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UK Fares and NeTEx Profile Workshop – 1a Intro

London 16th July 2019. Sheffield 18th July 2019

13:15 – 14:00	NeTEx Intro & Basic fares profile
14:00 – 14:30	NeTEx routes and timetables – detailed -
14:30	Break
14:40 - 15:30	Complex fares requirement & Fare modelling
15:40 – 16:00	Questions and Next Steps

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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)

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Netex.uk mirror site

UK Mirror

NeTEx UK

- Home
- Overview
- Downloads & Schema
- History
- Terms of Use
- Contact

Related Standards

- NeTEx (UK)
- FareXChange UK
- CEN NeTEx
- CEN Transmodel
- SIRI

Official sites

- CEN

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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.

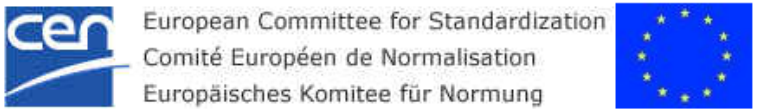
The official NeTEx site is at http://netex-cen.eu/

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

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Resource -UK profile “FareXChange”

Development site

UK Fares profile

- Home
- Overview
- Scope
- Downloads
- History
- Terms of Use
- Contact

Examples

- Examples

UK Standards

- FareXChange profile
- NeTEx UK
- UK NaPTAN (Stops)x
- UK TransXChange (Timetables)
- UK NOC (Operators)

CEN Standards

- CEN NeTEx
- CEN Transmodel
- CEN SIRI

FareXChange - Downloads

Downloads

UK NeTEx Fare Profile

- **UK Profile Draft for review.** June 2019.
  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)
- **European Passenger Information Profile** - Final Draft May 2019.
  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

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Audience

NeTEx UK Profile Progress - Specification

FareXChange documentation	Audience	Contents	FXCP Status	EPIP Status	XML Examples
Part1 **Introduction**	Overview, +Technical Intro	• **NeTEx intro.** • **Scope of profile**, Rationale for scope. • *Examples of UK Bus fare products in scope.*	Review Draft 5/2019		
Part2 **Framework, Stops & Timetable**	Technical detail	• Common profile elements. • Basic Stop elements; Basic Timetable elements. • Use of UK data sets & identifiers. • Coding, validation and data quality rules. • **Mapping from NPTG, NaPTAN, TransXChange.** • *Examples of using UK data.*	Review Draft 5/2019	Final Draft 4/2019	Draft 5/2019
Part3 **Fares**	Technical detail	• **Basic model elements for UK Bus Fares.** • **Advanced model elements for UK Bus Fares**. • Coding, Validation and data quality rules. • Use of NaPTAN and NOC data • *XML Examples.* ***Mapping to csv / spreadsheet***	Review Draft 5/2019	Future	Draft 5/2019

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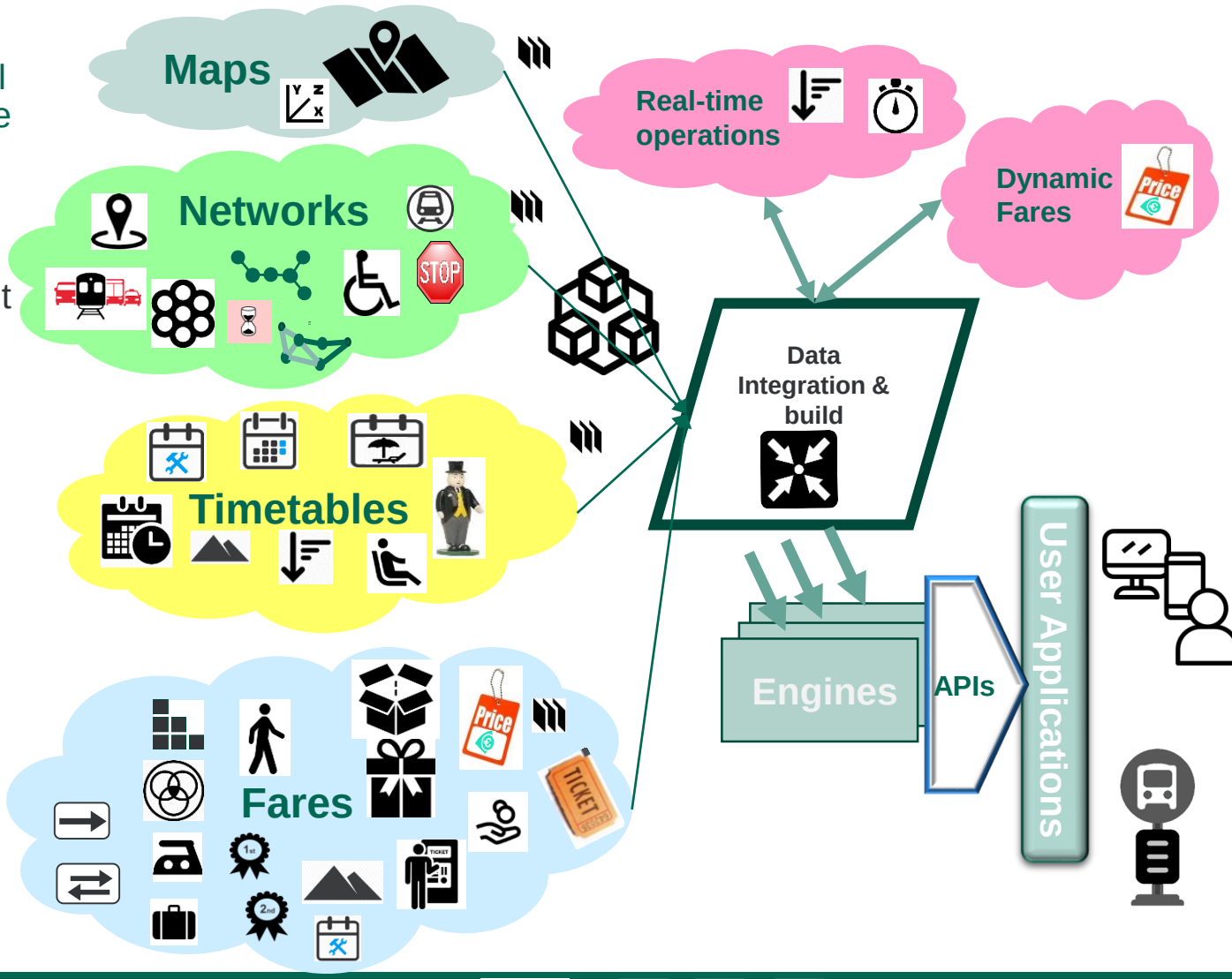
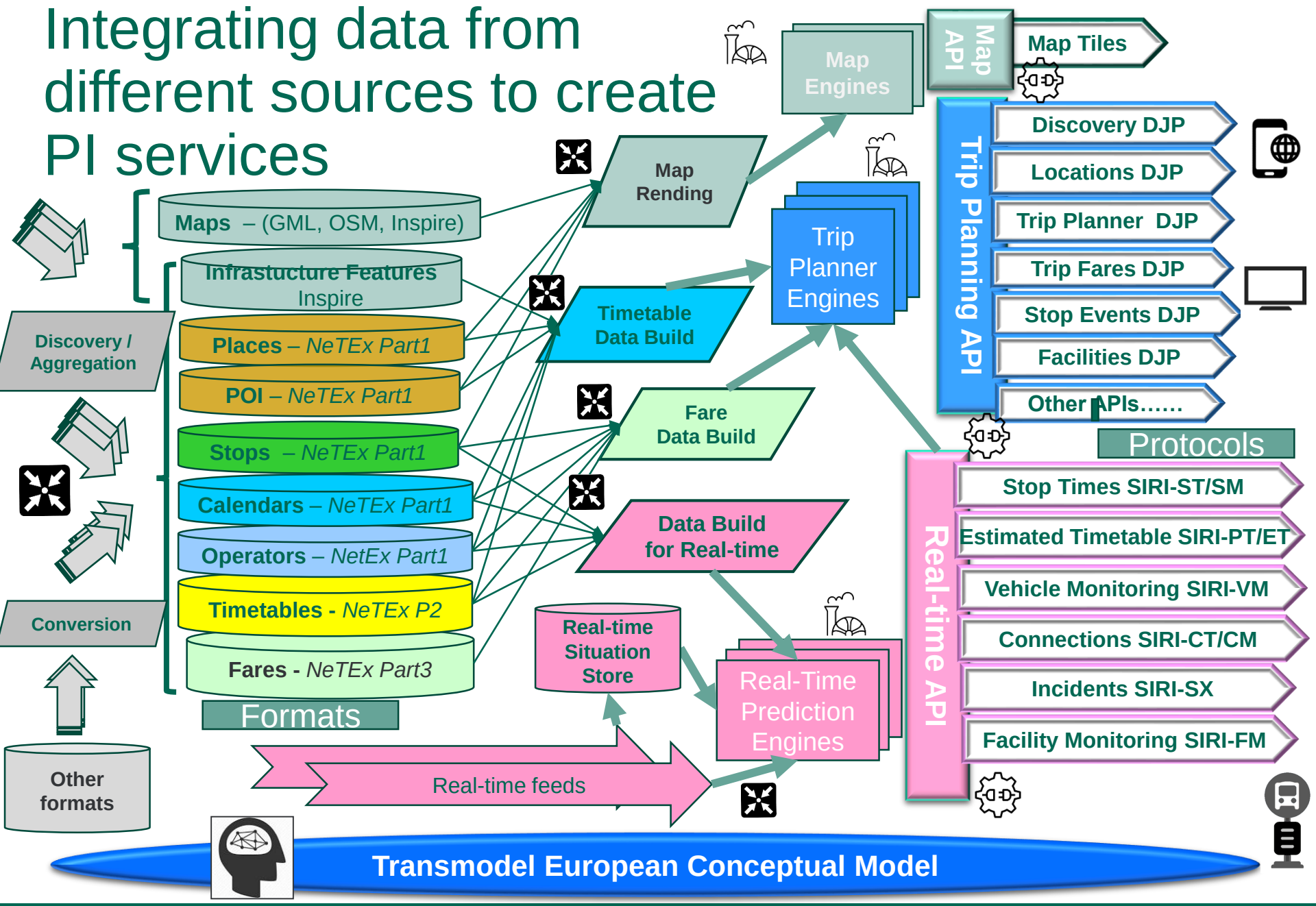
NeTEx
A Quick Overview

Why? - Integrating data for Passenger Information services

- 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



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Application Program Interface (e.g. SIRI)

API

Protocols

e.g. Stop Times SIRI-ST/SM

- 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

- 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

Examples:

- *SIRI-SM, GTFS-RT, JourneyWeb, DJP, TfL Unified API*

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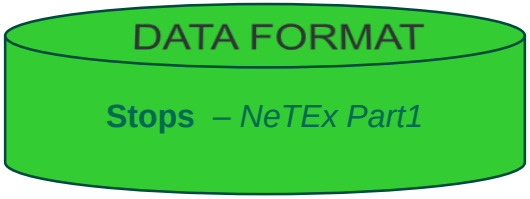
Bulk data formats (e.g. NeTEx)



- 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

```
<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>
    <tariffZones>
       <TariffZoneRef ref="THANET"/>
    </tariffZones>
    <StopPlaceType>onstreetBus</StopPlaceType>
    <quays>
       <Quay id="naptStop:2400100348" version="1">
          <Centroid>
             <Location>
                <Longitude>1.4324975357</Longitude>
                <Latitude>51.3469852361</Latitude>
                <gml:pos srsName="UKOS">639127 166471</gml:pos>
             </Location>
          </Centroid>
          <RoadAddress version="any" id="naptStop:2400100348@address">
             <RoadName>Detling Avenue</RoadName>
             <BearingCompass>SE</BearingCompass>
          </RoadAddress>
          <NameSuffix>opp</NameSuffix>
          <Landmark>White Deer Park Nursing Home</Landmark>
          <TransportMode>bus</TransportMode>
          <QuayType>busStop</QuayType>
       </Quay>
    </quays>
  </quays>
</StopPlace>
```

NeTEx: XML

Examples,

NaPTAN, NPTG, CIF, TransXChange, NeTEx, GTFS

```
Stops.txt
stop_id,stope_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,-116.768242,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
```

GTFS : CSV

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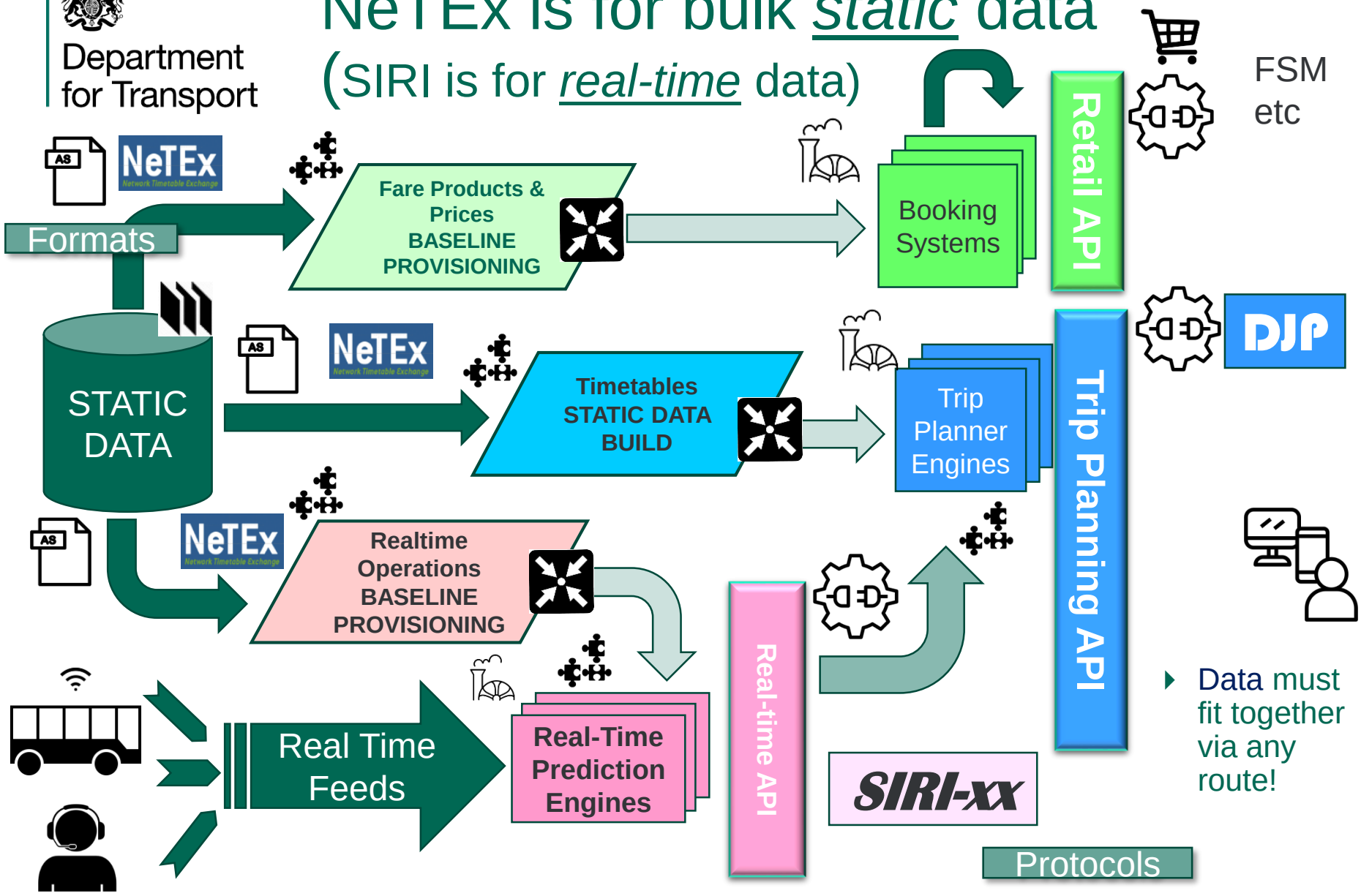
NeTEx is for bulk *static* data

(SIRI is for *real-time* data)



- Data must fit together via any route!

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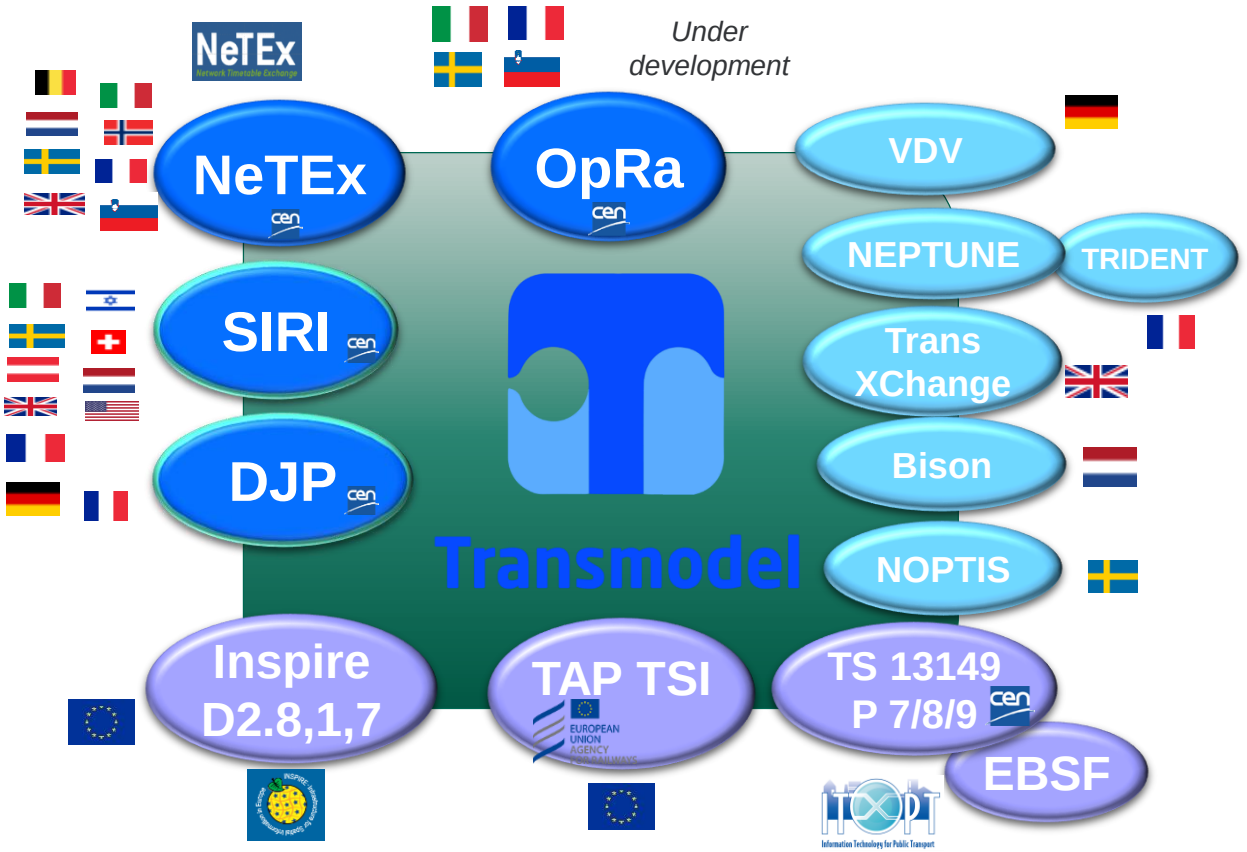
Coherent standards give Interoperability - The “Transmodel ecosystem”

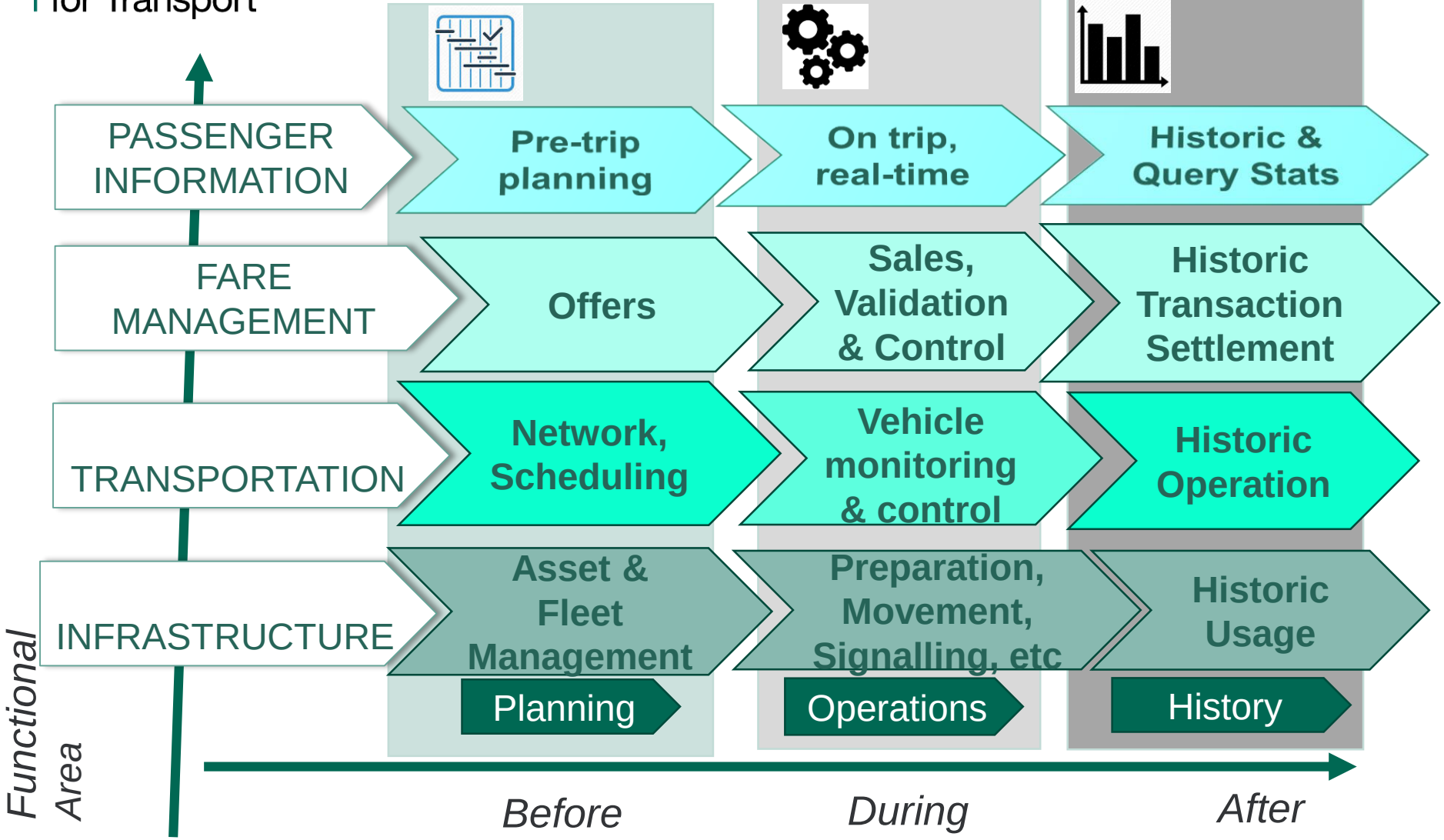
- Complementary formats & protocols:
  - Bulk exchange of static data (NeTEx)
  - Dynamic APIs for data (SIRI, DJP)
- Flexibility: adaptations to local needs
  - National Standards & profiles
- Coherent “Bridges” to standards for other domains

  GIS – eg Inspire

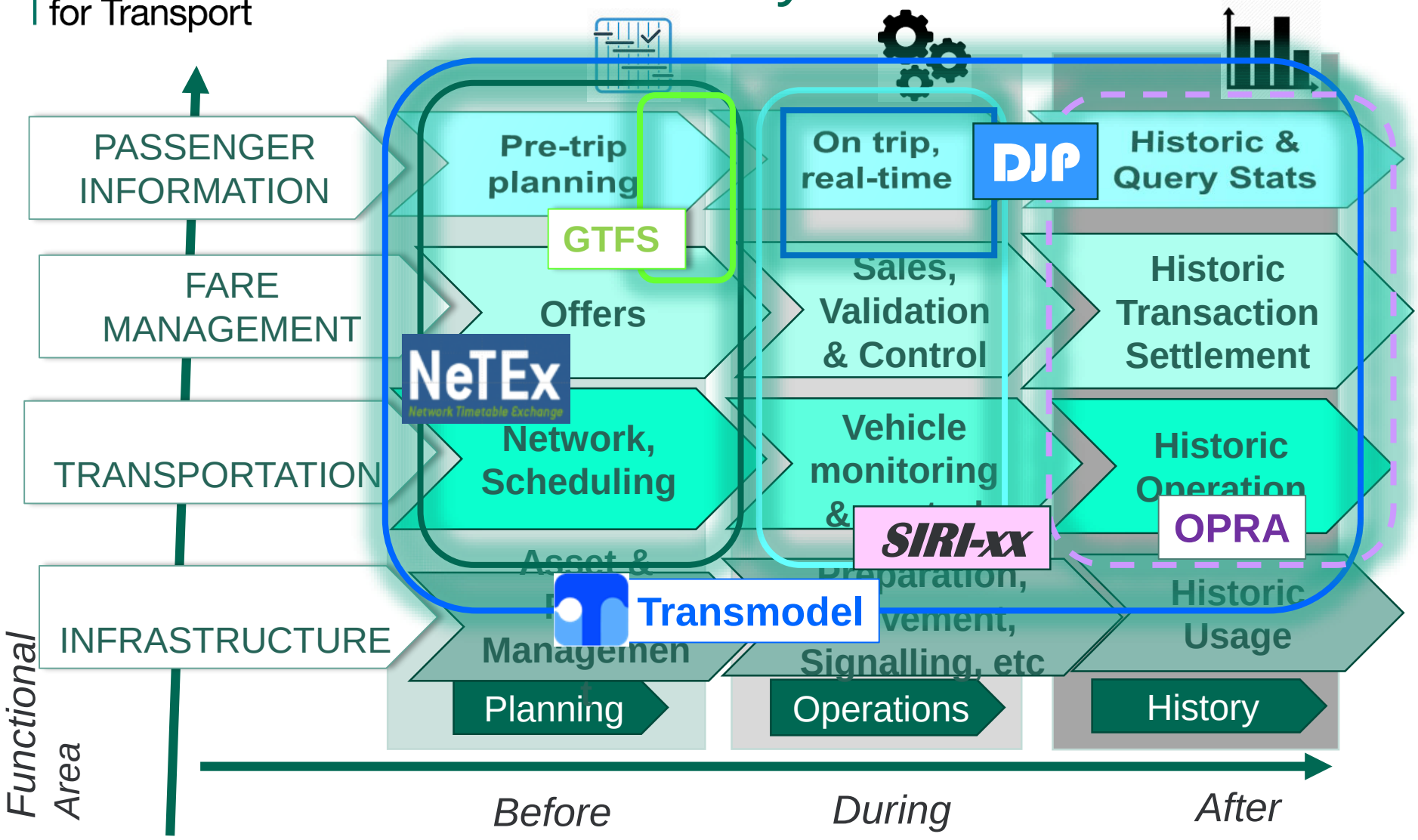
  Road – Eg DATEx



Public Transport data - Functional Activity *vs* Time of Travel



Standards Scope
Functional Activity vs Time of Travel



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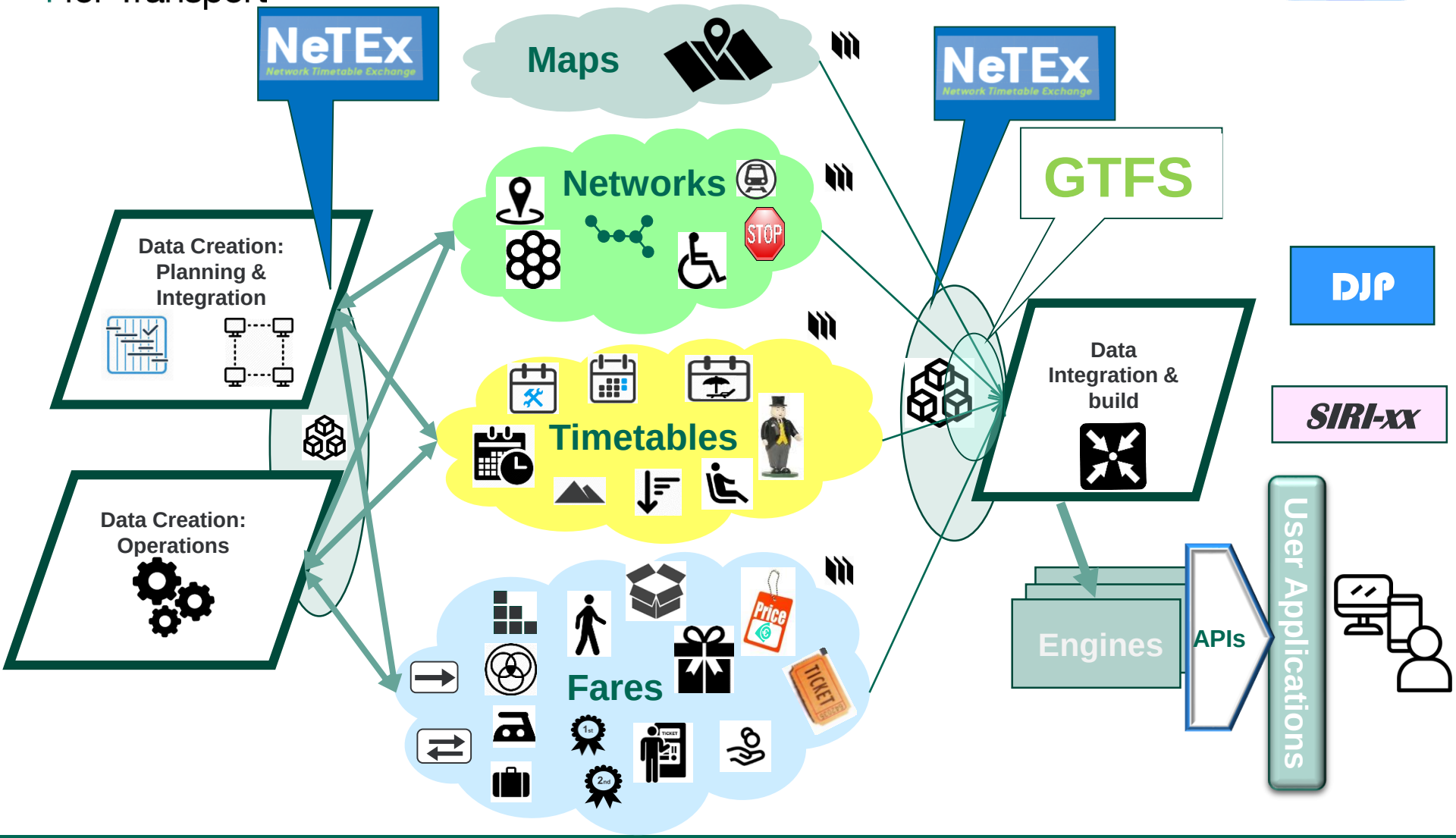
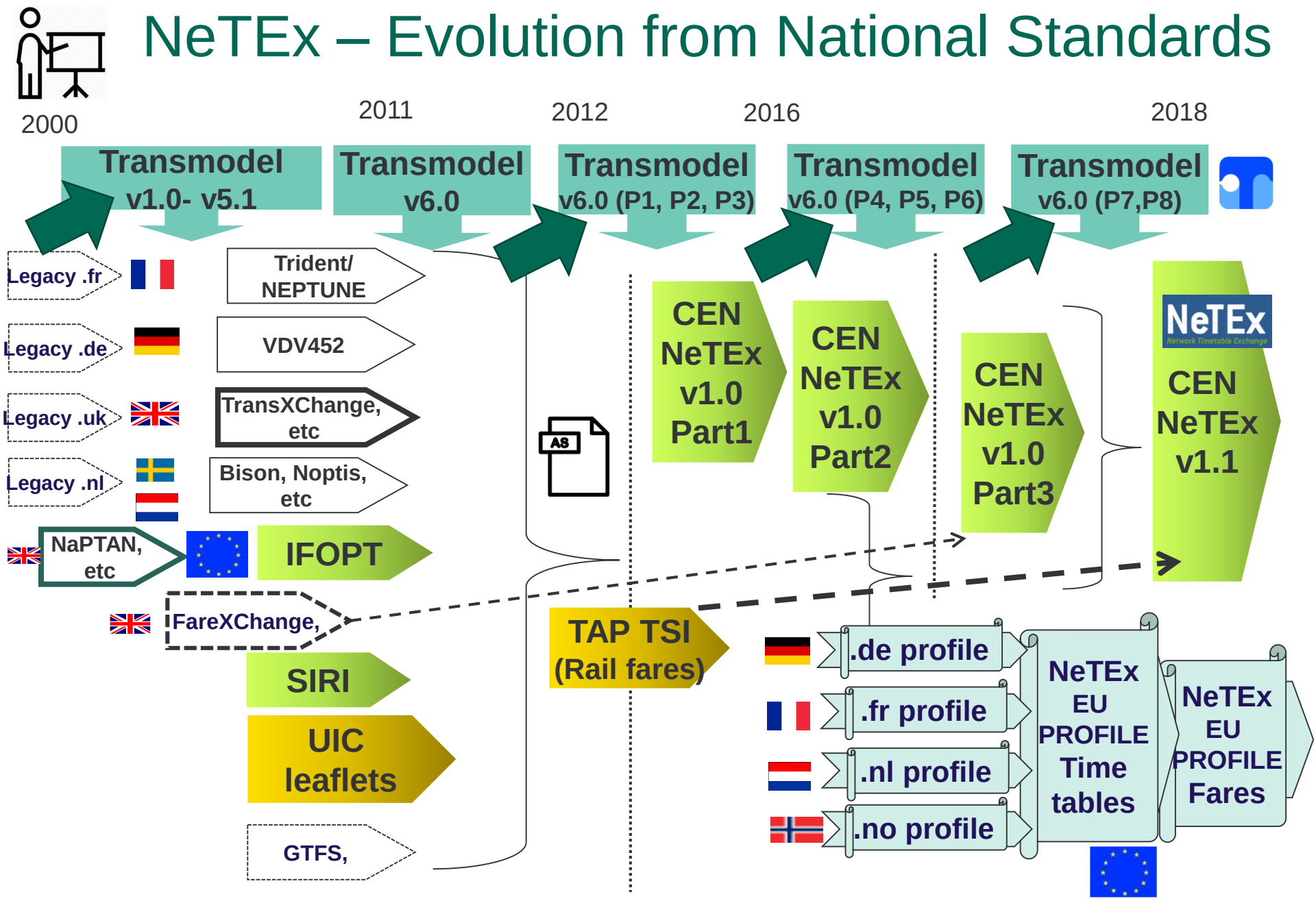
Upstream vs Downstream
(NB GTFS & NeTEx are complementary…)



NeTEx – Evolution from National Standards



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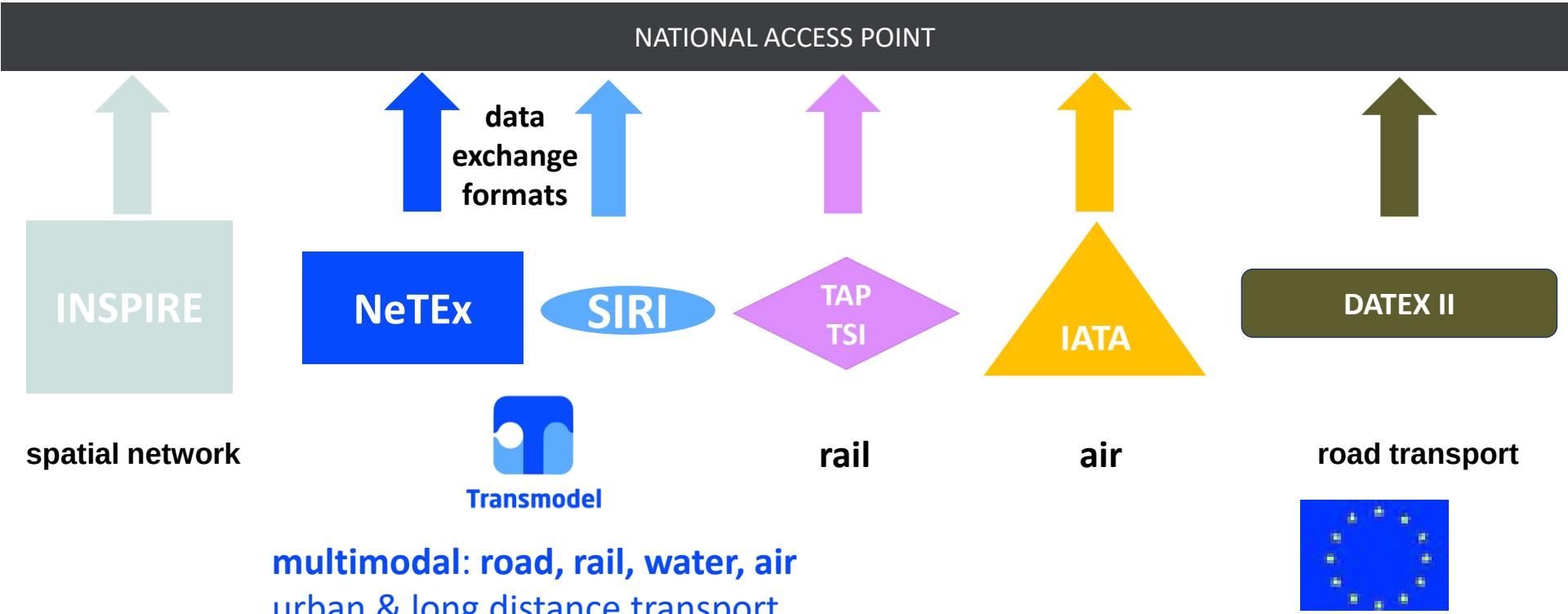
Transmodel and the EC ACT/ ITS MMTIS Regulation



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

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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

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Simplifying Use – Aspects of a NeTEx Profile

NeTEx Network Timetable Exchange

- **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

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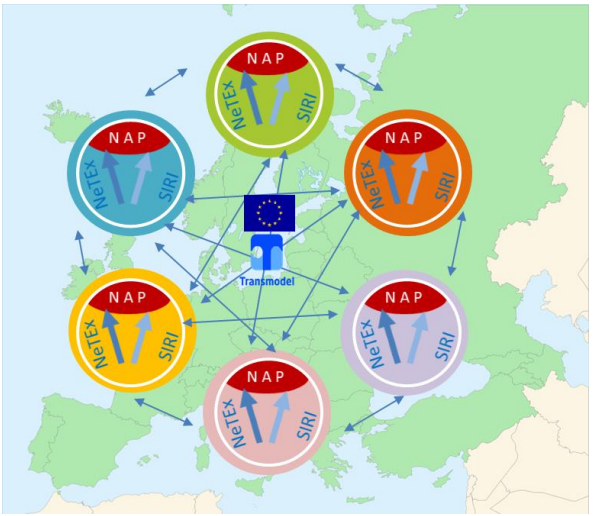
European Passenger Information Profile (EPIP)

- Final draft for country review May 2019
  - Draft available on Netex.uk website
- Minimal profile for Basic Passenger Iinformation
  - 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



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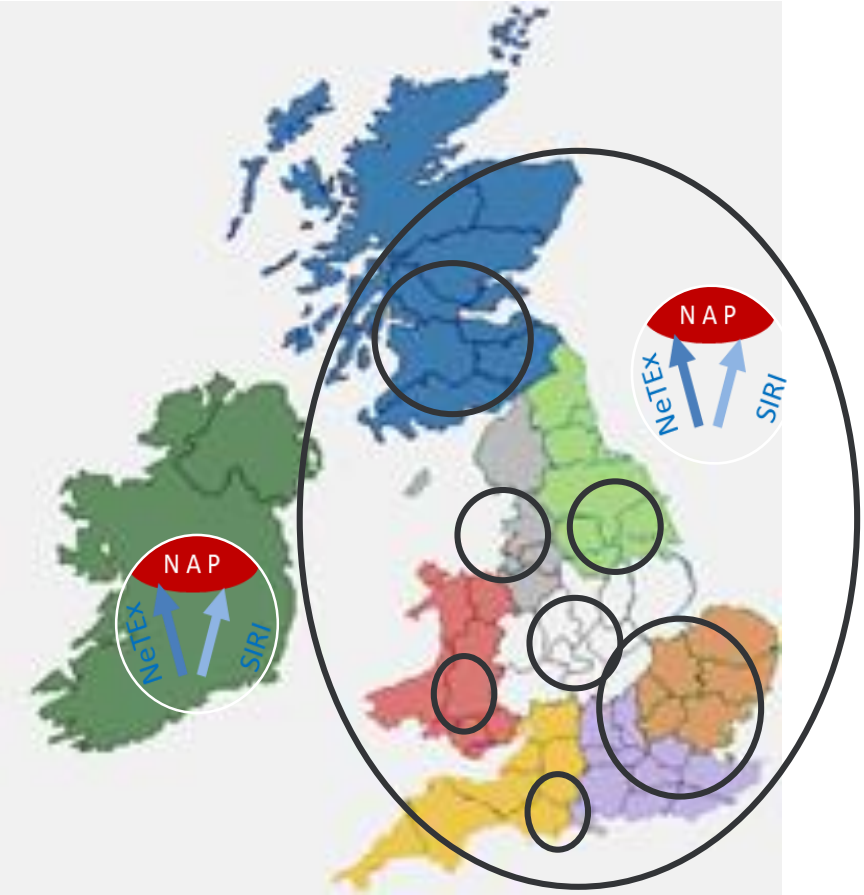
UK NeTEx Profile Project



- 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

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NeTEx Network Timetable Exchange

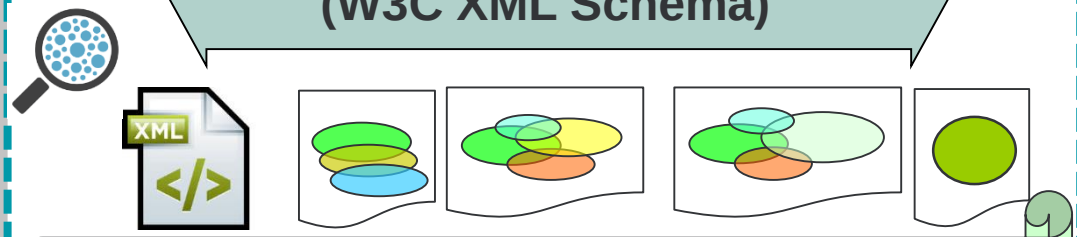
CEN Transmodel
A high level Conceptual Model for PT data:
implementation independent

System A

PLACES
STOPS
ACCESSIBILITY
OPERATORS
ROUTES
TIMETABLES
FARES
FARE PRICES

NaPTAN,
NPTG, TXC

NeTEx 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

System B

PLACES
STOPS
ACCESSIBILITY
OPERATORS
ROUTES
TIMETABLES
FARES
FARE PRICES

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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.

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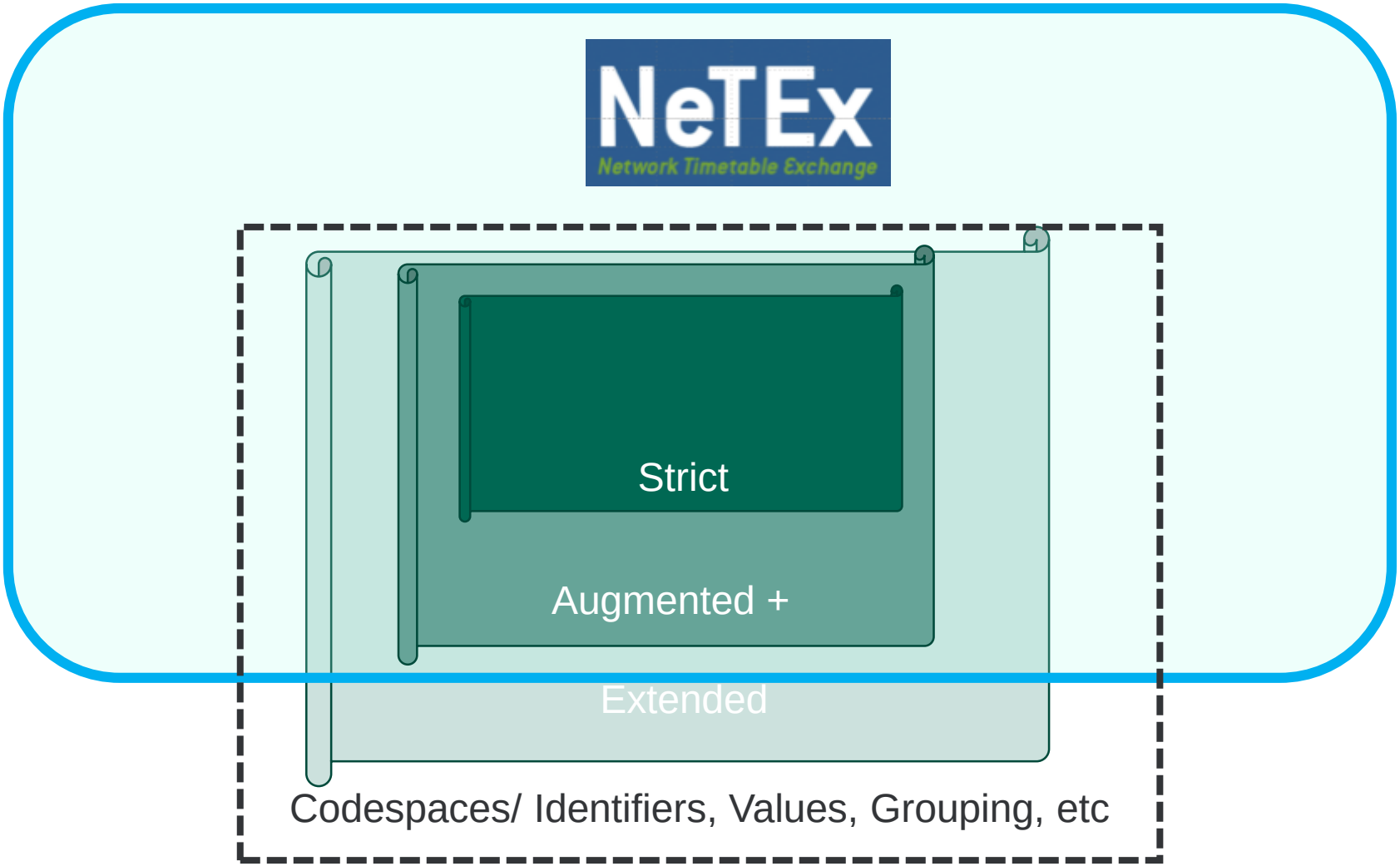
Degrees of Conformance



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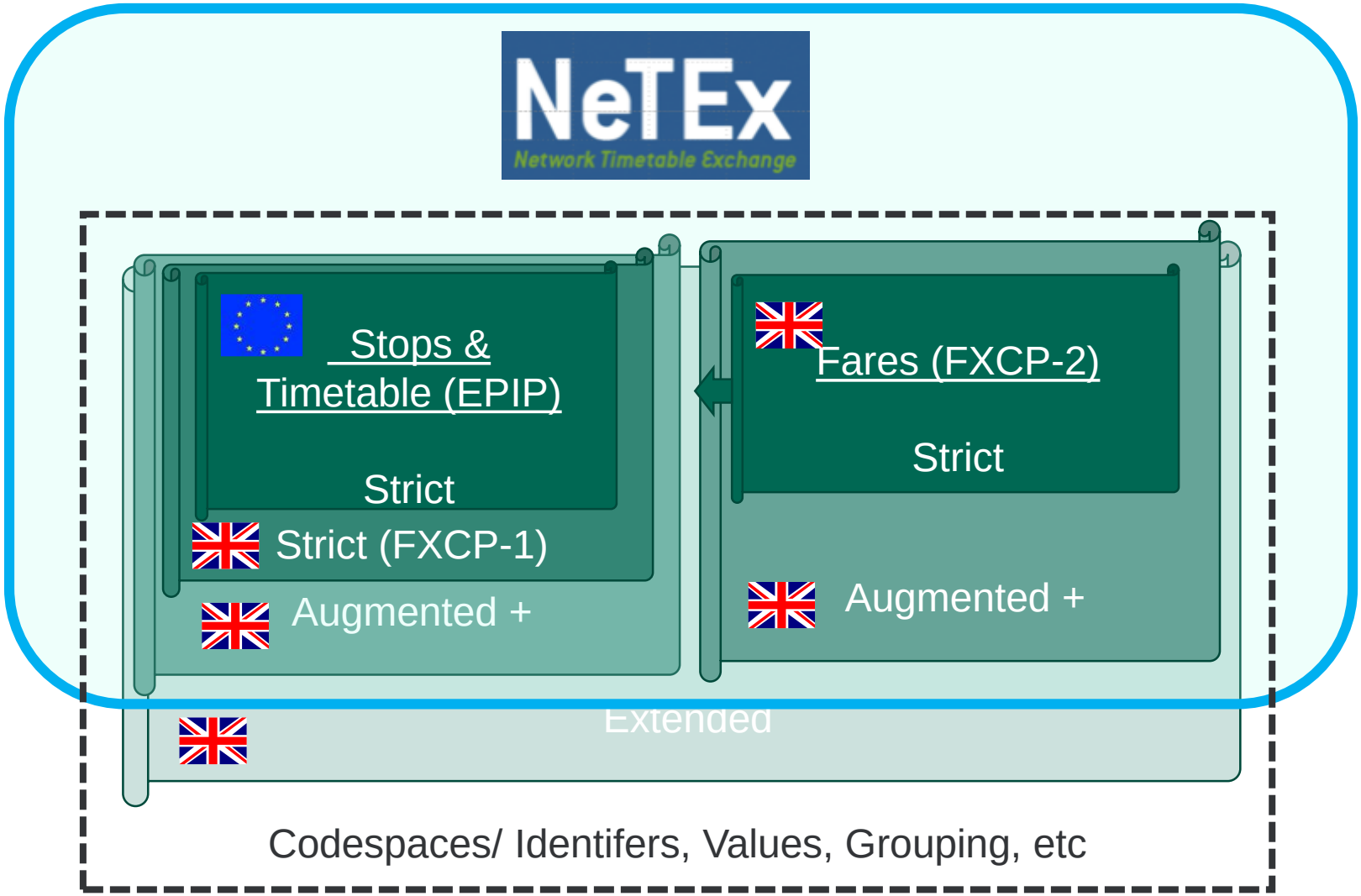
Degrees of Conformance – UK Profile



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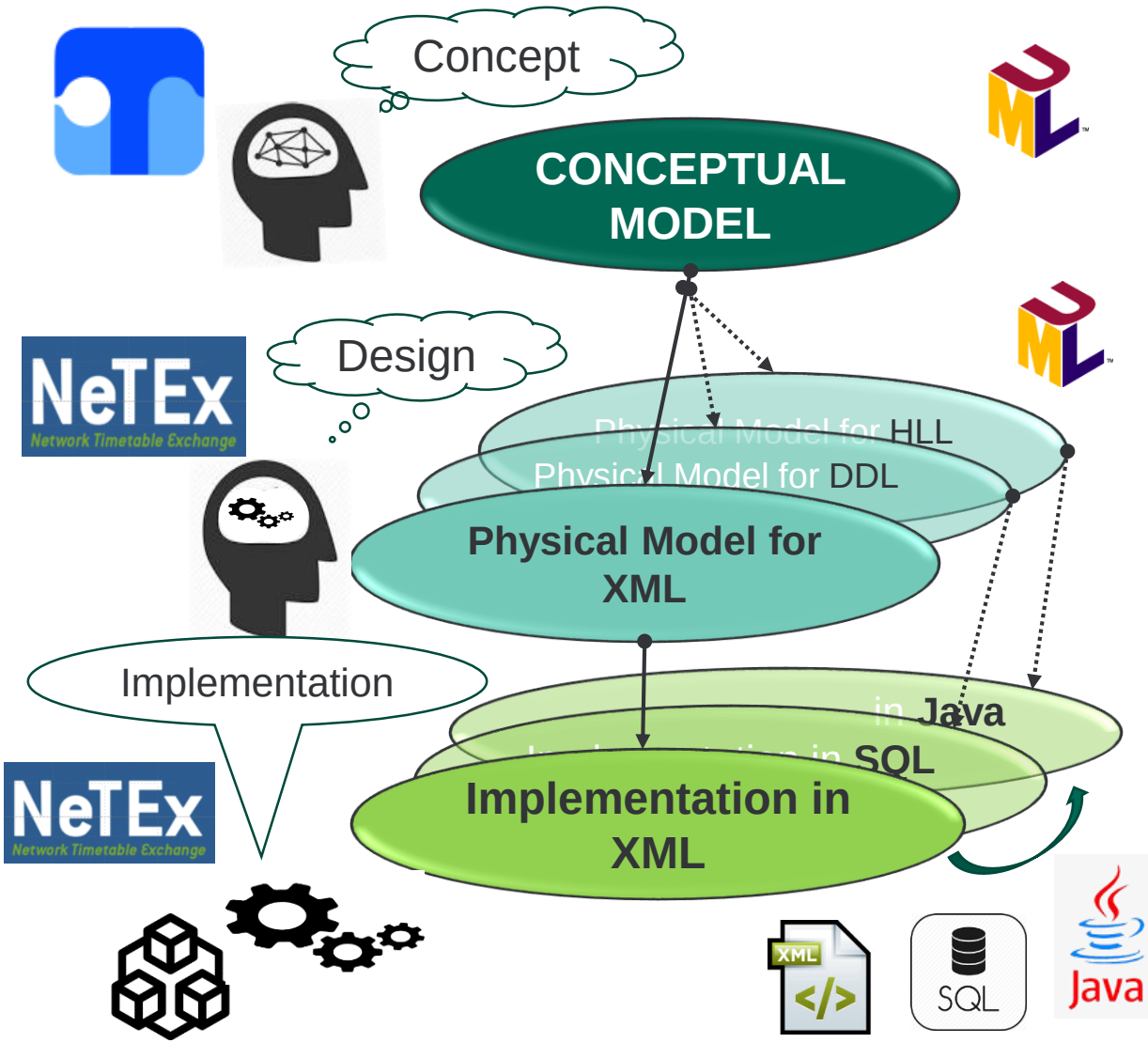
The Transmodel / NeTEx approach

Model Driven Design

Software engineering for robust standards

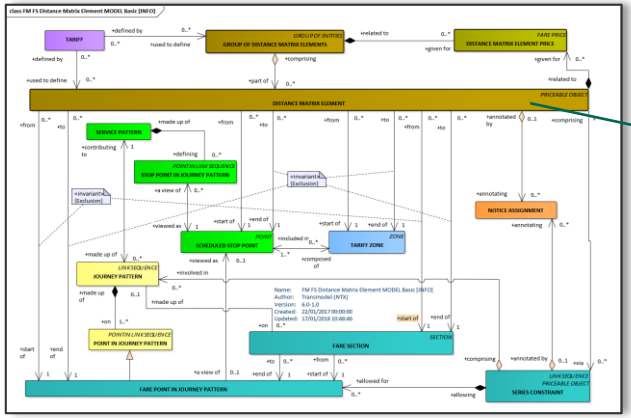
MODEL DRIVEN DESIGN

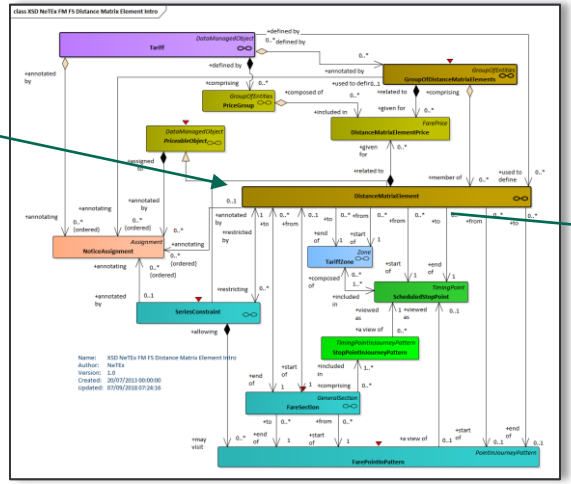
- **Conceptual Model is implementation independent**
  - Use to design
  - Described in UML
- **May have alternative Physical Models for different target implementations**
  - XML Physical design as UML
- **Implementation is derived from physical model.**
  - NeTEx XML Schema

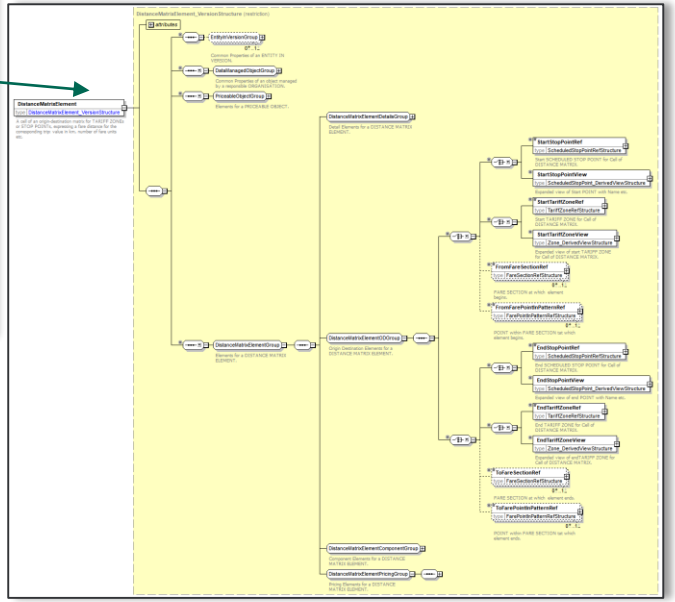


Designing a CEN Exchange format - Package & Element level traceability

Conceptual → Physical → Schema



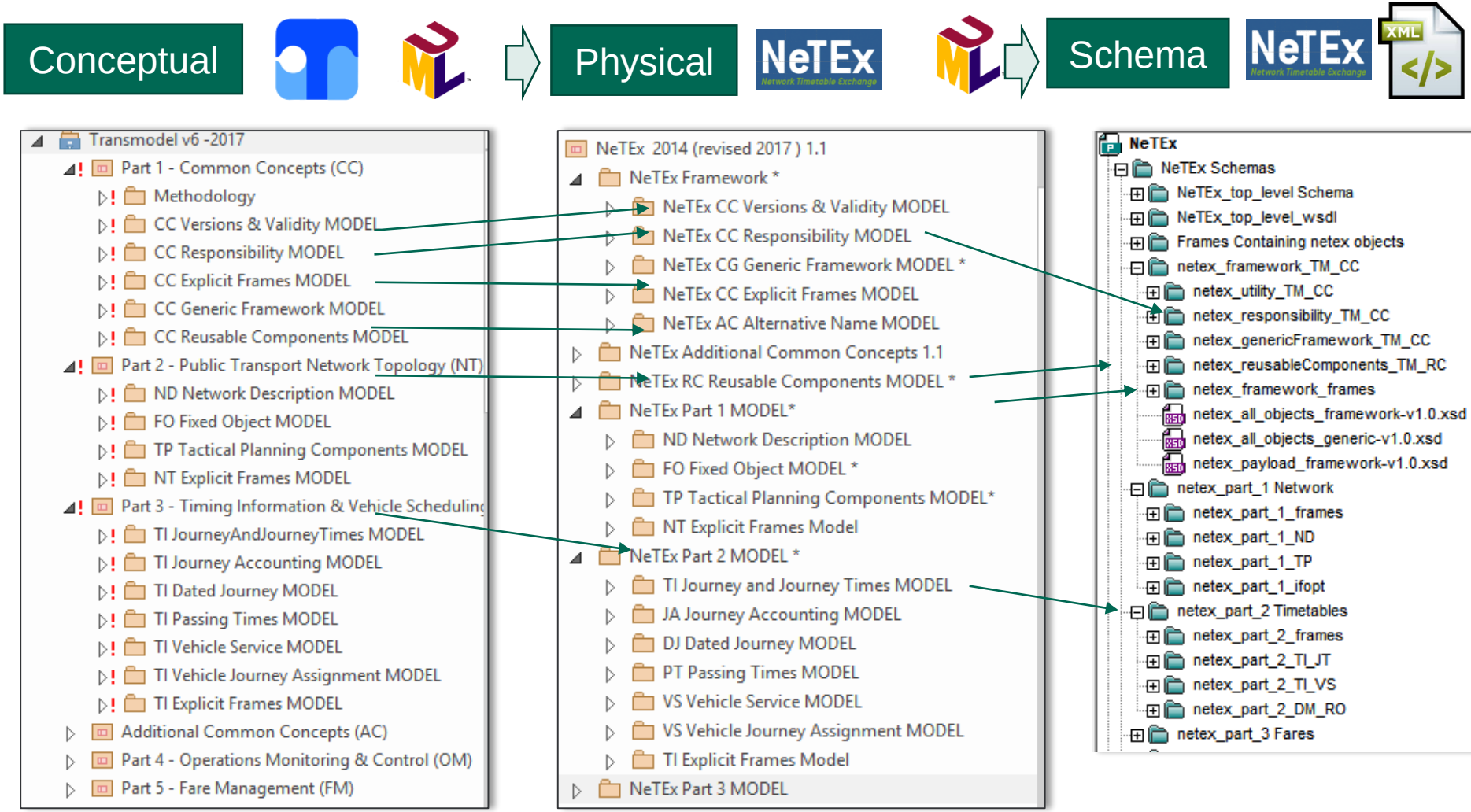




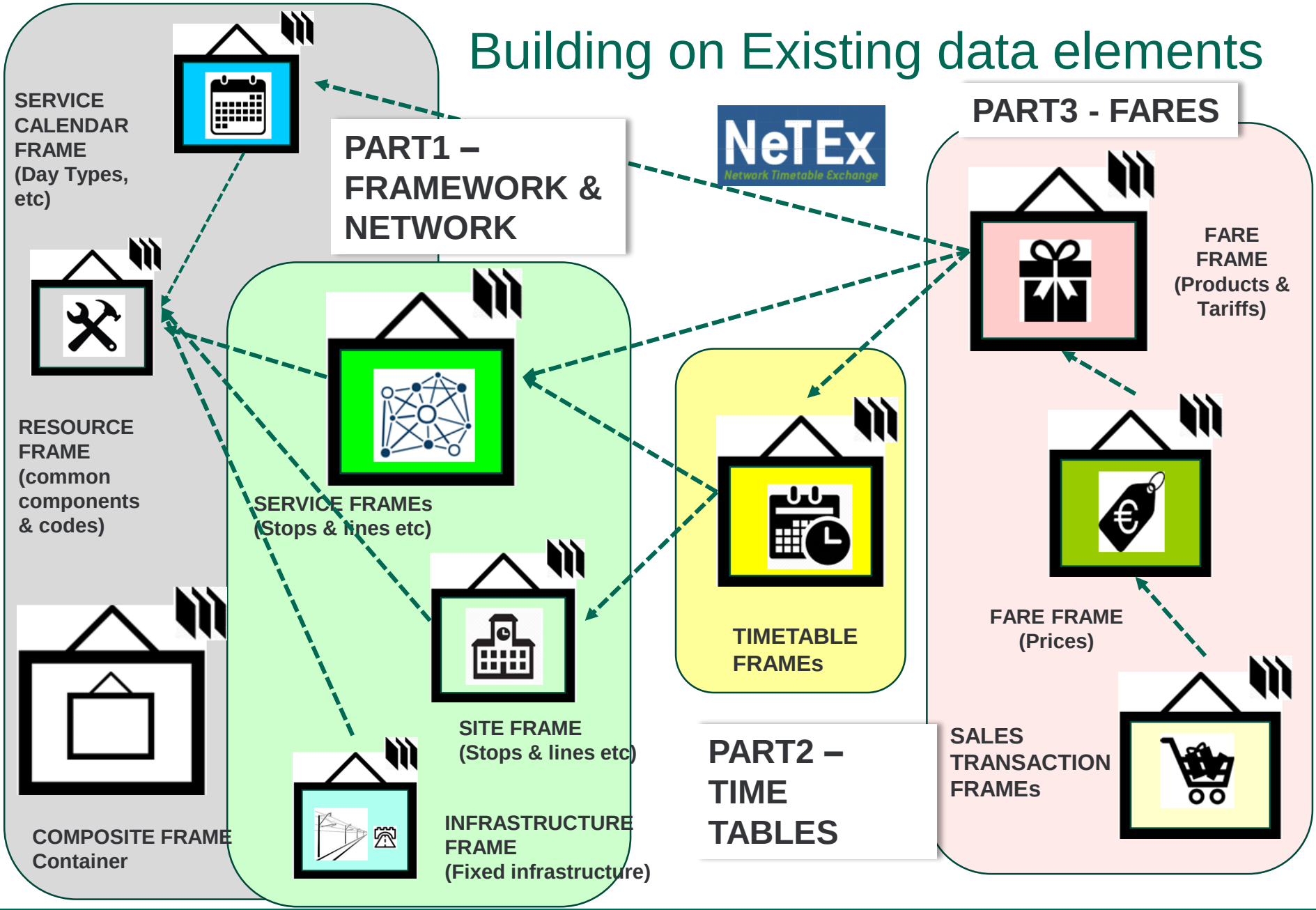
- **Traceability**
  - Equivalent elements can be found at each level
  - Physical design and Implementation each add further detail and constraints
- **Tool support (EA, XML SPY, OXYGEN, etc)**

Designing a CEN Exchange format - Package & Element level traceability

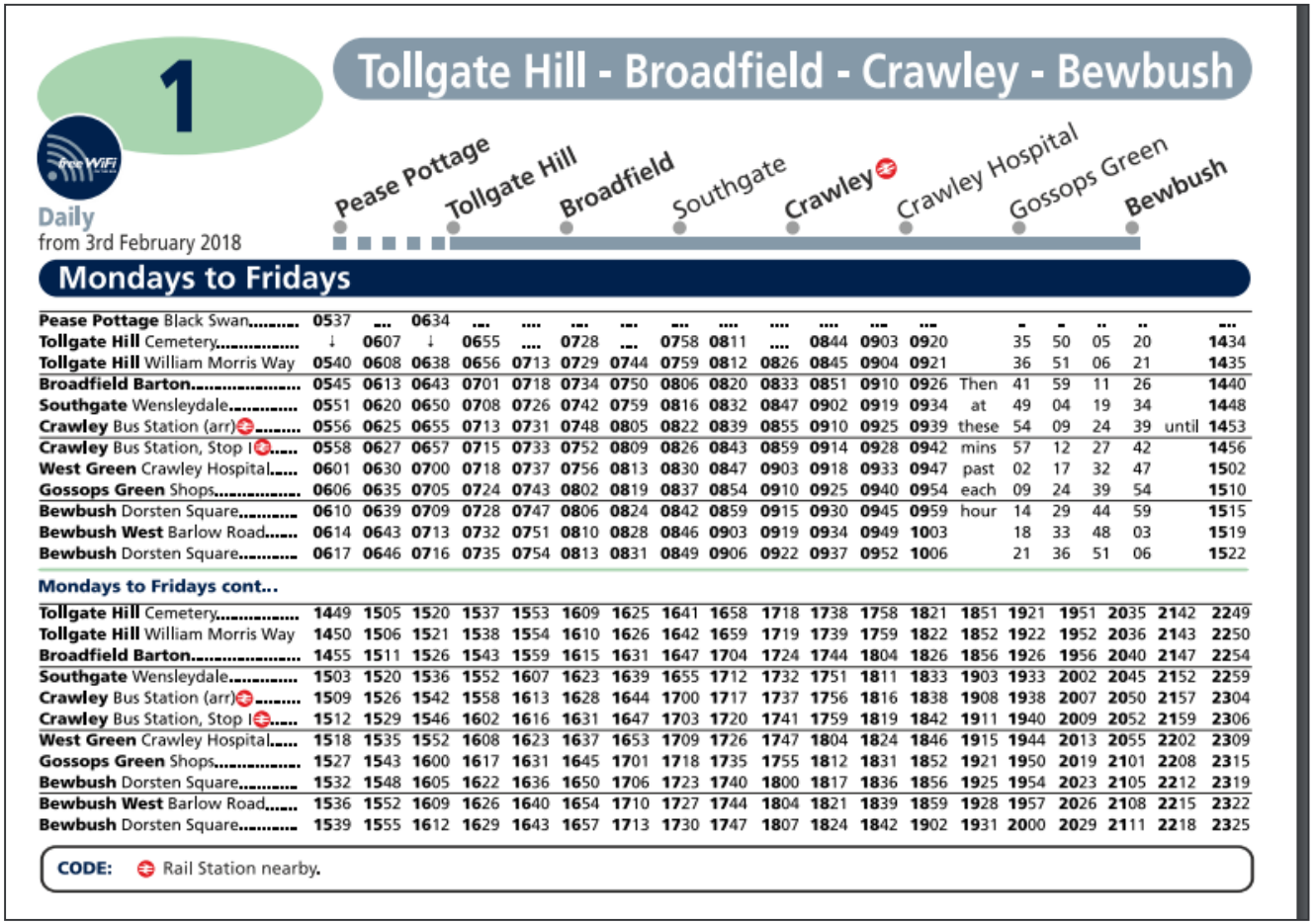
Conceptual → Physical → Schema



Building on Existing data elements



A typical Bus timetable (Metrobus Route 1)



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

free WiFi

Daily
from 3rd February 2018

Pease Pottage · Tollgate Hill · Broadfield · Southgate · Crawley · Crawley Hospital · Gossops Green · Bewbush

Mondays to Fridays

Pease Pottage Black Swan	0537	...	0634	...	....	...	...	...	....	....	....	...	...		-	-	..	..		...
Tollgate Hill Cemetery	↓	0607	↓	0655	....	0728	...	0758	0811	....	0844	0903	0920		35	50	05	20		1434
Tollgate Hill William Morris Way	0540	0608	0638	0656	0713	0729	0744	0759	0812	0826	0845	0904	0921		36	51	06	21		1435
Broadfield Barton	0545	0613	0643	0701	0718	0734	0750	0806	0820	0833	0851	0910	0926	Then	41	59	11	26		1440
Southgate Wensleydale	0551	0620	0650	0708	0726	0742	0759	0816	0832	0847	0902	0919	0934	at	49	04	19	34		1448
Crawley Bus Station (arr)	0556	0625	0655	0713	0731	0748	0805	0822	0839	0855	0910	0925	0939	these	54	09	24	39	until	1453
Crawley Bus Station, Stop I	0558	0627	0657	0715	0733	0752	0809	0826	0843	0859	0914	0928	0942	mins	57	12	27	42		1456
West Green Crawley Hospital	0601	0630	0700	0718	0737	0756	0813	0830	0847	0903	0918	0933	0947	past	02	17	32	47		1502
Gossops Green Shops	0606	0635	0705	0724	0743	0802	0819	0837	0854	0910	0925	0940	0954	each	09	24	39	54		1510
Bewbush Dorsten Square	0610	0639	0709	0728	0747	0806	0824	0842	0859	0915	0930	0945	0959	hour	14	29	44	59		1515
Bewbush West Barlow Road	0614	0643	0713	0732	0751	0810	0828	0846	0903	0919	0934	0949	1003		18	33	48	03		1519
Bewbush Dorsten Square	0617	0646	0716	0735	0754	0813	0831	0849	0906	0922	0937	0952	1006		21	36	51	06		1522

Mondays to Fridays cont...

Tollgate Hill Cemetery	1449	1505	1520	1537	1553	1609	1625	1641	1658	1718	1738	1758	1821	1851	1921	1951	2035	2142	2249
Tollgate Hill William Morris Way	1450	1506	1521	1538	1554	1610	1626	1642	1659	1719	1739	1759	1822	1852	1922	1952	2036	2143	2250
Broadfield Barton	1455	1511	1526	1543	1559	1615	1631	1647	1704	1724	1744	1804	1826	1856	1926	1956	2040	2147	2254
Southgate Wensleydale	1503	1520	1536	1552	1607	1623	1639	1655	1712	1732	1751	1811	1833	1903	1933	2002	2045	2152	2259
Crawley Bus Station (arr)	1509	1526	1542	1558	1613	1628	1644	1700	1717	1737	1756	1816	1838	1908	1938	2007	2050	2157	2304
Crawley Bus Station, Stop I	1512	1529	1546	1602	1616	1631	1647	1703	1720	1741	1759	1819	1842	1911	1940	2009	2052	2159	2306
West Green Crawley Hospital	1518	1535	1552	1608	1623	1637	1653	1709	1726	1747	1804	1824	1846	1915	1944	2013	2055	2202	2309
Gossops Green Shops	1527	1543	1600	1617	1631	1645	1701	1718	1735	1755	1812	1831	1852	1921	1950	2019	2101	2208	2315
Bewbush Dorsten Square	1532	1548	1605	1622	1636	1650	1706	1723	1740	1800	1817	1836	1856	1925	1954	2023	2105	2212	2319
Bewbush West Barlow Road	1536	1552	1609	1626	1640	1654	1710	1727	1744	1804	1821	1839	1859	1928	1957	2026	2108	2215	2322
Bewbush Dorsten Square	1539	1555	1612	1629	1643	1657	1713	1730	1747	1807	1824	1842	1902	1931	2000	2029	2111	2218	2325

CODE: Rail Station nearby.

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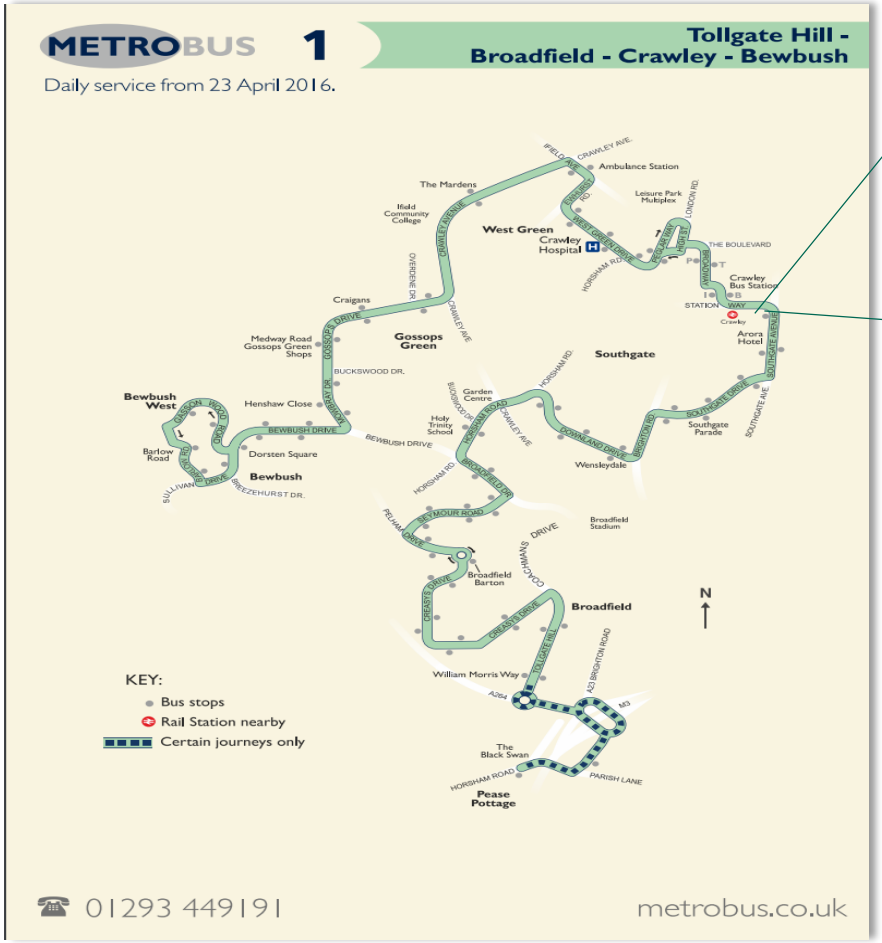
A Typical Bus Route (Metrobus Route 1)



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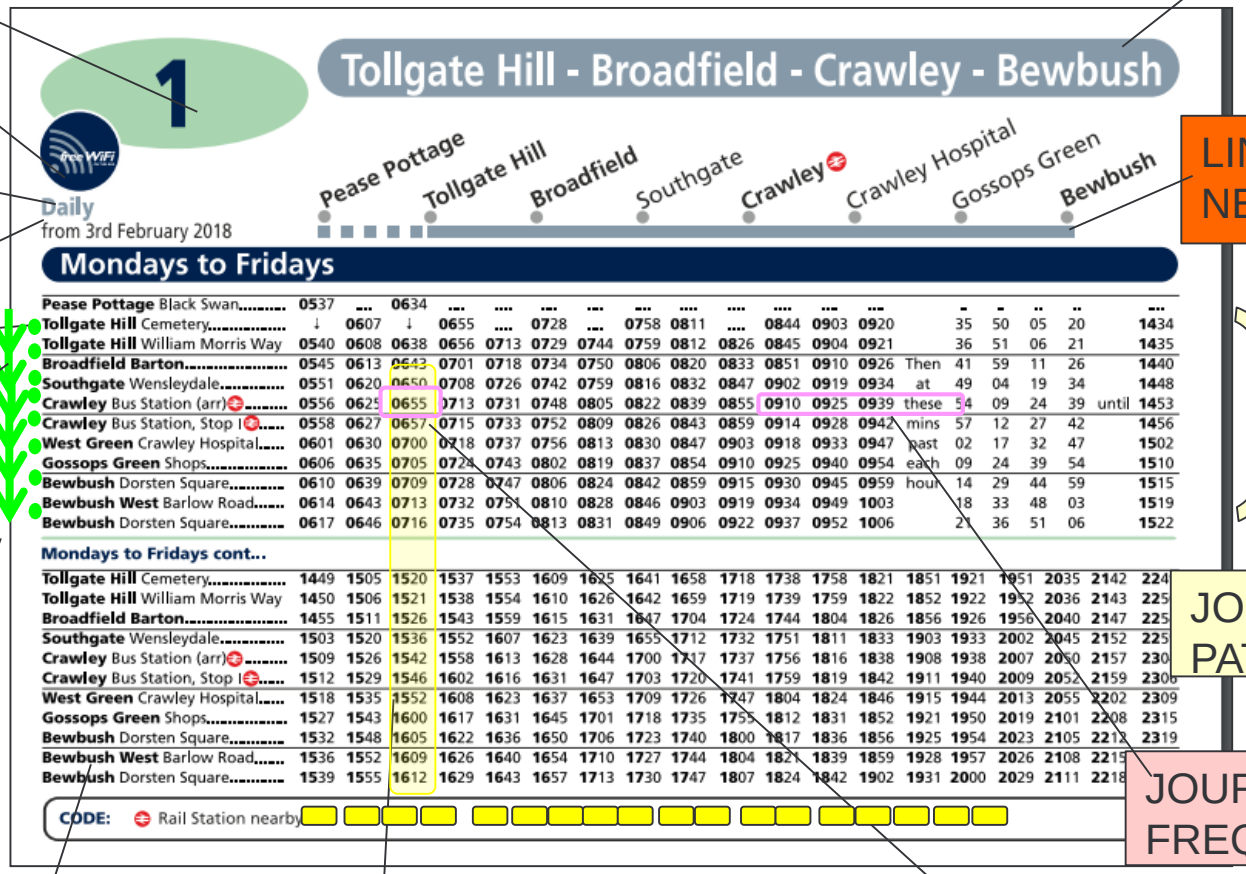
TM: A Bus timetable as model elements



LINE

FACILITY

DAY TYPE

VALIDITY CONDITION

SCHEDULED STOP POINTs

SERVICE LINKs

CONNECTION

SERVICE PATTERN

NOTICE

VEHICLE JOURNEYs

PASSING TIMEs

JOURNEY FREQUENCY

JOURNEY PATTERNs

LINE NETWORK

TIMETABLE

TM: The PT Network Description

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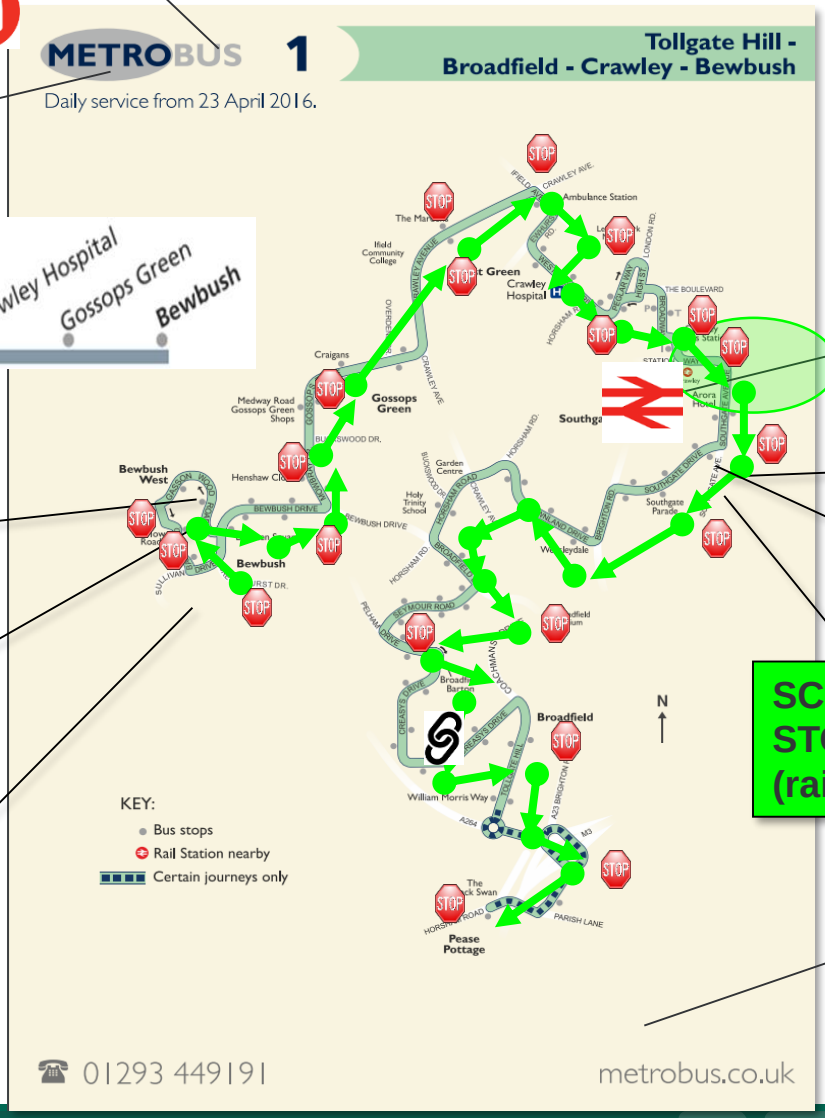
MODE

LINE



POINT OF INTEREST *(hospital)*

CONNECTION *(rail)*

STOP AREA

SCHEDULED STOP POINT (rail)

SCHEDULED STOP POINTs (bus)

SERVICE LINKs

SERVICE PATTERNs

TOPOGRAPHIC PLACEs

OPERATOR

TM: A Vehicle Journey

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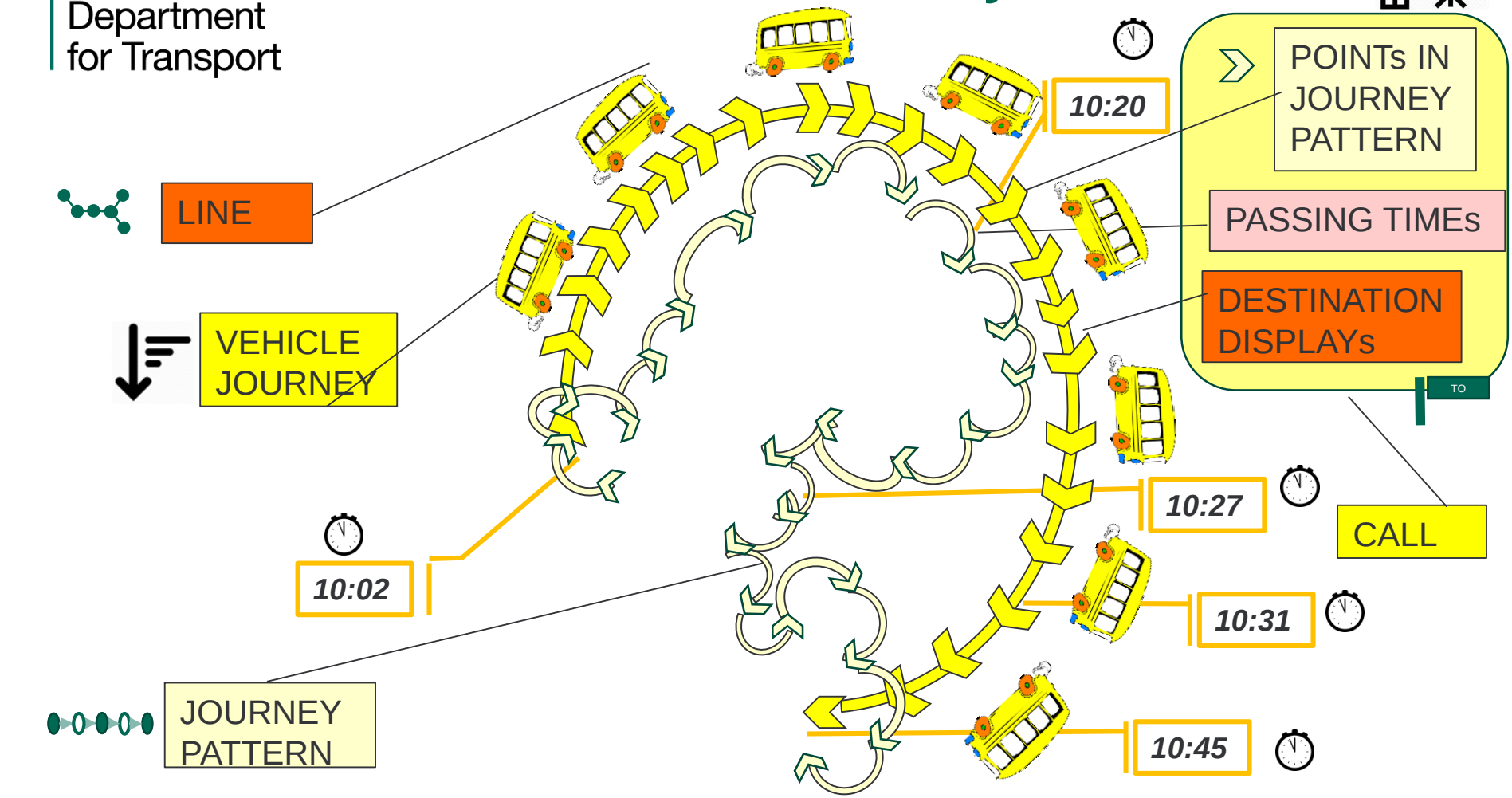

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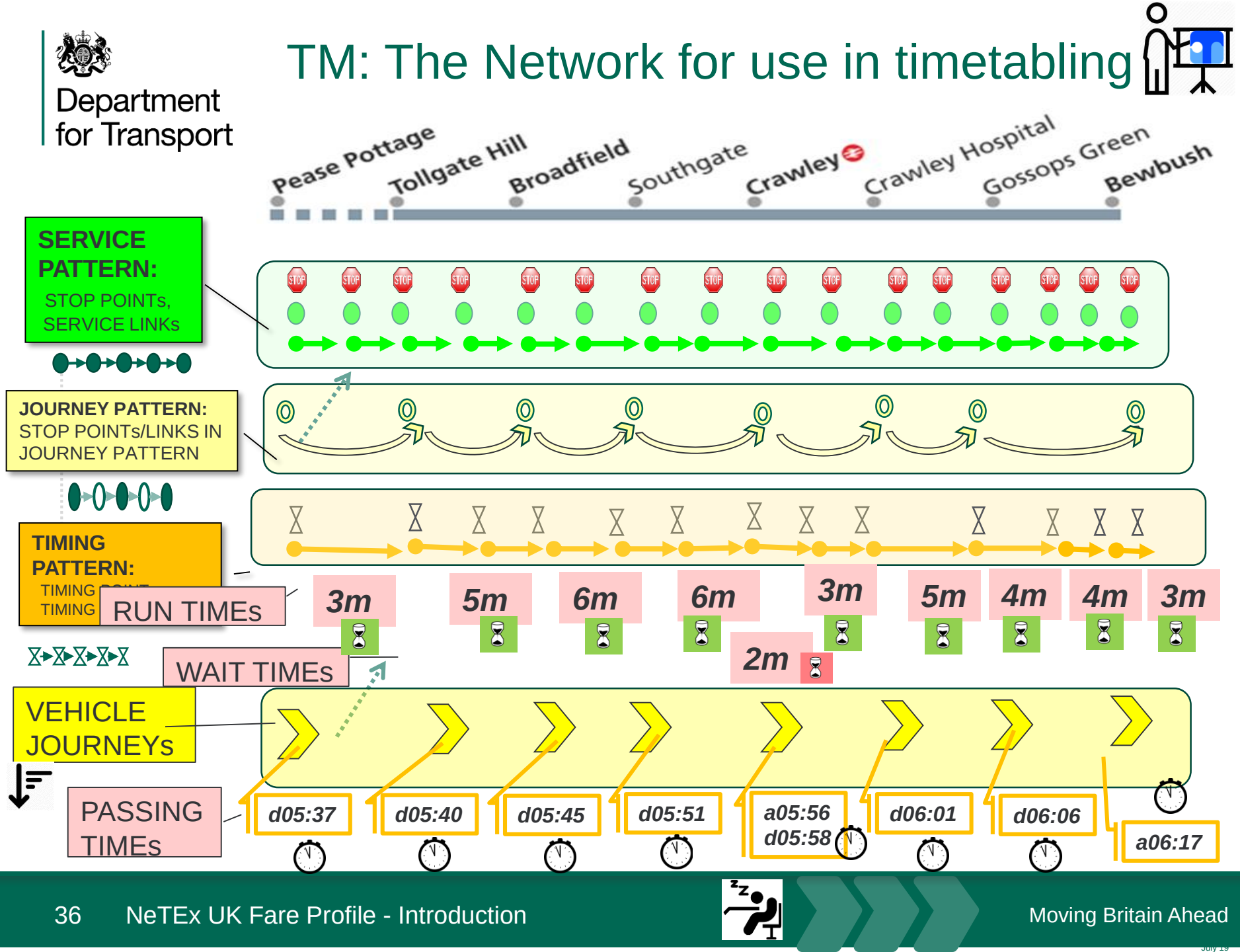
TM: The Network for use in timetabling



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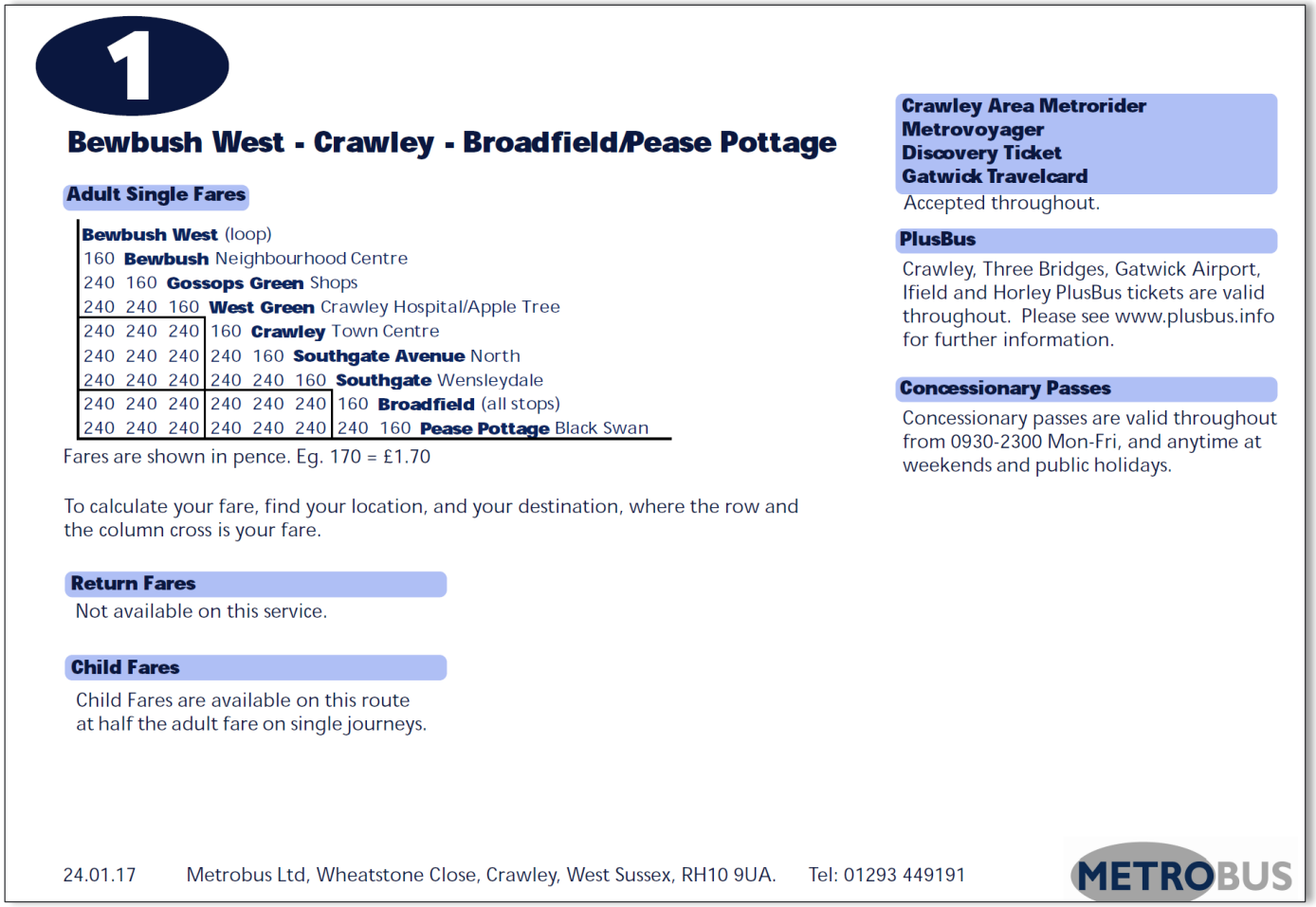
Metrobus 1 - Single ride



1

Bewbush West - Crawley - Broadfield/Pease Pottage

Adult Single Fares

Bewbush West (loop)						
160	**Bewbush** Neighbourhood Centre					
240	160	**Gossops Green** Shops				
240	240	160	**West Green** Crawley Hospital/Apple Tree			
240	240	240	160	**Crawley** Town Centre		
240	240	240	240	160	**Southgate Avenue** North	
240	240	240	240	240	160	**Southgate** Wensleydale
240	240	240	240	240	240	160 **Broadfield** (all stops)
240	240	240	240	240	240	240 160 **Pease Pottage** Black Swan

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.

Crawley Area Metrorider
Metrovoyager
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 0930-2300 Mon-Fri, and anytime at weekends and public holidays.

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

METROBUS

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https://www.metrobus.co.uk/route-information/1

Single Trip Fare Pricess

LINE 1

SALES PACKAGE
Single ride, "Cash"

FARE PRODUCT

TYPE OF TRAVEL DOCUMENT

FARE ZONEs

TARIFF

USER PROFILE
Adult

DISTANCE MATRIX ELEMENTs

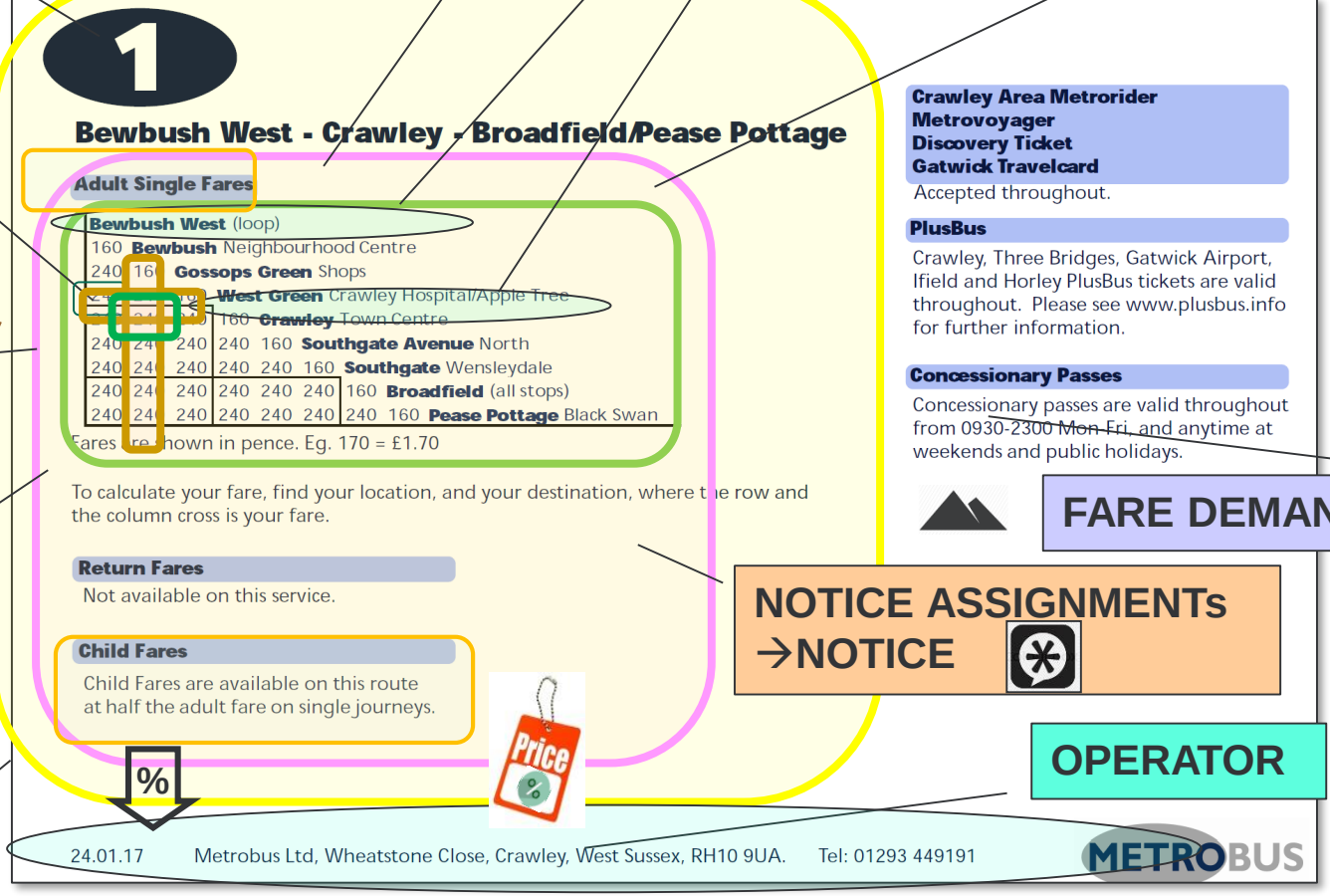
FARE PRICEs

FARE TABLE

PRICE UNIT

USER PROFILE

PRICE RULE



FARE DEMAND

NOTICE ASSIGNMENTs
→NOTICE

OPERATOR

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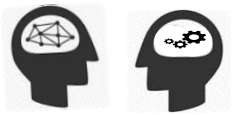
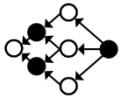
Advantages of Model Driven Design





- **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**

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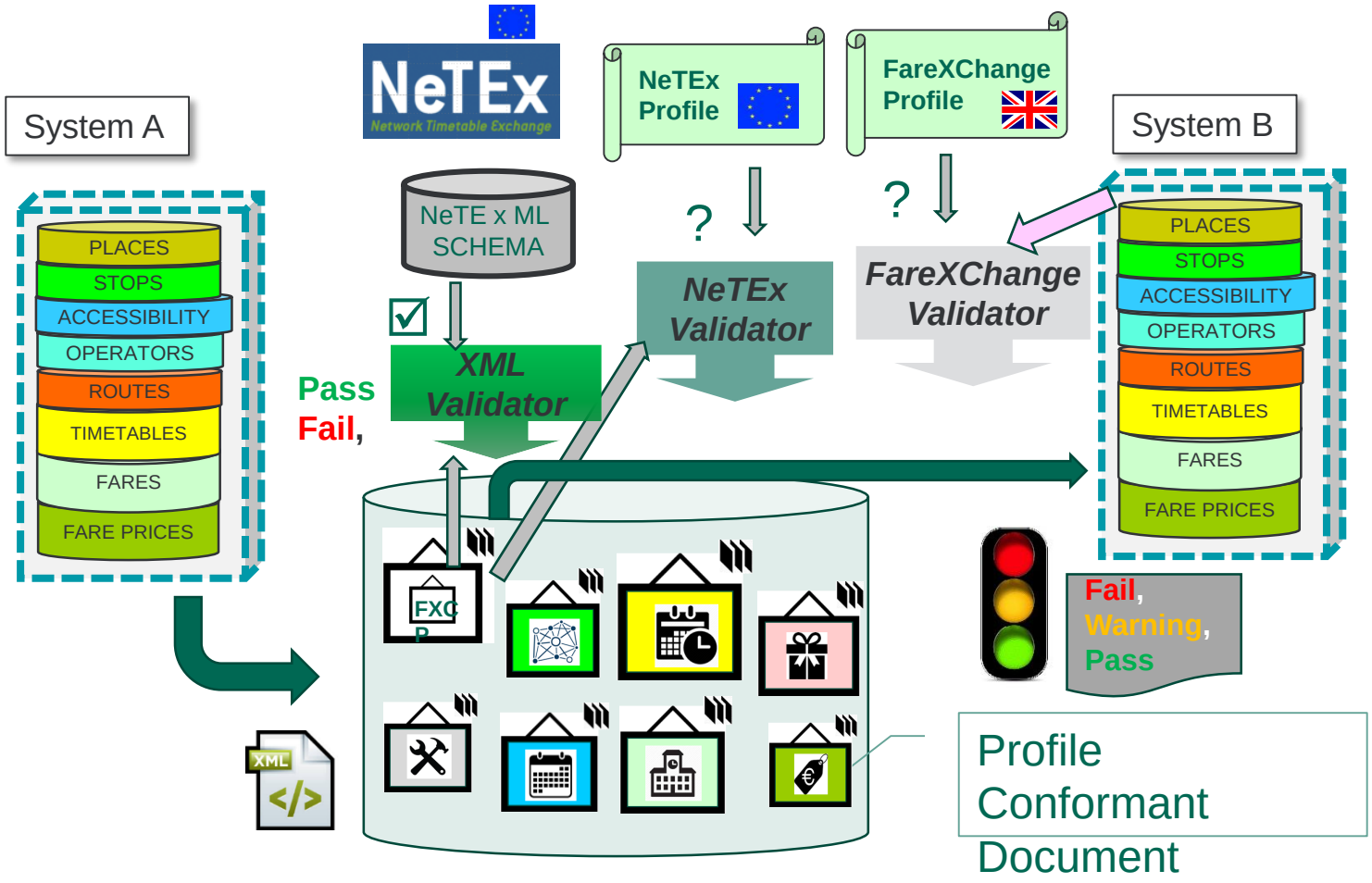
NeTEx Validators & Profiles - A model allows validation



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NeTEx Deliverables & IPR

NeTEx Network Timetable Exchange

- 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/

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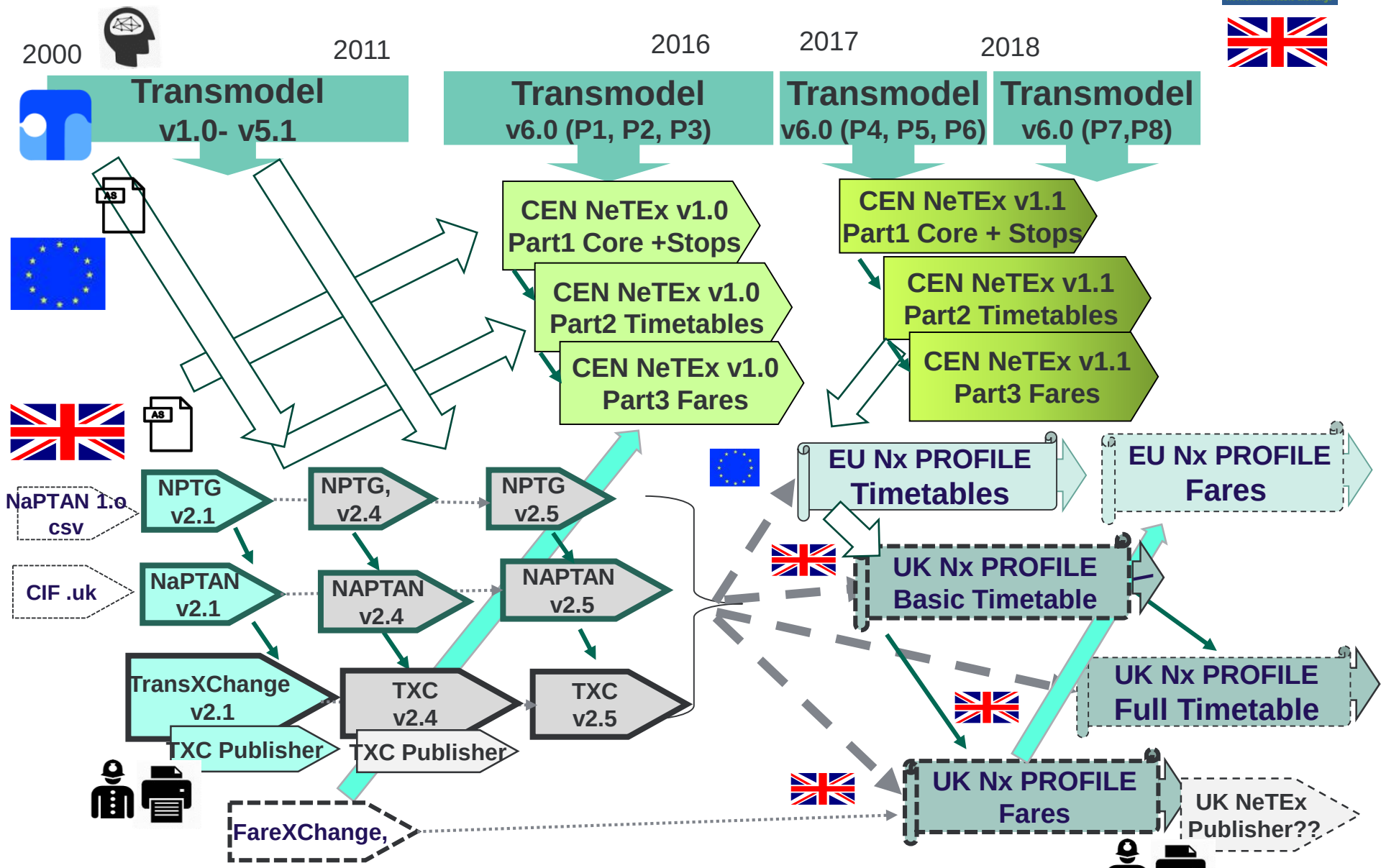
NeTEx & UK Standards

NeTEx – and UK National 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