pre-computed resolved fares for every allowed combination of features (for which the pricing parameters merely provide justification).

5.2.1.2.2 Dynamic prices

In situations where PT operator competition is significant, and where the necessary advanced systems are in place, tariffs and prices can be varied dynamically. Such tariffs and prices can depend on market or yield based business rules. Prices are obtained by querying a pricing engine for a given set of criteria (e.g. origin destination, type of user) and only an overall current price is disclosed. The calculation process may be opaque and publication of the full list of current prices and the fare calculation algorithms can be restricted.

In either case, in order for the user to select a product for pricing and understand its applicability to her needs, information still needs to be available about the available products in relation to the journeys they price including their pre and aftersales conditions.

The use cases for definition of a dynamic price based fare policy are outside the scope of the NeTEx standard. Use cases that define the organisation of the use of market prices are within the NeTEx scope. However, in case a fare structure is used as a basis for a market price fare policy, these NeTEx use cases can be used internally. The Fare Query model included provides an informative demonstration of how NeTEx parameters can be mapped to typical dynamic systems.

5.2.1.3 Overall fare planning process

A fare planning process will consider the effects of different possible procurements and prices for tickets. Consequently the process requires modelling of expected traffic levels against the putative fare

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structure to decide where to place fare boundaries, what products to offer and what prices need to be set to obtain satisfactory returns on investment. This may be an iterative process that must also consider other factors such as network congestion and existing retail infrastructure and ticket validation methods. Sometimes social policy drives the offering of certain products – for example the provision of free passes for veterans or the elderly must also be modelled and costed – since they must be accounted and paid for even if "free" to the user. Although for purposes of exposition the following use cases break the fare policy processes down into discrete steps and separate the development of fare structures from fare products, in reality the two are closely interdependent and development involves the iterative consideration of the overall picture.

The choice of use cases also depends on the degree of transparency of the pricing process being offered. Where only the final resolved prices for every possible combination are exposed (say as a fully populated fare table) it is not necessary to expose all the underlying pricing factors, dependencies and discounts used to compute them. Only a final set of computed fares need be disclosed. In other cases, it is desirable to exchange a set of base fares with the necessary fare structure elements and pricing parameters to derive prices for all the dependant elements. NeTEx can be used for both cases (i.e. "Fare Table Exchange" and "Fare Structure Exchange").

The fare planning process can be represented by a sequence of workflows (high level use cases):

1. Describe overall fare structure type (rules, parameters determining the access rights).
2. Determine spatial/temporal/quality parameters of the fare structure: (i) whole network, whole line (i.e. flat fares), (ii) point to point (ii) zonal (ii) fare stage (iv) sequence of stages (iv) composite variants, (v) time intervals, etc.
3. Determine sequences of fare structure elements grouped together to be validated in one go ("validable elements": e.g. bus ride, train ride, metro trip, metro ride, etc.
4. Choose limitation parameters for access rights e.g. round trip allowed, specific user profiles, group tickets, etc.
5. Determine fare products, i.e. "marketable elements" classified according to the "charging moment", e.g. pre-paid monthly pass, post-paid monthly pass, etc.
6. Add pricing rules and price parameters.
7. Test these against predicted yields and iterate steps 1-6.
8. Choose travel documents and distribution channels.
9. Add deriving prices.
10. Choose sales offer packages to be marketed to customers.
11. Derive final prices.

However, in reality it is unusual to design a whole fare structure from scratch as a new workflow, or even to do this in order to create a new electronic representation. Rather most aspects of the system will be dictated by the existing network and its fare products, fare collection and fare management systems. Processes are required to make updates to the existing representations of the system (stops, routes, services, products, conditions etc.) and to manage and update the prices for the available fares.

The process and described above may be used as well to represent the main steps to represent an existing situation (fare structure, fare products, prices and all the linked concepts).

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5.2.1.3.1 Workflow for creation and maintenance of Fare Structures

The workflow for creation and maintenance of fare structure requires the choice of a fare model that suits the characteristics of the mode and network (e.g. urban mass transit, long distance rail, rural bus etc., etc.); the available channels for ticket retailing and the viable methods of ticket validation, and the required business yields for the expected (and likely fraud) levels. Fare models between different regions, operators and modes will be significantly different.

The definition of a fare structure is based in effect on generic quantitative rules that influence the access rights regulating the consumption, together with the price a passenger has to pay for a specific consumption factor: limitation of the duration or the length of a trip, price based on the number of zones crossed, etc.

These rules describe the use of the transport system in terms of space, time and service quality. Therefore, space-based, temporal and quality factors may need be specified.

A particular version of all the fare structure, i.e. of the rules and associated parameter values will be called tariff in this standard.

A fare structure typically contains base prices optionally enhanced with price differentiations for modality, user profiles, peak / off-peak hours, seat class, etc.

Fares can be flat, i.e. not depending on consumption factors, or progressive, that is increasing in proportion to consumption.

Fare structures differ greatly in their complexity, ranging from a single flat fare to a multi-dimensional matrix of factors connected by a complex object model. The fare model may contain objects such as tariff zones and fare stages that need to be collated with network data such as stop points, and availability restrictions that need to be collated with demand on specific routes. An effective date and (geographical) validity scope will be assigned to the fare structure overall.

The output of all the processes will be fare tables in structured form.

5.2.1.3.2 Workflow for fare calculation and ticket charging

In general, the purchase of a fare product breaks down into several successive steps. This is of particular importance for electronic ticketing systems providing automated fare calculation, but a similar flow for conventional ticketing system processes is observed in the following sections.

5.2.1.3.2.1 Selection of fare product

Whether the selection of a fare product is done prior to a trip, directly after finishing a trip or even later is fundamental to the fare charging process.

In a conventional ticketing system with printed paper tickets or magnetic strip tickets, the fare product, (e.g. a single ride ticket or a season ticket) is selected by the traveller before starting a trip.

The same process may be followed in an electronic ticketing system, where the ticket is provided in electronic form by means of a data set stored on a smartcard or in a back-office system. The traveller may deliberately select a fare product in advance, e.g. a flat rate for a limited region and / or limited

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validity period, which entitles him to unlimited travelling within the chosen scope (in conventional ticketing systems this is a period pass season ticket).

However, in an electronic ticketing system with automated fare product selection (AFC system), the traveller actually only needs an access right to enter the vehicle and start a trip. No fare product selection need necessarily be done at the start of a journey. The selection of the product used for a specific trip (and its accounting) is done by the AFC system after completion of the trip. For example, the AFC system will automatically distinguish whether the dedicated trip is done within the coverage of a season ticket product held by the user, such as a single trip within the limiting scope, or another product), e.g. a single trip in a different zone, or a mixture of existing and additional access rights.

Moreover, if the tariff includes price capping that limits the total fare cost within a given period to a specified limit, the choice of products used to account for the fares may be modified by subsequent travel. For example, after the third ride with a single ride ticket at the same day the previously selected products (three single ride tickets) may be converted to a day ticket.

5.2.1.3.2.2 Price calculation

Thus, the calculation of a ticket price may be done:

- Either prior to the beginning of a trip (conventional ticketing system)
- At the end of a trip (or part of a trip) (automated fare product selection and price calculation system)
- Or sometime later to incorporate rebates like a fare cap or volume discounts.

5.2.1.3.2.3 Charging of ticket price

After making the price calculation, the price can be charged to the customer in a number of different ways. A general distinction is made between **prepaid ticketing** and **post-paid** ticketing.

Prepaid Ticketing

In a conventional ticketing system with preselected products (paper based or electronic) the price will be charged directly after the price calculation by various means, e.g. a self-service ticket machine or at a sales counter.

Smartcard based electronic ticketing systems often require the user to pay an amount of money as a deposit in advance to riding. This is the case for stored value cards, where the deposit is registered on the smart card, but can also be achieved by linking the smartcard to an online system in the cloud that holds the deposit.

In conventional electronic ticketing systems, deposits are used to pay the preselected tickets, so the process is very similar as paying with cash but without the necessity of cash-handling for every transaction. The smartcard may also be enabled as a payment device so that it links directly to a credit or debit card to make a payment for the prepaid travel at the time of purchase (as is the case of a travel payment application actually in a smart credit card).

A refinement (applicable to both prepaid and post-paid ticketing) is to enable a stored value card for automated top-up so that it will be recharged by a credit from a bank or credit card account at regular intervals or at a predefined credit trigger threshold.

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Post-paid Ticketing

Post-paid ticketing systems are characterised by a sales transaction made by the public transport operator on completion of the journey – this may be either a debit for the full amount, or an adjustment against a prepaid deposit charged at the start of the journey. In both cases accounting is only completed after riding.

For stored value cards, the debit may be made against the store. For travel cards that allow credit (including for example the use of nfc credit cards to pay fares) the amount will later be charged to the user by deducting a bank or credit card account.

Stored value cards may be anonymous (i.e. the operator does not know who the owner is other that a passenger can show the card as proof of a ticket) or personal – i.e. registered with the operator, and traceable to an individual. Usually such cards are non-transferable and supported by a photo or other verification mechanism.

To summarise: for prepaid ticketing the user is charged prior to riding for a ticket; for post-paid ticketing the user is charged on completion of the ride (but may also have been required to make a pre-paid deposit when they started the journey).

5.2.1.4 Further evolution of fare systems

Fare structures for complex networks represent a significant investment and once established tend to be relatively stable, with only evolutionary changes to services and routes within an established overall structure, for example the addition of new stops or services on existing routes. There is a continuing need however to periodically re-price existing fares, and it is therefore important to have separate price data with well-defined validity.

There is also a continuing need to introduce new fare products to increase yields from the network; these will typically be constrained to the existing fare collection infrastructure but may products with specific limitations targeted at different users and different travel times, for example promotion passes for tourists. Many operators thus support set two sets of products: a regular set of standard products and fare offerings covering all the network, and an ad hoc set of promotional products intended to generate additional custom at particular times. These will normally have more restrictive commercial conditions.

5.3 Actors and use case types

The following table gives an overview of information technology systems that are likely to use the NeTEx Part 3 interface. The “Producer” and “Consumer” columns indicate whether the systems will provide or receive the information content. In the last column examples for organisations are given that might operate such systems. The list in this table is not complete and may be extended.

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Table 1 — NeTEx Part 3 actors

Systems	Producer	Consumer	Organisations
Service tendering and timetable registration systems: NeTEx Part 3 compliant fare structure information (i.e. tariffs, tariff zones)	x	x	Public transport authorities
Fare Management and Planning Systems: NeTEx Part 3 compliant entities for determination of pre- and post-sale conditions (i.e. generic parameter assignment for attaching conditions for the fare product retail process)	x	x	Public transport authorities, public transport operators
Journey planning systems: NeTEx Part 3 compliant fare product information	x	x	Public transport authorities, public transport operators
Ticket selling systems: NeTEx Part 3 compliant price entities (i.e. sales offer packages, fare products, validable element, usage parameters, access rights, etc.) and customer entities (i.e. fare contract, customer, user profile) that accompany route information (NeTEx Part 2).	x	x	Public transport authorities, public transport operators
Automated fare collection (AFC) systems (automatic ticket barriers (gate, turnstile) with fare collection (mechanical, infrared, magnetic)): NeTEx Part 3 compliant travel document, fare product data, access rights in product, access right parameter assignments, border point, blacklists.	x	x	public transport operators

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Systems	Producer	Consumer	Organisations
Passenger information systems (i.e. on-board fare displays): NeTEx Part 3 compliant fare price entities for devices (fare prices charged at usage)	x	x	public transport operators
Demand responsive transport (DRT) or Dial-a-Ride Transit (DART) systems: NeTEx Part 3 compliant graduated time-based fare structure entities (i.e. time interval price, time structure factor) and graduated geographically-based fare structure entities (i.e. geographical unit, geographical interval, border point) for (non-)public, (non-)commercial mass transport.	x	x	Demand responsive transport operators
Mapping systems: NeTEx Part 3 compliant price entities for public transport journey routes		x	Commercial and non-commercial services providers like Google Maps, Yellow Pages, etc.
Strategic planning systems: NeTEx Part 3 compliant price entities for planning and decision making in the development of public transport: controllable element price, fare structure element price, geographical interval price, distance matrix price, time interval price, validable element price, usage parameter price, fare product price, sales offer package price.		x	All levels of public transport authorities
General third-party systems		x	Various

The use cases are subdivided into two main groups:

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- A set of use-cases that aim to define **a fare policy.** These use cases comprise the definition of the basic features of a **fare structure** and the definition of **fare products** that use the basic fare structure to determine the sale and usage prices.
- A set of use cases that aim to **organise usage** of the **fare policy for passenger information on fares**, fare information to feed sales channels and fare information to feed other operational processes such as validation. These usage processes are partially executed by IT devices. Specific information to configure these devices, such as security sensitive data, are outside the scope of NeTEx.

5.3.1 Use Cases for Fare Policy

The fare policy use cases define the structural elements (fare structures) of a fare (network scope, basic geographical and temporal factor, fare price) and fare products (access rights, entitlements).

5.3.1.1 Provide data for determination of fare network scope (part of fare structure)

FARE-001-NETWORK-X: use cases for determination of relevant PT network scope structures that apply to a fare.

5.3.1.2 Provide data for determination of fare price (part of fare structure)

FARE-001-PRICING-X: use cases for determination of fare price structure parameters.

5.3.1.3 Provide data for determination of basic fare tariffs (part of fare structure)

FARE-001-TARIFF-X: use cases for determination of basic tariff-based fare structure (network) elements.

5.3.1.4 Provide data for determination of fare products

FARE-001-PRODUCT-X: use cases for determination of fare product, which gives the PT user right to access and use PT transport.

5.3.2 Use Cases for Organisation of Fare Policy Usage

5.3.2.1 Provide data for distribution of information about fare products

FARE-002-INFORMATION-X: use cases that describe the organisation and distribution of fare data to downstream systems such as journey planners.

5.3.2.2 Provide data for organisation of fare products sales

FARE-002-SALES-X: use cases for distribution of fare parameters to sale systems.

5.3.2.3 Provide fare data for support of PT operations

FARE-002-OPERATIONS-X: use cases for distribution of fare data for operational support.

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5.4 Excluded Use Cases

Examples that illustrate what is out of the scope of NeTEx.

Table 2 — Excluded Use Cases

Excluded use cases or business domains	Reason for exclusion
Provision of fare information to validation devices	Specific provision of fare information to validation devices is out of NeTEx scope. NeTEx Part 3 provides entities for validation process (i.e. VALIDABLE ELEMENTs like ACCESS RIGHT IN PRODUCT) in the Fare Product MODEL, which may be consumed by validation devices.
Provision of fare information to sale devices	Specific provision of fare information to sale devices is out of NeTEx scope. NeTEx Part 3 provides entities for RETAIL model, which identifies RETAIL CONSORTIUMs, ORGANISATIONs who sell products, and RETAIL DEVICEs used to sell products.
Customer registration and identification	Specific support for the management of registration and identification of customers in public transport is out of NeTEx scope. NeTEx Part 3 provides entities within TRAVEL DOCUMENT MODEL, which enable pairing of a TRAVEL DOCUMENT with a CUSTOMER's identity at the time of a SALE TRANSACTION.
Purchasing and fulfilment	NeTEx supports only basic purchasing and fulfilment parameters like how a product may be purchased (DISTRIBUTION CHANNEL, i.e. online) and how a purchase is subsequently delivered (FULFILMENT METHOD, FULFILMENT METHOD PRICE, i.e. Self-printing). The rest of the purchasing and fulfilment processes is out of NeTEx scope.
Calculation of fare prices	Specification of entities that would model algorithms for fare price calculations are out of NeTEx scope. NeTEx provides only entities for exchange of product price information.

5.5 Use Cases

5.5.1 Collection of Use Cases

The use cases in this section describe exchange of fare-related information. They are compliant with the use case categories for fare exchange identified in the NeTEx Part 1 document and subsequently to functional areas in Transmodel:

- FARE-001-X: Definition of fare policy (fare structure, fare products) / (Transmodel: AREA 4)
- FARE-002-X: Organisation of fare policy usage (fare policy implementation, tickets) / (Transmodel: AREA 21)

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The use cases are not directly NeTEx use cases. The following tables describe how NeTEx is used to facilitate these use cases and which requirements for NeTEx originate from them.
Use cases number 1-X originate primarily from FareXChange, numbers X - 46 from IFOPT.
The numbering may have gaps because of removal of use cases. (Numbers are currently persistent.)

5.5.1.1 Provide data for definition of fare network scope (part of fare structure)

The use cases are denoted as FARE-001-NETWORK-X where X is the ordered number

5.5.1.1.1 Use Case: Determination of basic fare structure network scope

Use Case: FARE-001-NETWORK-001 (#1)	
Name	Determination of basic fare structure network scope.
Source	Transmodel, FareXChange, BISON, NeTEx, TAP/TSI
Description	Tariffs will apply to a given network scope that is defined by the PT Operator, domain, line, group of lines, mode, tariff zones, etc., based on the network characteristics Define the scope for the tariff structure in terms of: • **Geography**: network domain, group of lines, line. • **Modes**: the mode or modes the tariff is valid for within the geographical scope. The scope can be defined at alternative abstraction levels: • For the entire tariff structure and implicitly for the tariff information components within. For example, the zones of a metro network. • Explicitly for the information components within the tariff structure, e.g. for point to point fares described in a Distance Matrix.
NeTEx contribution	NeTEx provides a means to exchange a representation of the network and subsequent changes to it. The same elements are used for network and timetable descriptions in NeTEx Part 1 and 2, so the fare structure can be related to the timetabled journeys.
Main actors	Fare planning systems.
Main objects	Part 1: TRANSPORT MODE, LINE, LINE SECTION, SCHEDULED STOP POINT, TARIFF ZONE, VALIDITY CONDITION, TOPOGRAPHICAL PLACE. Part 2: VEHICLE JOURNEY, SERVICE JOURNEY, GROUP OF SERVICEs, TYPE OF SERVICE, TYPE OF PRODUCT CATEGORY. Part 3: FARE ZONE, FARE SECTION, BORDER POINT, DISTANCE MATRIX ELEMENT, GROUP OF DISTANCE MATRIX ELEMENTs.

Some examples of validity scope are given below:

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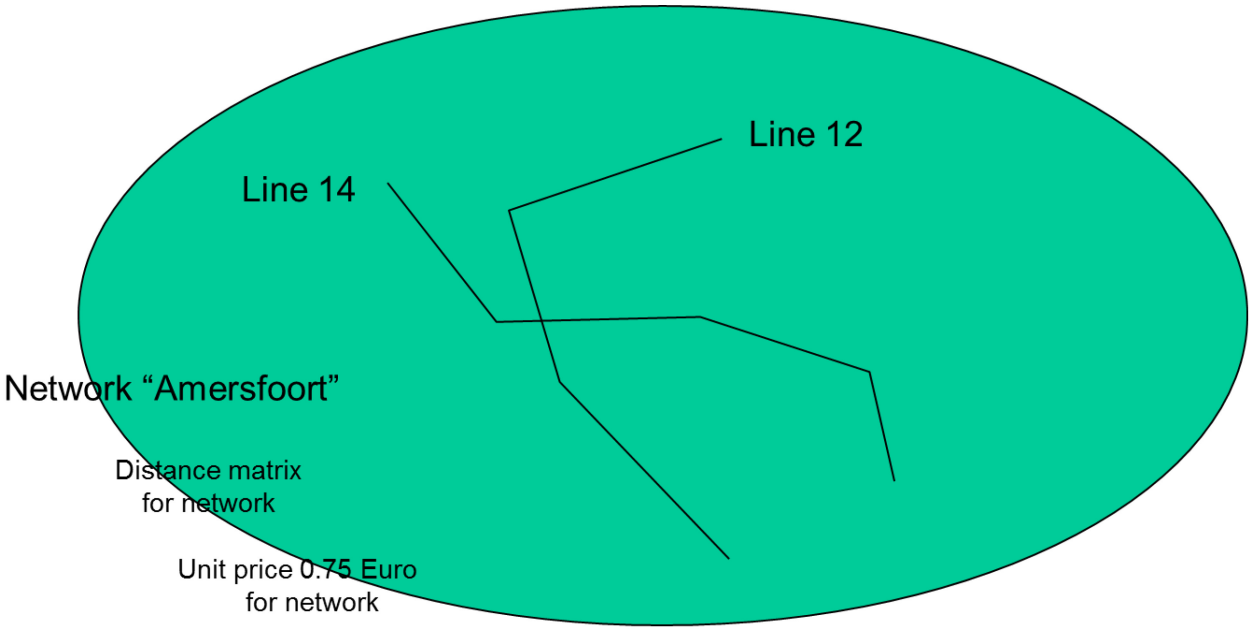


Figure 2 — Example of a fare structure that contains an OD matrix and a unit price (EXM)

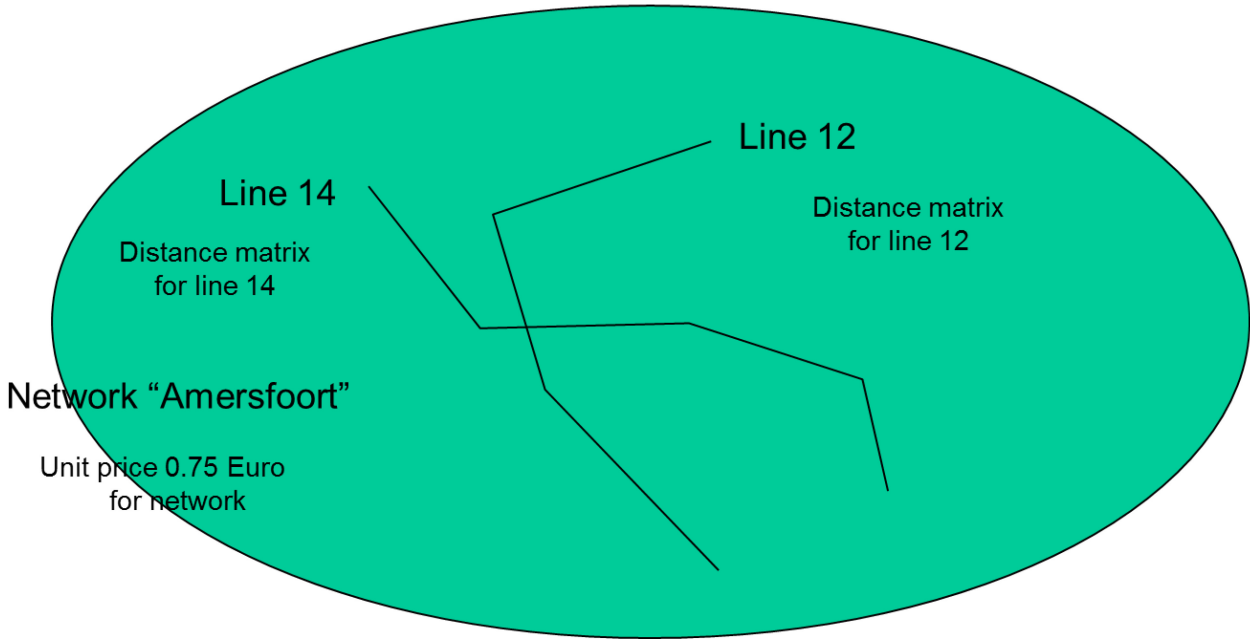


Figure 3 — Example with OD matrices for each line within and a unit price for the entire network (EXM)

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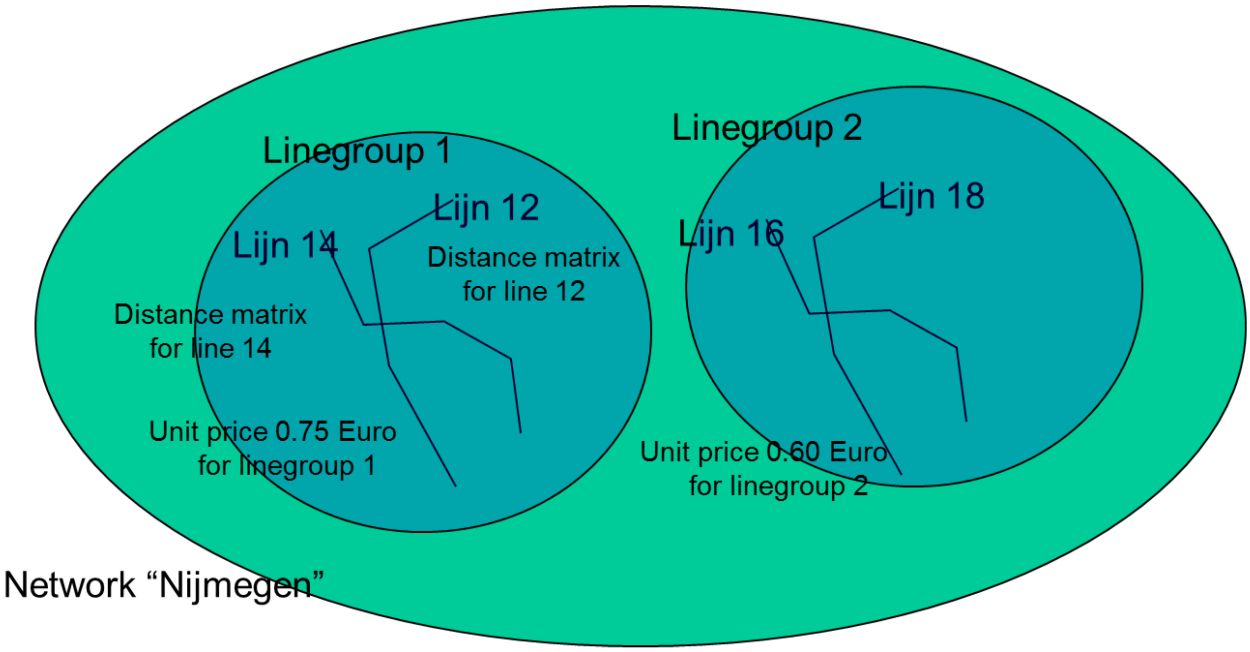


Figure 4 — Example with line groups, OD matrices for each line and a unit price for each line group. (EXM)

5.5.1.1.2 Use Case: Demarcating Fare stages or Fare zones / honeycombs

Use Case: FARE-001-NETWORK-002 (#2)	
Name	Demarcating Fare stages or Fare zones / honeycombs
Source	Transmodel, FareXChange, BISON, NeTEx
Description	In the case where geographically defined space-based factors are used, such as zones or stages, they need to be defined explicitly. A zone or comb can be seen as a layer on stops. Within a stage, zone (or comb) a tariff is flat. A zone or comb can be part of an OD matrix to define tariffs between them. A stage is a layer on a route (or several routes) that defines geographical factors that depend on the start of a journey, e.g. 0 to 3 stops ahead, 4 to 6, etc. ***Fare zones and combs:*** A comb is equivalent to a zone for the level of definition that is required here [2]. Zonal fares require the geographic delineation of a fare zone. Each fare zone will have a different name or number within the transport network. Each zone will be bounded by a polygon or more complex shape e.g. torus. Fare zones may overlap, i.e. a stop may be in two zones. Fare zone can be concentric. Fare zone can form hierarchies containing sub- and super- zones. Define the Fare Zones in terms of:

[2] For instance, the comb structure as used in Berlin is similar to the zone structure that is used in the Netherlands. The zone structure as used in Berlin is quite different geographically to the zones in the Netherlands. However, they can all be defined in terms of groups of points or polygons and the fact that the tariff is flat within a zone or comb is also a common feature.

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	• **Explicitly**: every single stop in the network is directly 'attached' to the named zone. This representation is used for fare calculation purposes. • **Indirectly**: Zone areas are described by a polygon and fares are considered to be in the zone if they reside within that boundary. This representation is used for presentation purposes, e.g. on maps. • **Hierarchy**: a zone can optionally be attached to a sub- or super- zone. E.g. the Berlin combs are part of the bigger zone in which they reside. ***Fare stages:*** Fare stages are geographical points that demarcate a transition boundary for charging a fare. A stage may be at a stop, or between stops.
NeTEx contribution	NeTEx provides a means to exchange the zone and stages and subsequent updates. Common Network Definition elements from Part 1 are reused, with fare related properties attached to them.
Main actors	Fare planning systems.
Main objects	Part 1: SCHEDULED STOP POINT, TARIFF ZONE, LINE, LINE SECTION, POINT IN JOURNEY PATTERN, Part 3: FARE ZONE, FARE SECTION, FARE STRUCTURE ELEMENT, BORDER POINT, FARE SCHEDULED STOP POINT. GEOGRAPHICAL INTERVAL

5.5.1.1.3 Use Case: Define routes and transfer points

Use Case: FARE-001-NETWORK-003 (#3)	
Name	Define routes and transfer points
Source	Transmodel, FareXChange, BISON, TAP/TSI
Description	In some systems, in particular long-distance rail, the fares will depend on the routes taken or the transfers points used. There may be different prices for alternative routes and / or alternative transfer points For the fare structure the available routes may be specified as constraints on point to point fares
NeTEx contribution	NeTEx provides a means to exchange the actual routes and transfer points and subsequent updates.
Main actors	Fare planning systems.
Main objects	SERIES CONSTRAINT, FARE POINT IN PATTERN ROUTING usage parameter

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5.5.1.1.4 Use Case: Projections of Fare elements on maps

Use Case: FARE-001-NETWORK-004 (#4)	
Name	Projections of Fare elements on maps
Source	Urban fare systems
Description	Visualisations of the zones, fare stages and or routings will be needed for passenger information, for example on maps. These may apply to whole areas, or to specific sections of route Stops and zones may require include projections onto different coordinate systems with colours and symbols.
NeTEx contribution	The NeTEx representation can include projections onto different coordinate systems.
Main actors	Fare planning systems.
Main objects	Part 1: SCHEDULED STOP POINT, TARIFF ZONE, LINE, LINE SECTION, POINT, LINK, ZONE, POINT PROJECTION, LINK PROJECTION, ZONE PROJECTION, SCHEMATIC MAP, LOCATION SYSTEM Part 3: FARE ZONE, FARE SECTION, FARE SCHEDULED STOP POINT, SERIES CONSTRAINT, FARE POINT IN PATTERN

5.5.1.1.5 Use Case: Determination of the basic fare structure factors

Use Case: FARE-001-NETWORK-005 (#5)	
Name	Determination of the basic fare structure factors
Source	Transmodel, FareXChange, BISON, TAP/TSI
Description	Determination of the basic fare structure factors. A fare structure factor represents the basic quantitative value of consumed PT service for which tariffs can be defined. A quantitative value can consist of space, time, qualitative factors or any combination. Define the fare structure factor in terms of: • **Space based.** The most common fare structure rules are space-based, more precisely distance-based. A space-based factor defines a value of distance, represented in a distance unit (e.g. KM), in stops, zones, stages, sections or combinations thereof. and / or • **Time based.** The time-based factors are described in a similar way to the space-based

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	factors. A time-based factor describes values of time for which a tariff can be defined. A time-based factor is a value based on travel time, e.g. minute, hour. and / or • **Quality based factor.** Another way to represent PT consumption is by defining quality factors. Quality-based factors describe the quality categories that are experienced while travelling. For instance, the current level of congestion or occupancy (e.g. in %) may influence the tariff.
NeTEx contribution	NeTEx provides a means to exchange the factors between systems. The factors may be chosen though a planning system or identified from an existing system.
Main actors	Fare planning systems.
Main objects	PART 1: FACILITY SET PART 3: GEOGRAPHICAL STRUCTURE FACTOR, GEOGRAPHICAL INTERVAL, GEOGRAPHICAL UNIT, TIME STRUCTURE FACTOR, TIME INTERVAL, TIME UNIT, QUALITY STRUCTURE FACTOR, TIME DEMAND FACTOR. USAGE PARAMETERs: ROUND TRIP, ROUTING, FREQUENCY OF USE, INTERCHANGING, USAGE VALIDITY PERIOD, etc

5.5.1.2 Provide data for definition of fare pricing (part of fare structure)

The use cases are denoted as FARE-001-PRICING-X where X is the ordered number.

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5.5.1.2.1 Use Case: Determination of price currency and unit

Use Case: FARE-001-PRICING-001 (#6)	
Name	Determination of price units and amounts
Source	Transmodel, FareXChange, BISON, NeTEx, TAP/TSI
Description	Prices shall be given in a specific currency or units • Define the **currency** or currencies in which the prices are represented. E.g. EURO, GBP. • Define the **unit** the prices are represented in. E.g. 0.01, 1 journey The currency and unit can be defined at different levels of specificity: • For the entire tariff structure and implicitly for the tariff information components within. • Explicitly for the information components within the tariff structure, e.g. for a DISTANCE MATRIX or for individual DISTANCE MATRIX ELEMENTs. It is possible to have alternative prices in different currencies.
NeTEx contribution	NeTEx provides a means to exchange the actual currencies and units.
Main actors	Fare planning systems.
Main objects	PRICE UNIT, FARE PRICE. PRICE GROUP, FARE TABLE

5.5.1.2.2 Use Case: Setting rounding and calculation factors

Use Case: FARE-001-PRICING-002 (#7)	
Name	Setting rounding and calculation factors
Source	FareXChange, BISON, TAP/TSI
Description	Where fare calculations take place to derive a fare from base factors, or to derive a fare from another fare, the results may need to be rounded to the nearest viable currency amount, for example 50 cent intervals. Rounding factors can be set for whole fares Another datum of relevance is the actual start and end times of a fare day.
NeTEx contribution	NeTEx provides a means to exchange the actual tariff and different versions of it.
Main actors	Fare planning systems.
Main objects	ROUNDING, ROUNDING STEP, FARE DAY.

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5.5.1.2.3 Use Case: Market segmentation and user eligibility criteria

Use Case: FARE-001-PRICING-002 (#8)	
Name	Market segmentation and user eligibility criteria.
Source	Transmodel, FareXChange, BISON, NeTEx
Description	Particular products may be targeted at specific groups of users: for example, children, seniors, the disabled, disabled companions, veterans, holders of other products such as rail cards etc There may also be products for groups of users of a particular type. To define the eligible user profiles of a product, the following steps are required: • Determination of the criteria to define a user (e.g. age) and the required proof. • Determination of concessionary discounts to be given to these categories of users
NeTEx contribution	NeTEx provides a means to exchange the user profiles and related conditions, and the prices associated with them.
Main actors	Marketing planners, Fare planning systems
Main objects	USER PROFILE, GROUP TICKET, COMMERCIAL PROFILE, COMPANION PROFILE, TYPE OF CONCESSION USAGE PARAMETER PRICE, PRICING RULE, DISCOUNTING RULE, LIMITING RULE.

5.5.1.3 Provide data for determination of basic fare tariffs (part of fare structure)

5.5.1.3.1 Use Case: Define Flat (including zero) prices

Use Case: FARE-001-TARIFF-001 (#9)	
Name	Define Flat (including zero) fare prices
Source	Transmodel, FareXChange, BISON, NeTEx
Description	Some systems, especially bus, use a simple system of flat fares. A flat fare is found in particular in systems for concessionary fares for elderly and disabled people (for example 50p for any journey in Greater Manchester in 2005/06). A special case is zero or “free” fares. In some areas such concessions extend to rail travel as well. Define the flat or zero fare and the conditions under which they are valid. Applicable conditions can be Network properties User profile categories Temporal categories Or any combination of the above.

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Use Case: FARE-001-TARIFF-001 (#9)	
	Note that concessionary travel is not "free" typically it is priced and paid for by government. A related use case, outside of the scope of NeTEx, is to model the actual cost of this travel, requiring tin addition projected traffic volumes and operating costs and margins. However, the value to the user could be priced by using the normal prices for equivalent travel.
NeTEx contribution	Flat fares can be defined for different categories of user and other conditions.
Main actors	Fare planning systems.
Main objects	FARE STRUCTURE ELEMENTs, VALIDITY CONDITION, DAY TYPE. USER PROFILE, USAGE PARAMETER PRICE

5.5.1.3.2 Use Case: Determination of the basic fare structure tariff

Use Case: FARE-001-TARIFF-002 (#10)	
Name	Determination of the basic structure tariff
Source	Transmodel, FareXChange, BISON, NeTEx, TAP/TSI
Description	The base tariff is a set of Priceable elements for each of which a price is set without concessionary reductions. The tariffs are defined for categories or intervals of space (stops, zones or stages), travel time or combination. The basic tariff factors can be represented in several ways. • Define a **factor** unit price. Definition of the price per basic fare structure factor resulting in a linear price function. E.g. 1.05 EUR per Km, 0.79 GBP per minute, 1.50 EUR per zone. • Define a tier table that maps a consumed amount of factor units to the due tariff. E.g. e.g. three coupons for a two-zone journey. • Define an OD distance matrix Definition of a matrix that holds tariff distance and / or the actual tariff that is due while travelling from Origin to Destination. Origins and destinations can be defined as fare points, zones, stages or sections. The pricing may involve estimating traffic volumes along with running costs in order to arrive at a projected revenue and operating profit.
NeTEx contribution	NeTEx provides a means to exchange the actual basic prices and subsequent revisions.
Main actors	Fare planning systems.
Main objects	FARE STRUCTURE ELEMENT, GEOGRAPHICAL STRUCTURE FACTOR, GEOGRAPHICAL INTERVAL PRICE, TIME STRUCTURE FACTOR, TIME INTERVAL PRICE, etc DISTANCE MATRIX ELEMENT, DISTANCE MATRIX ELEMENT PRICE.

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Examples of tariff tables:

Time factor units:

Hours travelled	tariff
0 to 0.5	2.0 EUR
0.5 to 1	3.0 EUR
1 to 1.5	3.75 EUR
Etc.	

Distance factor units:

Zones travelled	tariff
0 to 1	2.0 EUR
1 to 3	3.0 EUR
3 to 6	4.0 EUR
Etc.	

5.5.1.3.3 Use Case: Determination of tariff differentiation based on network properties

Use Case: FARE-001-TARIFF-003 (#11)	
Name	Determination of tariff differentiation based on network properties
Source	Transmodel, FareXChange, BISON, NeTEx, TAP/TSI
Description	Derivative tariffs can be based on network properties, e.g. single or return, mode of transport, express or stopping line, travel class. Derivative tariff prices are usually a simple multiple of the standard or base fare, but an arbitrary pricing rule may be indicated if necessary. • Define the network properties and accompanying multipliers that need to be used to differentiate tariffs. These properties will be represented by validity conditions. and • Define the representation of the derived tariffs. The following representation methods are possible: Multiplier(s) with accompanying conditions that restrict to the corresponding network property. Upon use, in case a condition applies, the selected multiplier is used to multiply the base tariff to obtain the derived tariff. For each determined base tariff, additional derivative tariffs can be added with accompanying conditions that restrict to the corresponding network

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