UK Fares and NeTEx Profile Workshop – 1a Intro

London 16th July 2019. Sheffield 18th July 2019

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>13:15 – 14:00</td>
<td>NeTEx Intro &amp; Basic fares profile</td>
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<tr>
<td>14:00 – 14:30</td>
<td>NeTEx routes and timetables – detailed</td>
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<td>14:30</td>
<td>Break</td>
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<td>14:40 – 15:30</td>
<td>Complex fares requirement &amp; Fare modelling</td>
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<tr>
<td>15:40 – 16:00</td>
<td>Questions and Next Steps</td>
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Objective: Present an overview of the published UK NeTEx profile

- Quick overview of NeTEx (NK)
  - Update on European Profile etc
  - Model driven design

- Scope of UK NeTEx Fare Basic (NK) Profile (functional overview)

- Scope of UK NeTEx Timetable Profile (SR)

- Scope of UK NeTEx Fare Advanced Profile (Advanced feature) (NK)
Netex.uk mirror site

Netex Network Timetable Exchange -
CEN/TS 16614

UK Mirror site

Netex is a CEN/ Technical Standard for exchanging Public Transport schedules, fares and related data.

The official Netex site is at http://netex-cen.eu/

This is a UK development site to assist the use of Netex formats for UK data.

Netex is intended to provide a European wide standard for exchanging Public Transport data for Passenger Information;

- Netex is a general purpose format capable of exchanging timetables and fares for Rail, Bus, Coach, Ferry, Air or any other mode of public transport. It includes full support for rail services and can be used to exchange UIC (International Union Of Railways) data

- Netex is based on the CEN Transmodel standard which specifies a Conceptual model for Public Transport data.

Netex uses a fully articulated model that represents PT concepts as well characterised, layered abstractions; the format is designed for the efficient, updateable exchange of complex transport data between distributed systems. This allows the data to be used in modern web services architectures and to support a wide range of passenger information and operational applications.

- The Netex schema is free to use and its development is managed by the CEN standards process.

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Page last Updated 2019/07/12
Resource - UK profile “FareXChange”

FareXChange - Downloads

Downloads

  1. netex uk profile 1 - intro.pdf (2019.06.17-v0.09)
  2. netex uk base profile 2 - base profile.pdf (2019.06.30-v0.14)
  3. netex uk fare profile 3 - fares.pdf (2019.06.17-v0.17)

  1. netex uk profile 1 - intro.pdf (2019.06.17-v0.09)

Presentations

- Summary December 2018
  1. netex uk fare profile summary of basic scope - ppt/pdf

- Workshops - London & Manchester November 2018
  1. netex introduction - ppt/pdf
  2. netex uk fare profile basic fares scope - ppt/pdf
  3. netex uk profile stop & timetable scope - ppt/pdf
  4. netex uk fare profile advanced profile requirements - ppt/pdf
## Audience

### NeTEx UK Fare Profile - Introduction

### Contents

|--------------------|-----------------------------|-----------------|----------------------------------------|--------------------------------------------|---------------------|-------------|--------------|

|------------------------------------|-----------------|--------------------------|-----------------------------------------------|-----------------------------------------|------------------------------------------------|--------------------------------|------------------------------------------------|---------------------|----------------------|---------------------|

|--------------|-----------------|--------------------------------------|---------------------------------------------|------------------------------------------|---------------------------------|------------------------------------------------|---------------------|-------------|---------------------|
NeTEx
A Quick Overview
In order to create useful information services, we need to integrate data of many different types…

from many different providers…

that changes constantly – some of it in real-time

This needs to be done

Precisely…

Repeatedly...

Cheaply…

Scaleably
Integrating data from different sources to create PI services

- Maps – (GML, OSM, Inspire)
- Infrastructure Features – Inspire
- Places – NeTEx Part1
- POI – NeTEx Part1
- Stops – NeTEx Part1
- Calendars – NeTEx Part1
- Operators – NetEx Part1
- Timetables – NeTEx P2
- Fares – NeTEx Part3

Data Build for Real-time

- Real-time Situation Store
- Real-Time Prediction Engines
- Real-time feeds

Protocols

- Stop Times SIRI-ST/SM
- Estimated Timetable SIRI-PT/ET
- Vehicle Monitoring SIRI-VM
- Connections SIRI-CT/CM
- Incidents SIRI-SX
- Facility Monitoring SIRI-FM

Other APIs

- Other formats

Discovery / Aggregation

Conversion

Transmodel European Conceptual Model

Moving Britain Ahead
Application Program Interface (e.g. SIRI)

- **API**: Set of structured messages to perform a specific function
  - Encoded using a specific syntax
    - E.g. http parameters, wsdl, json, xml, etc
  - Exchanged over a transport protocol.
    - E.g. http, https, CORBA, etc
- Designed to deliver specific function
  - Message + Payload
- An Optimised view of data model
  - Transient use
  - Relative, easy to change
  - Can support alternatives APIs from same data model and engine

Examples:
- SIRI-SM, GTFS-RT, JourneyWeb, DJP, TfL Unified API

- **Protocols**
  - E.g. Stop Times SIRI-ST/SM

- **Eg DJP-LOCATIONS**
  - request list of stops for area/
  - return list of stops for an area

- **E.g. SIRI-SM**
  - request events for stop /
  - return list of arrivals, departures for stop

- **E.g. SIRI-ET**
  - request real time timetable for a vehicle journey /
  - return list of calls with times
Bulk data formats (e.g. NeTEx)

- A Syntax for serialising data as a flat file that can be exchanged
  - W3C XML, csv, JSON Schema
- Exchanged using a file exchange protocol,
  - E.g. FTP, SMTP, http attachment
- Designed to deliver specific function
- Corresponds to data model, data base
  - Persistent data
  - Hard to change/evolve:
  - Major long term investment to develop tools to populate, and store model

Examples,
- NaPTAN, NPTG, CIF, TransXChange, NeTEx, GTFS

```
<StopPlace responsibilitySetRef="nptgAdminArea:086" version="1" id="naptStop:2400100348@Place">
  <Name>White Deer Park Nursing Home</Name>
  <TopographicPlaceRef ref="nptgLocality:E0015410">Thanet</TopographicPlaceRef>
  <AtCentre>False</AtCentre>
  <TransportMode>bus</TransportMode>
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  </TariffZones>
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      </Location>
    </Quay>
  </quays>
</StopPlace>
```

```
Stops.txt
stop_id,stop_code_stop_name,stop_desc,stop_lat,stop_lon,zone_id,stop_url,location_type, parent_station
NADAV,125,North Ave / D Ave N,,36.914893,-116.76821,FZ02,http://demoagency.org,0,
NANAA,126,North Ave / N A Ave,,36.914944,-116.761472,FZ02,http://demoagency.org,0,
DADAN,127,Doing Ave / D Ave N,,36.909489,-116.761472,FZ02,http://demoagency.org,0,
EMSI,129,E Main St / S Irving St,,36.905697,-116.76218,FZ02,http://demoagency.org,0,
AMV,1231,Amargosa Valley,,36.641496,-116.40
```
NeTEx is for bulk *static* data
(SIRI is for *real-time* data)

- Data must fit together via any route!
Coherent standards give Interoperability - The “Transmodel ecosystem”

- Complementary formats & protocols:
  - Bulk exchange of static data (NeTEx)
  - Dynamic APIs for data (SIRI, DJP)
- Flexibility: adaptations to local needs
  - National Standards & profiles
- Coherent “Bridges” to standards for other domains
  - GIS – eg Inspire
  - Road – Eg DATEX

Flags Indicative, not Exhaustive

Transmodel European Conceptual Model
Public Transport data - Functional Activity vs Time of Travel

- **Before**
  - PASSENGER INFORMATION
  - FARE MANAGEMENT
  - TRANSPORTATION
  - INFRASTRUCTURE

- **During**
  - Pre-trip planning
  - Offers
  - Network, Scheduling
  - Asset & Fleet Management Planning
  - On trip, real-time
  - Sales, Validation & Control
  - Vehicle monitoring & control
  - Preparation, Movement, Signalling, etc Operations

- **After**
  - Historic & Query Stats
  - Historic Transaction Settlement
  - Historic Operation
  - Historic Usage
  - History

**Functional Area**

13 NeTEx UK Fare Profile - Introduction
Standards Scope

Functional Activity vs Time of Travel

Before

Planning Operations

Historic Operation

Network, Scheduling

Historic Transaction Settlement

PASSENGER INFORMATION

FARE MANAGEMENT

TRANSPORTATION

INFRASTRUCTURE

Pre-trip planning

GTFS

NeTEx

Network Timetable Exchange

On trip, real-time

DJP

Sales, Validation & Control

Vehicle monitoring & control

SIRI-xx

Asset & Fleet Management

Historic & Query Stats

Preparation, Movement, Signalling, etc

Historic Usage

Planning Operations

History

Before

During

After

NeTEx UK Fare Profile - Introduction
Upstream vs Downstream (NB GTFS & NeTEx are complementary…)

NeTEx

Data Creation: Planning & Integration

Data Creation: Operations

Maps

Networks

Timetables

Fares

GTFS

Data Integration & build

Engines

APIS

User Applications

DJP

SIRI-xx

NeTEx UK Fare Profile - Introduction
NeTEx – Evolution from National Standards

2000

- Transmodel v1.0- v5.1
- Trident/NEPTUNE
- Legacy .fr
- Legacy .de
- Legacy .uk
- Legacy .nl
- NaPTAN, etc
- IFOPT
- FareXChange, etc
- SIRI
- UIC leaflets
- GTFS

2001

- Transmodel v6.0
- VDV452
- TransXChange, etc
- Bison, Noptis, etc
- TAP TSI (Rail fares)

2002

- Transmodel v6.0 (P1, P2, P3)
- CEN NeTEx v1.0 Part1

2003

- Transmodel v6.0 (P4, P5, P6)
- CEN NeTEx v1.0 Part2

2004

- Transmodel v6.0 (P7, P8)
- CEN NeTEx v1.0 Part3

2005

- NeTEx UK Fare Profile - Introduction

2006

- NeTEx EU PROFILE Time tables
- .de profile
- .fr profile
- .nl profile
- .no profile

2007

- NeTEx EU PROFILE Fares

2008

- 2000
- 2011
- 2012
- 2016
- 2018
Transmodel and the EC ACT/ITS MMTIS Regulation

- Phased requirement to make data available
- EC investing in PT standards support

multimodal: road, rail, water, air
urban & long distance transport
CEN Standardisation – Global Standards system (not EU specific)

- Open proposal, review and voting process
  - Need 5 countries to create a new Work Item
- Multi-country review organised through National Standards Bodies
  - British Standards Institute + Mirror bodies (e.g., PTIC)
  - BREXIT: “The British Standards Institution (BSI) will still be a voting member of CEN, like other European Free Trade Association (EFTA) members, and there is no suggestion this will change”.

Attention to existing Standards
- Where available, reuse
- Lifecycle management
  - Standards must be completed and reviewed to set timescales
- Different tracks for new / mature areas:
  - Technical Specification ➔ Full Specification
  - Documentation conventions
Simplifying Use – Aspects of a NeTEx Profile

- **Profile - Scope?**
  - Relevant subset of NeTEx data elements for specific local business requirements.
  - Mapping of legacy data elements to NeTEx.

- **Profile - Local Technical Details?**
  - Use of identifiers & codespaces (NPTG, NaPTAN, NOC).
  - Use of coordinate systems (O/S, WGS85..), Time zones, etc..
  - Grouping of elements in document

- **Profile - Use in National Context**
  - Granularity of NeTEx data files
  - Participants & Workflow of data exchange
  - Validation & Verification processes

- **Profile Management**
  - Stakeholders engaged in profile revision process
  - Governance of processes for future evolution
European Passenger Information Profile (EPIP)

- Final draft for country review May 2019
  - Draft available on Netex.uk website
- Minimal profile for Basic Passenger information
  - Covers localities, stops and timetables
  - Timetables are basic - Passing times only (no timings)
  - No Fares
- Intended for international and cross-regional exchange
  - E.g. National Access Points can convert existing data
- Shorter, implementation focused specification
  - Includes validation rules and other implementation details
  - Pan-European identifier system for frames & documents
- Model for UK Base profile
  - How to map a minimum set of UK timetable data
  - Presentation Conventions also used Fare profile documentation
Develop a **UK PI Profile** that shows how UK Timetable data can be made available in NeTEx to conform to common EU Profile
- Subset of existing TransXChange capability

Develop a **UK Fare Profile**
- New UK standard for exchanging fares
- Focus on buses
NeTEx Profiles

CEN Transmodel
A high level Conceptual Model for PT data: 
implementation independent

CEN NeTEx
An Exchange Format for PT data: 
a concrete implementation 
(W3C XML Schema)

NeTEx Profile:
Local agreement for using NeTEx in 
a national or international context
for a specific business purpose

NaPTAN, NPTG, TXC
Conformance to a Profile

- **Strict Conformance**
  - Use only the identifier **codespaces, values, groupings**, etc of the profile.
  - Use **only** the XML elements, and attributes in the profile.
  - A consumer system must interpret all elements and values.

- **Augmented conformance**
  - Use only the identifier **codespaces, values, groupings**, etc for the profile elements.
  - Allow **additional** NeTEx XML attributes and elements to be present.
  - A consumer system must interpret and consume **all strict profile** elements and values.
  - A consumer system can ignore any augmented elements.

- **Extended conformance**
  - Use only the **identifier codespaces, values, groupings**, etc for the profile elements.
  - Allow **embedding** of user defined **extensions** to NeTEx.
    - Simple keylist,
    - Embedded user schemas
  - A consumer system must interpret and consume **all strict profile** elements and values.
  - A consumer system can ignore any augmentations and extensions.
Degrees of Conformance

Codespaces/ Identifiers, Values, Grouping, etc

NeTEx
Network Timetable Exchange

Strict

Augmented +

Extended
Degrees of Conformance – UK Profile

NeTEx

Network Timetable Exchange

- Degrees of Conformance
  - Codespaces/ Identifiers, Values, Grouping, etc
  - Extended
  - Fares (FXCP-2)
    - Strict
  - Stops & Timetable (EPIP)
    - Strict
    - Strict (FXCP-1)
    - Augmented +
  - Augmented +

- NeTEx UK Fare Profile - Introduction
The Transmodel / NeTEx approach

Model Driven Design
Software engineering for robust standards
MODEL DRIVEN DESIGN

- Conceptual Model is implementation independent
  - Use to design
  - Described in UML

- May have alternative Physical Models for different target implementations
  - XML Physical design as UML

- Implementation is derived from physical model.
  - NeTEx XML Schema

CONCEPTUAL MODEL

Physical Model for HLL
Physical Model for DDL
Physical Model for XML

Implementation in XML
Implementation in Java
Implementation in SQL
Designing a CEN Exchange format - Package & Element level traceability

- **Traceability**
  - Equivalent elements can be found at each level
  - Physical design and Implementation each add further detail and constraints

- **Tool support** (EA, XML SPY, OXYGEN, etc)
Designing a CEN Exchange format - Package & Element level traceability

Conceptual → Physical → Schema

NeTEx UK Fare Profile - Introduction

29 Moving Britain Ahead
Building on Existing data elements

**PART1 – FRAMEWORK & NETWORK**

- SERVICE CALENDAR FRAME (Day Types, etc)
- RESOURCE FRAME (common components & codes)
- COMPOSITE FRAME (Container)
- SERVICE FRAMES (Stops & lines etc)
- SITE FRAME (Stops & lines etc)
- INFRASTRUCTURE FRAME (Fixed infrastructure)

**PART2 – TIME TABLES**

- TIMETABLE FRAMES
- SITE FRAMES

**PART3 - FARES**

- FARE FRAME (Products & Tariffs)
- SALES TRANSACTION FRAMES
- FARE FRAME (Prices)
A typical Bus timetable (Metrobus Route 1)

Mondays to Fridays

<table>
<thead>
<tr>
<th>Pease Pottage</th>
<th>Tollgate Hill</th>
<th>Broadfield</th>
<th>Southgate</th>
<th>Crawley</th>
<th>Crawley Hospital</th>
<th>Gosops Green</th>
<th>Bewbush</th>
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Mondays to Fridays

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A Typical Bus Route (Metrobus Route 1)
### NeTEx UK Fare Profile - Introduction

#### TM: A Bus timetable as model elements

**1. Tollgate Hill - Broadfield - Crawley - Bewbush**

*Daily from 3rd February 2018*

<table>
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<th>SERVICE PATTERN</th>
<th>CODE</th>
<th>NOTICE</th>
<th>SCHEDULED STOP POINTs</th>
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<th>VALIDITY CONDITION</th>
<th>LINKS</th>
<th>NETWORK</th>
<th>TIMETABLE</th>
<th>JOURNEY PATTERNs</th>
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### Notice

- Rail Station nearby
- CODE: 33
NeTEx UK Fare Profile - Introduction
## Bewbush West - Crawley - Broadfield/Pease Pottage

### Adult Single Fares

<table>
<thead>
<tr>
<th>Station</th>
<th>160 Bewbush</th>
<th>160 Gossops Green Shops</th>
<th>160 West Green Crawley Hospital/Apple Tree</th>
<th>160 Crawley Town Centre</th>
<th>160 Southgate Avenue North</th>
<th>160 Southgate Wensleydale</th>
<th>160 Broadfield (all stops)</th>
<th>160 Pease Pottage Black Swan</th>
</tr>
</thead>
</table>

Fares are shown in pence. Eg. 170 = £1.70

To calculate your fare, find your location, and your destination, where the row and the column cross is your fare.

### Return Fares

Not available on this service.

### Child Fares

Child Fares are available on this route at half the adult fare on single journeys.

---

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[https://www.metrobus.co.uk/route-information/1](https://www.metrobus.co.uk/route-information/1)
Single Trip Fare Prices

**SALES PACKAGE**
Single ride, “Cash”

**FARE PRODUCT**

**DISTANCE MATRIX ELEMENTS**

**USER PROFILE**
Adult

**FARE PRICES**

**FARE TABLE**

**PRICE UNIT**

**USER PROFILE**

**PRICE RULE**

**FARE ZONES**

**TYPE OF TRAVEL DOCUMENT**

**TARIFF**

**OPERATOR**

**FARE DEMAND**

**NOTICE ASSIGNMENTS**

**FARE DEMAND**

**RETURN FARES**
Not available on this service.

**CHILD FARES**
Child Fares are available on this route at half the adult fare on single journeys.

To calculate your fare, find your location, and your destination, where the row and the column cross is your fare.

Crawley Area MetroRider
Metrolytter
Discovery Ticket
Gatwick Travelcard
Accepted throughout.

PlusBus
Crawley, Three Bridges, Gatwick Airport, Ifield and Horley Plusbus tickets are valid throughout. Please see www.plusbus.info for further information.

Concessionary Passes
Concessionary passes are valid throughout from 08:30-23:00 Mon-Fri, and anytime at weekends and public holidays.

Metrobus Ltd, Wheatstone Close, Crawley, West Sussex, RH10 9UA. Tel: 01293 449191

24.01.17

Moving Britain Ahead
Advantages of Model Driven Design

- **Reusable:**
  - The same concepts & data sets can be used for
    - All PT domains: e.g. Networks, Timetables & Fares,
    - For all Modes,
    - For different use cases: planning, operations, PI, etc

- **Precise, Modular**
  - Uniform terminology & Concept set
  - Separates concerns
  - Separates data sets of different stakeholders
  - Only need to use relevant components / modules
  - Extensible, Flexible

- **Less complicated overall**
  - Single, uniform set of concepts
  - Systematically Engineered
  - Traceability across design levels

- Facilitates use of Software Tools to automate implementation
NeTEx Validators & Profiles
- A model allows validation

System A
- NeTEx Profile
- XML Validator
- System B
- FareXChange Profile
- FareXChange Validator

PLACES
STOPS
ACCESSIBILITY
OPERATORS
ROUTES
TIMETABLES
FARES
FARE PRICES

Pass
Fail,
NeTEx Deliverables & IPR

- CEN specification documents (Modular)
  - P1: Network, P2: Timetables, P3: Fares
  - Available from BSI £ Buy, Copyright CEN
- UML Models (Modular). £ Free, GPL
  - Conceptual, Physical
- NeTEx XML schema (Modular). £ Free, GPL
  - Uniform grouping & versioning mechanisms to support large scale integration
- XML Examples (Modular). £ Free, GPL
  - By Topic and Subject
- Website, white papers. £ Free, GPL
  - http://netex-cen.eu/

NeTEx UK Fare Profile - Introduction
NeTEx & UK Standards
UK NeTEx Deliverables & IPR

- UK Profile(s) £ Free, GPL
  - Basic Timetable,
  - Basic Fares, Additional Fares
  - Full Timetable,
- UML Models of UK Profile. £ Free, GPL
  - Conceptual, Physical
- XML Examples (Modular). £ Free, GPL
  - Fares