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| | **Verejná doprava. Sieť a výmena cestovných poriadkov (NeTEx). Príklady, pokyny a vysvetľujúce materiály.** | **TNI CEN/TR 16959**<br><br>01 8563 |

Public transport - Network and Timetable Exchange (NeTEx) - Examples, guidelines and explanatory materials

Táto technická normalizačná informácia obsahuje anglickú verziu CEN/TR 16959:2016.
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TECHNICAL REPORT

RAPPORT TECHNIQUE

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# CEN/TR 16959

May 2016

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English Version

# Public transport - Network and Timetable Exchange (NeTEx) - Examples, guidelines and explanatory materials

Transport Public - Échange des données de réseau et d'horaires (NeTEx)

Öffentlicher Verkehr - Netzwerk- und Fahrplan Austausch (NeTEx) - Beispiele, Vorgaben und erläuterndes Material

This Technical Report was approved by CEN on 4 April 2016. It has been drawn up by the Technical Committee CEN/TC 278.

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**CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels**



Ref. No. CEN/TR 16959:2016 E

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# European foreword

This document (CEN/TR 16959:2016) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

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# Introduction

## 0.1 General information

NeTEx is a series of CEN Technical Specifications dedicated to the exchange of Public Transport scheduled data (network, timetable and fare information) based on:

— Transmodel V5.1 (see [T1], [T1] and [T3]);

— IFOPT (see [I1]);

— SIRI (see [S1], [S2], [S3], [S4], [S5]);

It supports information exchange of relevance to public transport services for passenger information and AVMS (Automated Vehicle Monitoring Systems). Many NeTEx concepts are taken directly from Transmodel and IFOPT; the definitions and explanation of these concepts are extracted directly from the respective documents and reused in NeTEx, sometimes with further adaptions in order to fit the NeTEx context.

The data exchanges targeted by NeTEx are predominantly oriented towards passenger information and also for data exchange between transit scheduling systems and AVMS. However it is not restricted to these purposes, and it can provide an effective solution to many other use cases for transport data exchange

The NeTEx series of documents is divided into three parts, each covering a functional subset of the CEN Transmodel for Public Transport Information:

— Part 1 describes the Public Transport **Network topology** (see [N1]);

— Part 2 describes **Scheduled Timetables** (see [N2]);

— Part 3 covers **Fare information** (see [N3]).

NeTEX is intended to be a general purpose XML format designed for the efficient, updateable exchange of complex transport data among distributed systems. This allows the data to be used in modern web services based architectures and to support a wide range of passenger information and operational applications.

Most public transport modes are taken into account by NeTEx, including train, bus, coach, metro, tramway, ferry, and their submodes. Moreover, it is possible to describe airports and air journeys, but there has not been any specific consideration of any additional provisions that apply especially to air transport.

While there are a number of existing documents available for Timetables, NeTEx is the first systematically engineered document that also covers multimodal Fares.

## 0.2 Compatibility with existing standards and recommendations

The concepts covered in NeTEx that relate in particular to long-distance train travel include:

— rail operators and related organizations;

— stations and related equipment's;

— journey coupling and journey parts;

— train composition and facilities;

— planned passing times;

— timetable versions and validity conditions.

In the case of long distance train, the 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.

As regards the other exchange protocols, a formal compatibility is ensured with TransXChange (UK), VDV 452 (Germany), NEPTUNE (France), UIC Leaflet, BISON (Netherland) and NOPTIS (Nordic Public Transport Interface Standard).

The data exchange is possible either through dedicated web services, through data file exchanges, or using the SIRI exchange protocol as described in Part 2 of the SIRI documentation (see [S2]).

This Technical report is to be used in conjunction with the following documents:

— EN 15531-1, Public transport - Service interface for real-time information relating to public transport operations - Part 1: Context and framework (see [S1]);

— EN 15531-2, Public transport - Service interface for real-time information relating to public transport operations - Part 2: Communications infrastructure (see [S2]);

— EN 15531-3, Public transport - Service interface for real-time information relating to public transport operations - Part 3: Functional service interfaces (see [S3]);

— CEN/TS 15531-4, Public transport - Service interface for real-time information relating to public transport operations - Part 4: Functional service interfaces: Facility Monitoring (see [S4]);

— CEN/TS 15531-5, Public transport - Service interface for real-time information relating to public transport operations - Part 5: Functional service interfaces - Situation Exchange (see [S5]);

— EN 12896, Road transport and traffic telematics - Public transport - Reference data model (see [T1]);

— EN 28701, Intelligent transport systems - Public transport - Identification of Fixed Objects in Public Transport (see [I1]).

## 0.3 NeTEx exchanged information

NeTEx provides a means to exchange data for passenger information such as stops, routes timetables and fares, among different computer systems, together with related operational data. It can be used to collect and integrate date from many different stakeholders, and to reintegrate it as it evolves through successive versions.

All three parts covered by NeTEx use the same framework of *reusable components*, versioning mechanisms, validity conditions, global identification mechanisms, etc., defined in a NeTEx framework in Part 1. NeTEx also includes, container elements called “version frames” to group data into coherent sets for efficient exchange.

NeTEx schema can thus be used to exchange:

— public Transport schedules including stops, routes, departures times / frequencies, operational notes, and map coordinates;

— routes with complex topologies such as circular routes, cloverleaf and lollipops, and complex workings such as short working and express patterns. Connections with other services can also be described;

— the days on which the services run, including availability on public holidays and other exceptions;

— composite journeys such as train journeys that merge or split trains;

— information about the Operators providing the service;

— additional operational information, including, positioning runs, garages, layovers, duty crews, useful for AVL and on-board ticketing systems;

— data about the Accessibility of services to passengers with restricted mobility;

— data are versioned with management metadata allowing updates across distributed systems;

— fare structures, (flat fares, point to point fares, zonal fares);

— fare products (Single tickets, return tickets, day, and season passses etc);

— fare prices that apply at specific dates.

## 0.4 NeTEx exchanging data modality

Data in NeTEx format is encoded as XML documents that should conform exactly to the defined schema, and conformance can be checked automatically by standard XML validator tools. The schema can also be used to create bindings to different programming languages to assist automating part of the implementation process for creating software that supports NeTEx formats.

In this perspective, a NeTEx service need only to implement those elements of relevance to its business objectives – extraneous elements present in the binding can be ignored. Parties using NeTEx for a particular purpose will typically define a “profile” to identify the elements that have to be present and the code sets to be used to identify them.

Documents in NeTEx format are computer files that can be exchanged by a wide variety of protocols (http, FTP, email, portable media, etc). NeTEx publication documents can be used to define files suitable for the bulk exchange of XML documents representing whole data sets (for example all the timetables for an operator).

In addition, a SIRI based NeTEx protocol is specified for use by online web services. It defines NeTEx request and response messages that can be used to request and return data in NeTEx format, and also publish/subscribe messages for push distribution. The responses return a NeTEx XML document that satisfies the request criteria (and also conforms to the NeTEx schema). There is a WSDL binding for this NeTEx service to make it easy to implement services.

NeTEx XML thus serialises complex PT models into a standard flat file format that can be processed cheaply and efficiently using mainstream modern computer technologies.

## 0.5 Motivation

### 0.5.1 Business drivers

Modern public transport services rely increasingly on computerised information systems for passenger information; for example for timetables, for real time data and for ticketing. The increased use of online engines and electronic ticket products in particular requires the representation of timetables, products and fares as digitalised data sets. Such data are typically both inherently complex (since the real-world domains it describes are complex) - and subject to a complex workflow. Data are typically assembled

from many different stakeholders with different responsibilities (for stops, timetables, real time, fare products, pricing etc) and is continually changing - at intervals ranging from the intermittent periodic change of network and timetable data, to the second by second changes of real-time systems. Standardization seeks to provide effective data models that both capture these complex domains as reusable components and to support a workflow that involves continuous integration and validation of data under many different possible configurations of participants.

Well-defined, open interfaces therefore have a crucial role in improving the economic and technical viability of Public Transport Information systems. 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. Furthermore, individual functional modules can be replaced or evolved, without unexpected breakages of obscurely dependent function. Interfaces also allow the systematic automated testing of each functional module, vital for managing the complexity of increasing large and dynamic systems.

### 0.5.2 Technical drivers

Increasing complexity is itself a barrier to the development and uptake of systems, and it is not uncommon to find that organisations develop multiple and sometimes conflicting models to handle different aspects of their business processes, and also to find that the difficulty of changing the system impairs development of the business. Because PT data sets are complex and shared by so many participant, they are especially hard to change and they thus represent a strategic investment. It is thus is important to design them for long term use so that they are expressive enough to capture business requirements and flexible enough to evolve to meet to changing business requirements and use.

### 0.5.3 CEN documents context

NeTEx has been developed under the aegis of CEN and is the most recent development stage in over 15 years work to systemise and harmonize European passenger information data. The work draws on a number of existing national standards applying systematic principles of information architecture to construct flexible models that correctly separate the different concerns of representing and managing data. The keystone is the Transmodel standard (see [T1]), a conceptual model which names and represents PT info concepts for a wide set of functional areas and can be used to compare and understand different models. Transmodel project outputs have been used both to underpin a number of CEN concrete data standards such as SIRI and IFOPT, and to rationalize national standards to allow for harmonization and interoperability. Transmodel has been used to develop NeTEx and is itself being updated to include NeTEx additions. While there are a number of standards available for Timetables, NeTEx is the first systematically engineered document that also covers multimodal Fares.

CEN (European Commitee for Standardization) is Europe’s standardization body. It divides its work under into committees covering different aspects of industry and technology. NeTEx, as a transport Technical Specification is formally produced by Technical Committee 278, Work Group 3, Sub Group 9. Other TC278 WG3 sub groups handle the related standards Transmodel (SG4), SIRI (SG5 Service interface for real-time information) and IFOPT (Identification of Fixed Objects in Public Transport. NeTEx has thus both a concrete series of Technical Specifications, and an open consultative process for maintaining that document.

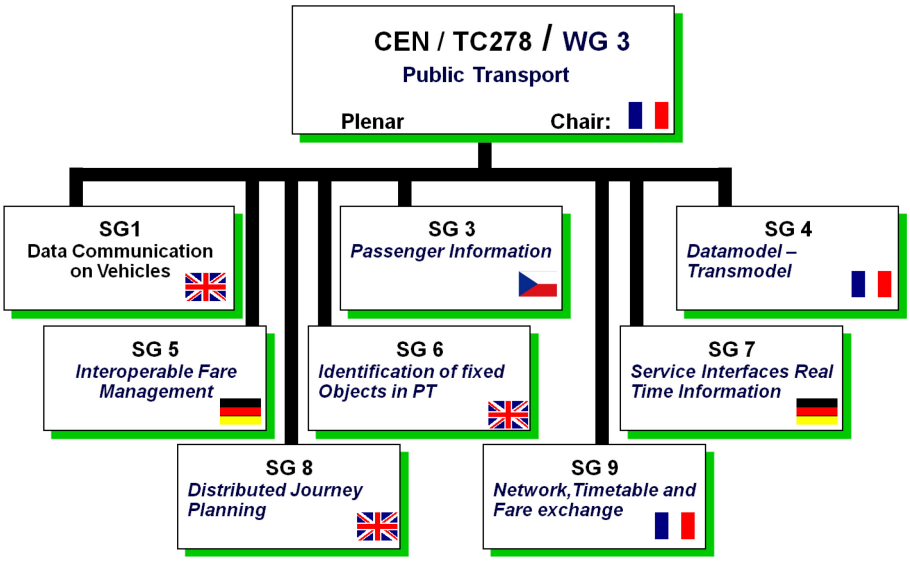


**Figure 1 — CEN TC278 WG3 Sub-groups**

### 0.5.4 CEN process and participants

Work on NeTEx has involved delegates from Austria France, Germany, Hungary, Italy, Netherlands, Slovenia, Sweden, Switzerland, UK, and the European Rail Authority. Part 1 and Part 2 were approved in 2013 and Part 3 is being finalized at the moment.

Evolution of EU PT standards and NeTEx for rail with TAP/TSI compatibility

### 0.5.5 Evolution of EU PT standards and NeTEx

The development of NeTEx has drawn on existing national and legacy standards such as VDV 452 (DE). BISON (NL) Neptune (FR) and TransXChange (UK) in particular to validate the NeTEx model by establishing mappings with established national standards.

The development of NeTEx also coincided with an interest by the European Rail Authority and other stakeholders in seeking a degree of data interoperability between different modes of public transport such as rail, metro and bus, that is, the ability to exchange data about routes, timetables and fares between systems, and also to supply external third party users. To this end a study was undertaken to compare the TAP/TSI B1, B2 and B3 models with the original Transmodel fare model used as the basis for NeTEx Part 3 and a number of gaps were identified and addressed. (A successful informal mapping of the MERITS data for stop and timetable data had already been achieved in Part 2).

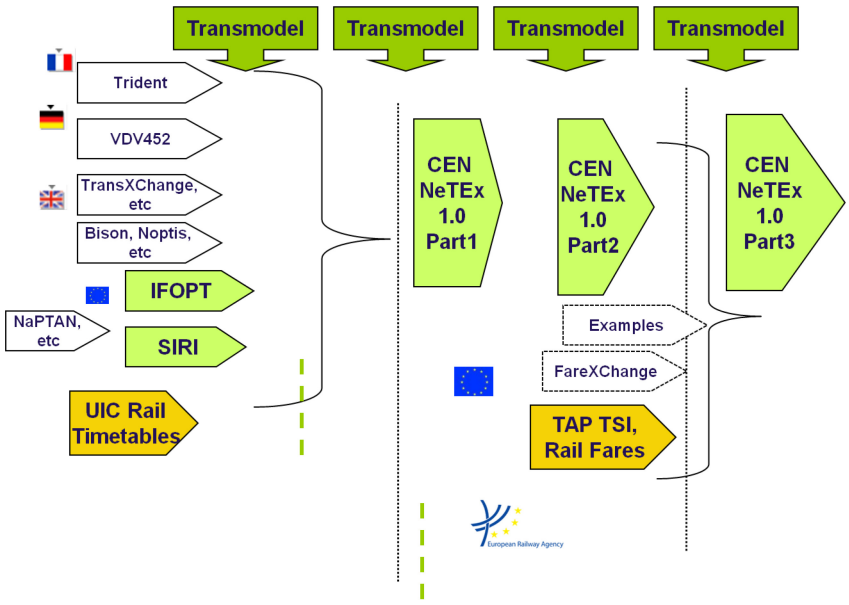


**Figure 2 — Evolution of NeTEx documents**

## 0.6 Term of Use

NeTEx is published as a series of CEN Technical Specification, (Part 1, Part 2 and Part 3). These are CEN copyright publications and are available for purchase from the shops of the respective National Standards Organisations of each CEN country: AFNOR (fr), BSI (uk), NEN (nl), SIST (si), UNI (it), DIN (de), etc).

The NeTEx XML Schema and UML models are free to use under a GPL version 3 Licence, so the use of schema and models is possible without necessarily purchasing the CEN NeTEX publications.

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# 1 Scope

This Technical Report provides a set of examples, white papers and explanatory material that makes it easy to understand how to use and deploy all parts of NeTEx. This will help EPTIS system providers and acquirers, providing functional scope, guidelines and terminology explanations needed to implement a system. It will also ease formalizing the requirements for the context of a procurement process.

This Technical report provides an explanatory material that makes it easier to understand how to use all parts of NETEX. This will help EPTIS system providers and acquirers, providing functional scope terminology explanations needed to implement a system. It will also ease formalizing the requirements for the context of a procurement process