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# UK Fares and NeTEx Workshop

## London 6th November, Manchester 7th November, 2018

| | |
|---|---|
| **13:15** | **Getting to know NeTEx** |
| **13:45** | NeTEx Basic fares profile - detailed |
| **15:15** | NeTEx routes and timetables - detailed |
| **15:45** | Preview of Complex fares requirement |
| **16:15** | Questions and Next Steps |

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# Getting to Know NeTEx

## Objectives of this session

- Give a High Level orientation on NeTEx as a standard for fares
  - Convey how Model Driven Design works
- Present an overview of the Transmodel / NeTEx approach to representing Fares
  - Access rights, Parameters, Products & Offers
- Introduce some examples, terminology & notations for the later detailed sessions on Fares & Timetables

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# NeTEx
# A Quick Technical Introduction

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# What is NeTEx?

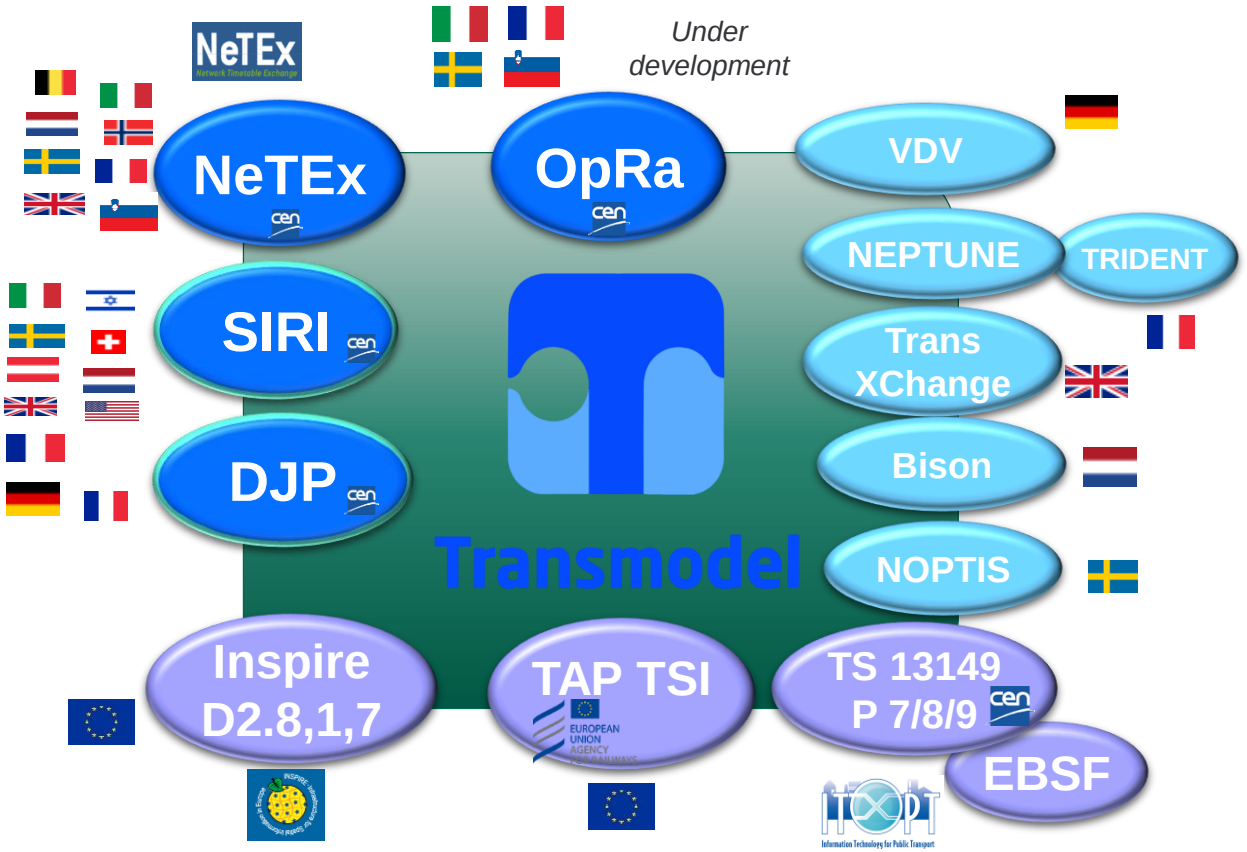
- **A CEN standard format for the exchange of PT data for Passenger Information**
  - Networks, Timetables, Fares
- **Based on CEN Transmodel conceptual model for PT data** (NeTEx is a subset)
  - Concepts evolved over 20 years from real PT systems across Europe. (Now on Version 6.0)
  - Now mandated for widespread EU use
- **Uses a modular XML schema**
  - Model driven design from conceptual model in UML
  - Free to use under a GPL License

# 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



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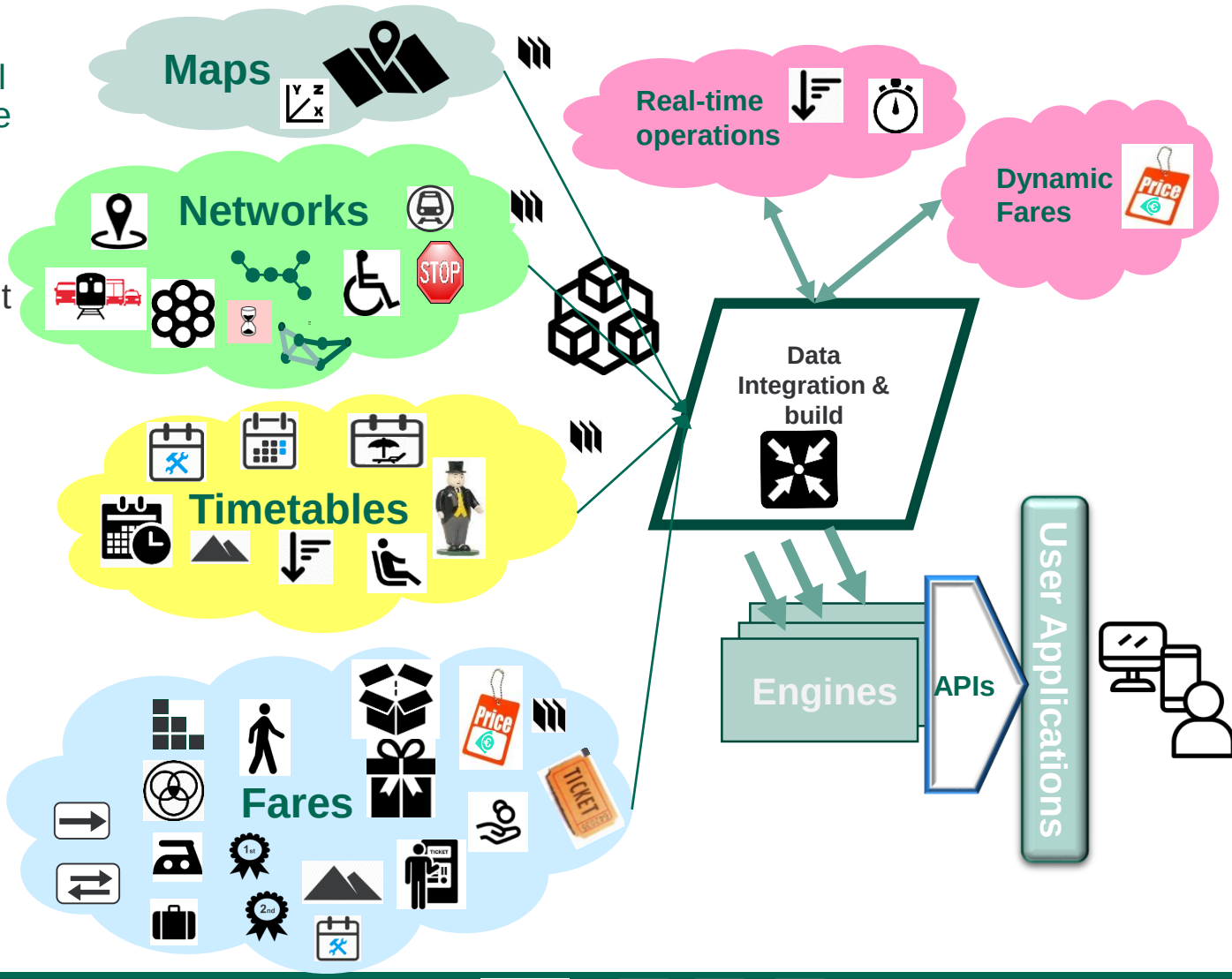
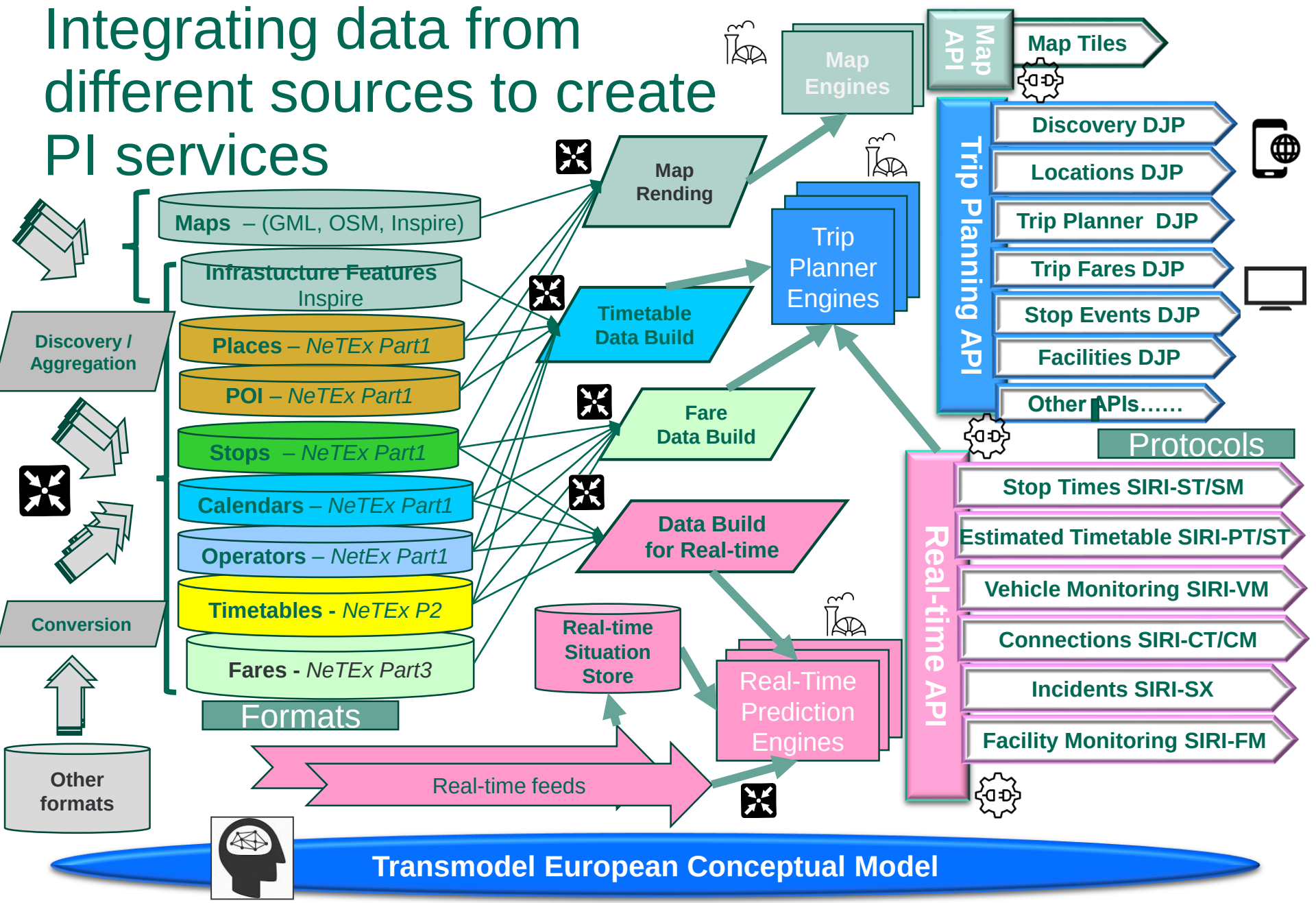
# Why? - Integrating data for Passenger Information services

- 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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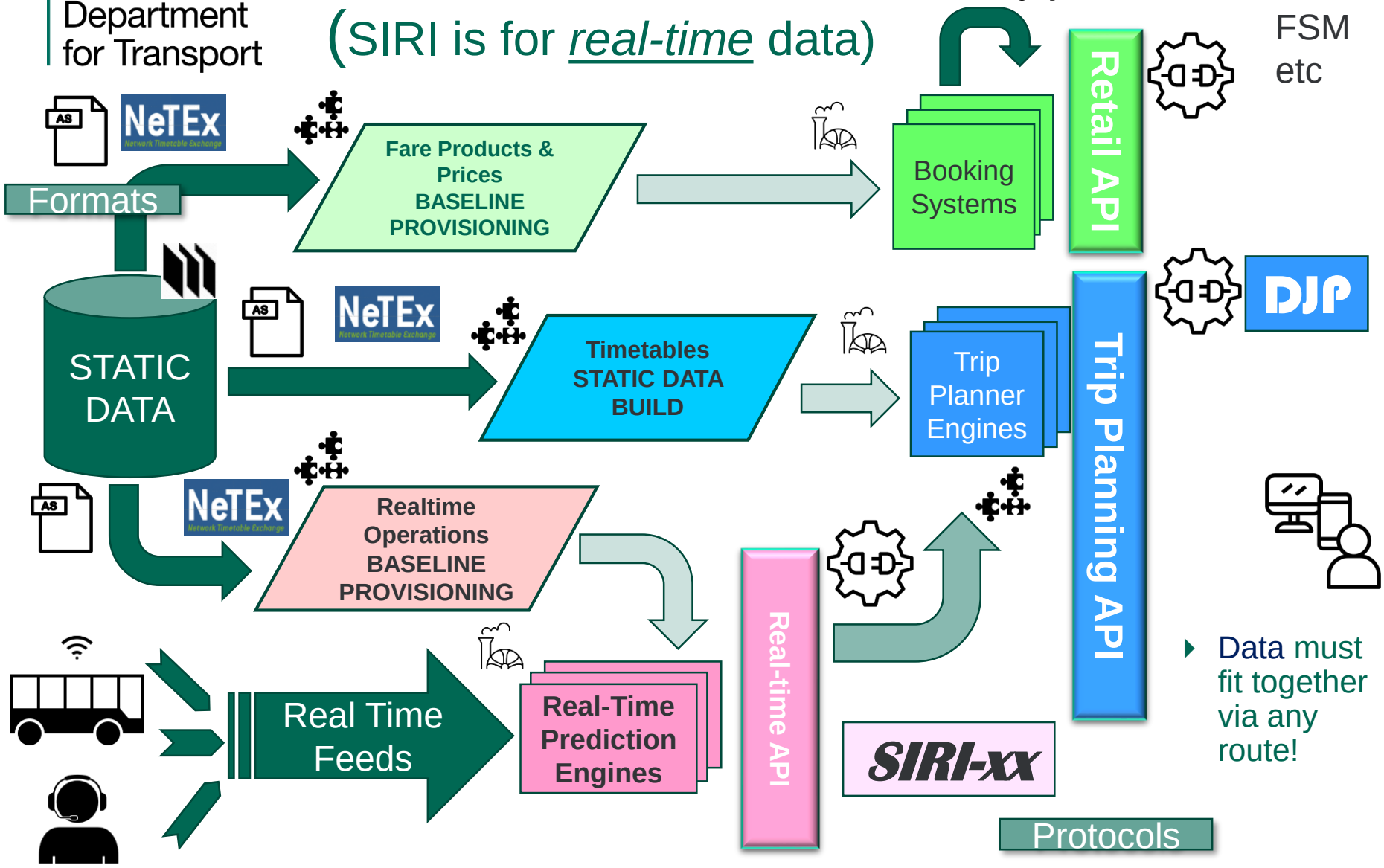
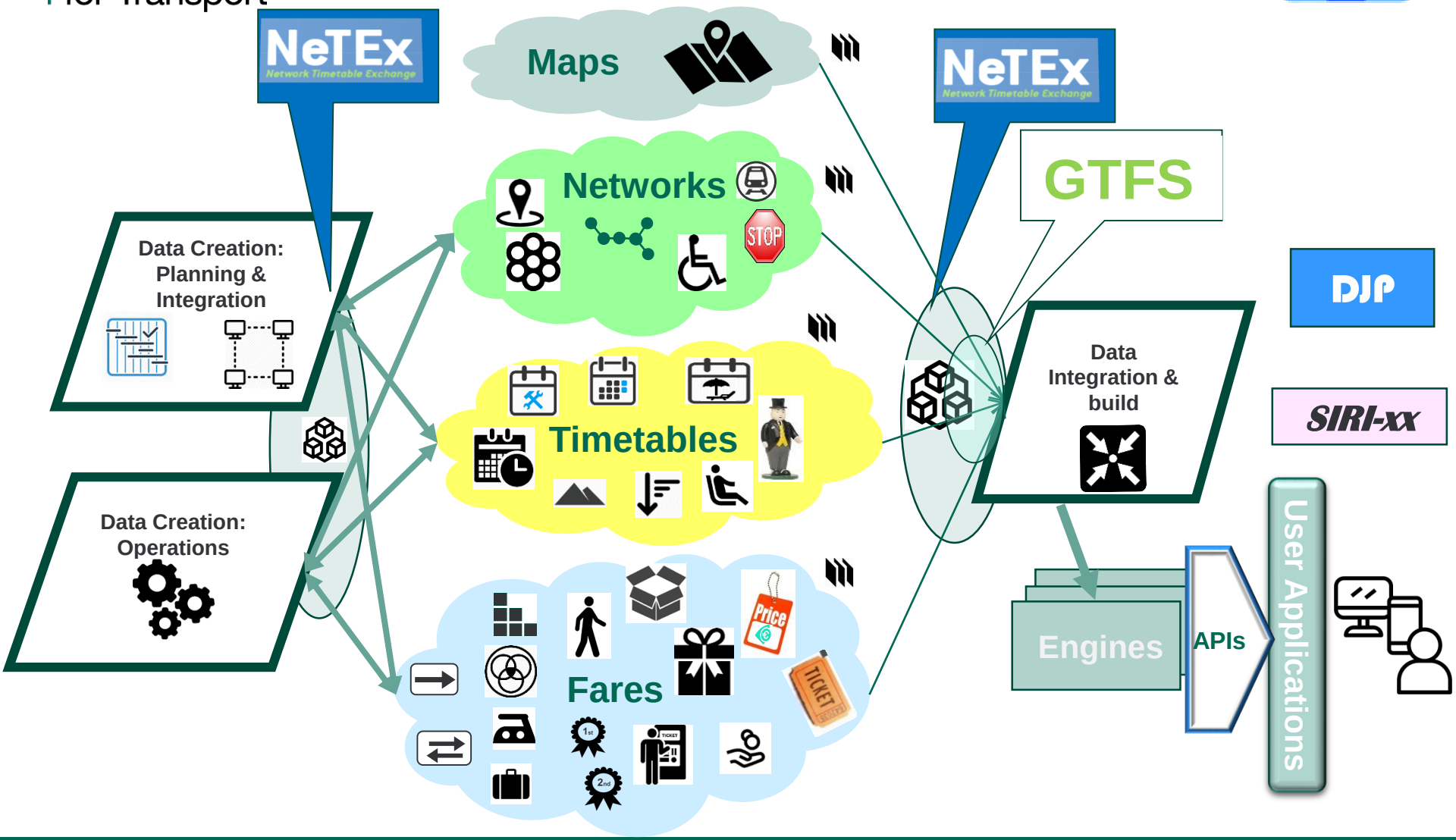
# NeTEx is for *static* data

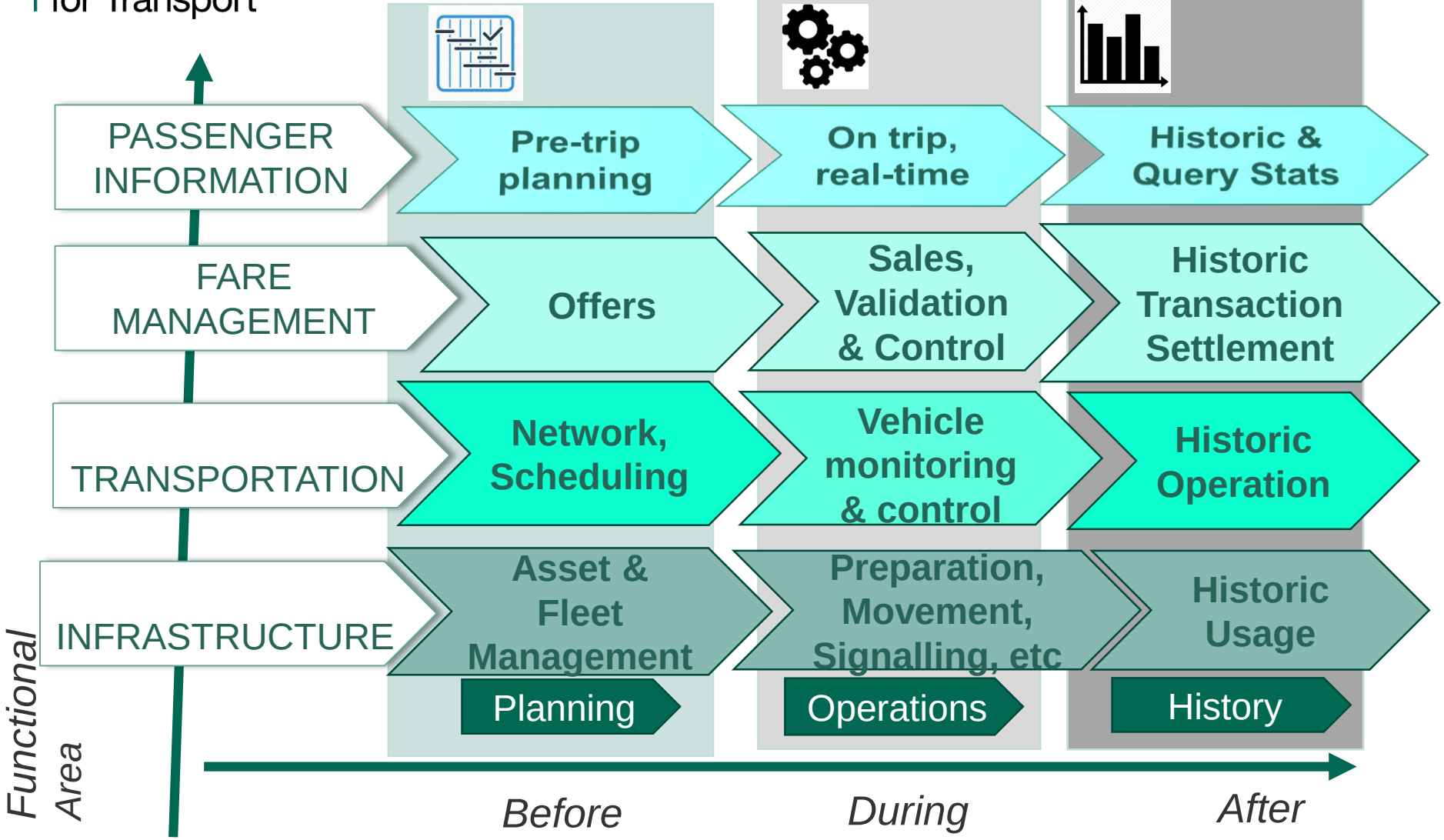
## (SIRI is for *real-time* data)



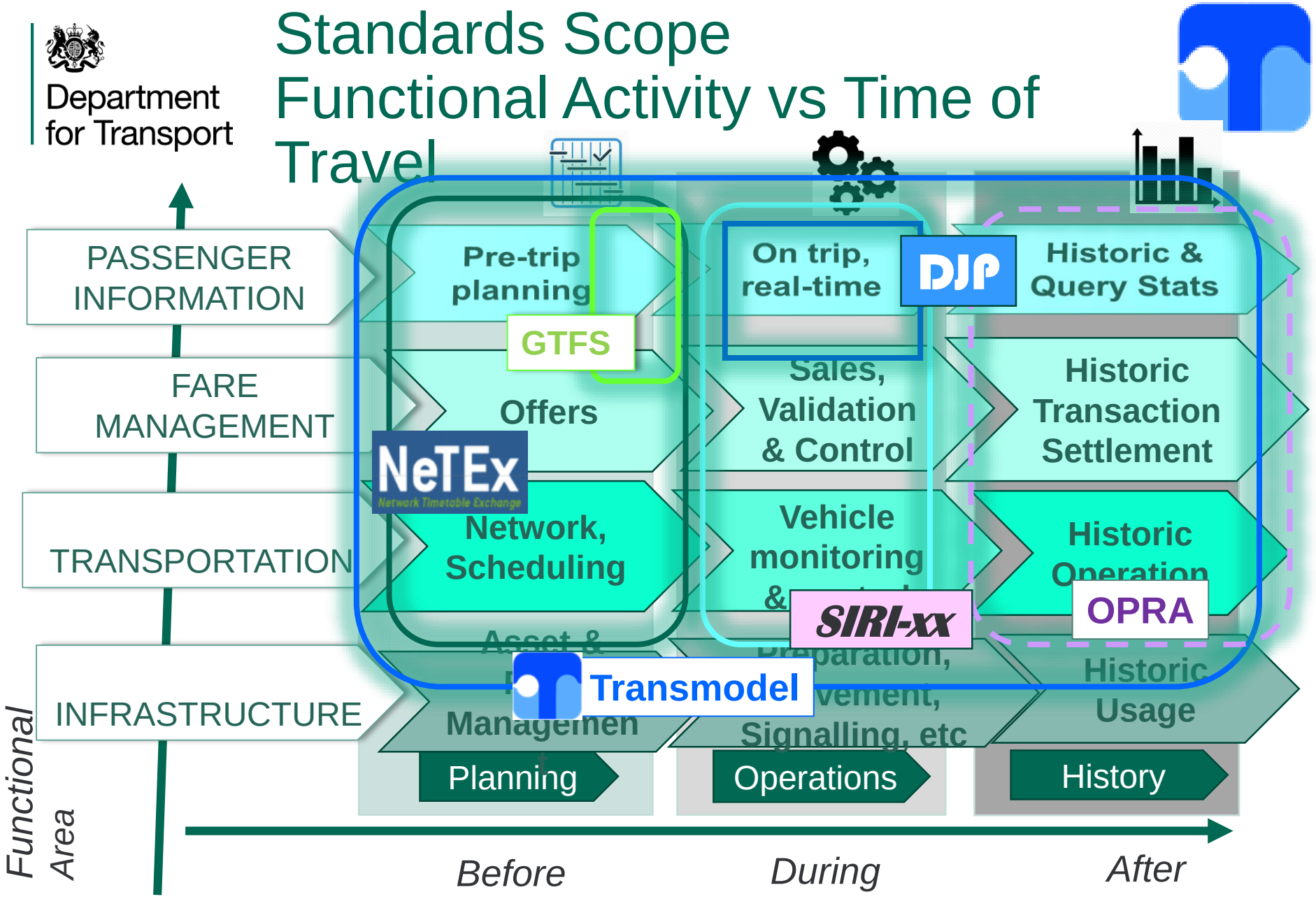
# Upstream vs Downstream
## (NB GTFS & NeTEx are complementary!)



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



# Standards Scope
# Functional Activity vs Time of Travel



# NeTEx Profiles

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NeTEx Network Timetable Exchange

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

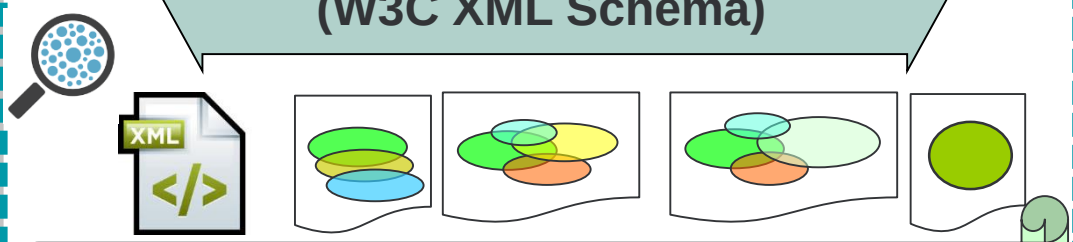
System A

- 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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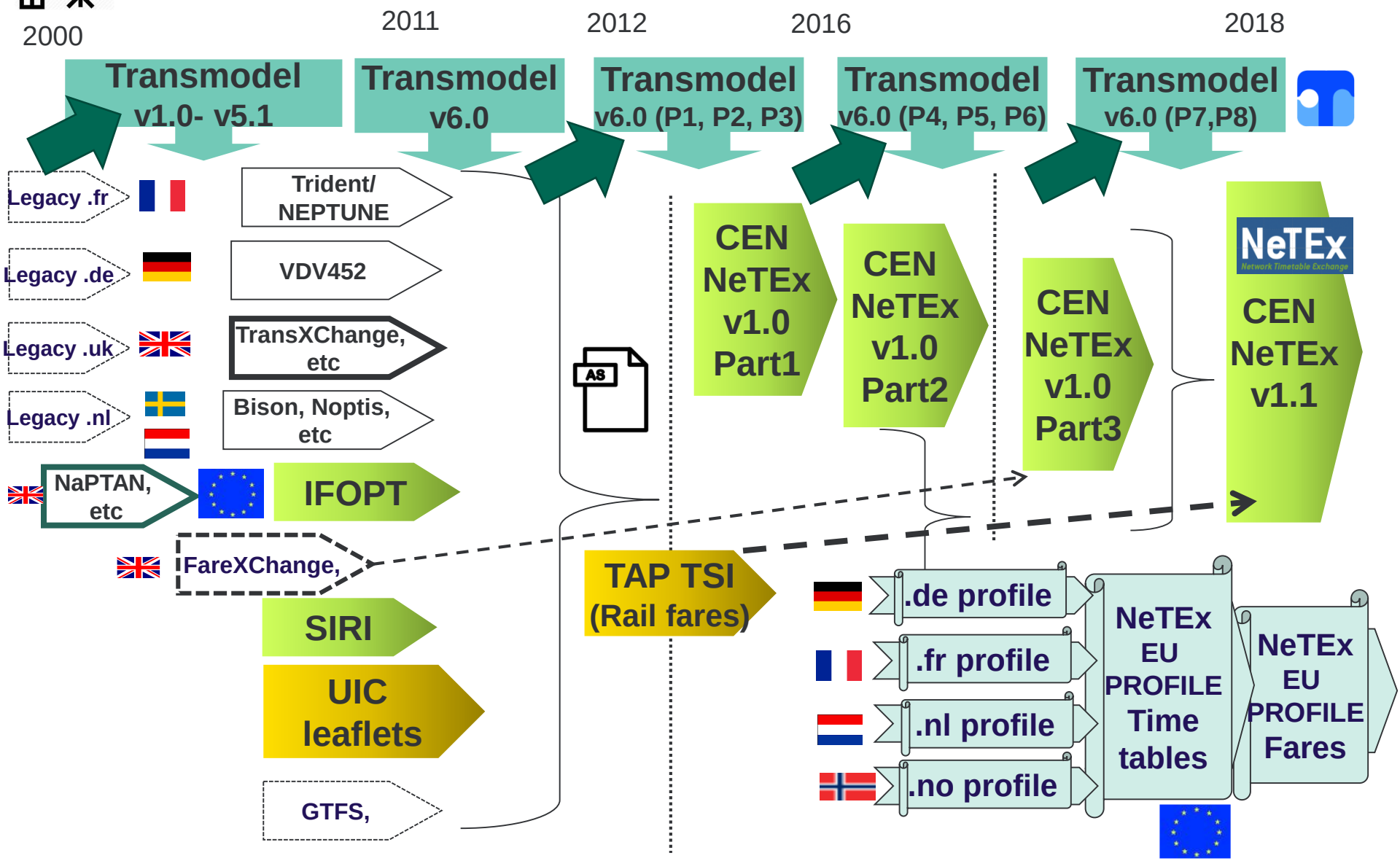
# Aspects of a NeTEx Profile

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.
  - Use of coordinate systems (O/S, WGS85..), Time zones, etc.
- **Profile - Use in National Context**
  - Granularity of NeTEx data files
  - Participants & Workflow of data exchange
  - Validation & Verification processes
- **Profile Management**
  - Stakeholders?
  - Governance processes for future evolution

# NeTEx – Evolution from National Standards



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# CEN Standardisation

- Open 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

# Standards Governance
## CEN 278 WG3 - Subgroups for PT Info

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CEN / TC278 / WG 3
**Public Transport**
Plenary Chair:

**SG1**
*Data Communication on Vehicles*

**SG 3**
*Passenger Information*

**SG 4**
*Datamodel – Transmodel*

**SG 5**
*Interoperable Fare Management*

**SG 6**
*Identification of fixed Objects in PT*

**SIRI-xx SG 7**
*Service Interface for Real Time Information*

**SG 8**
*Distributed Journey Planning*

**SG 9**
NeTEx Network Timetable Exchange

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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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# UK NeTEx Deliverables & IPR

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

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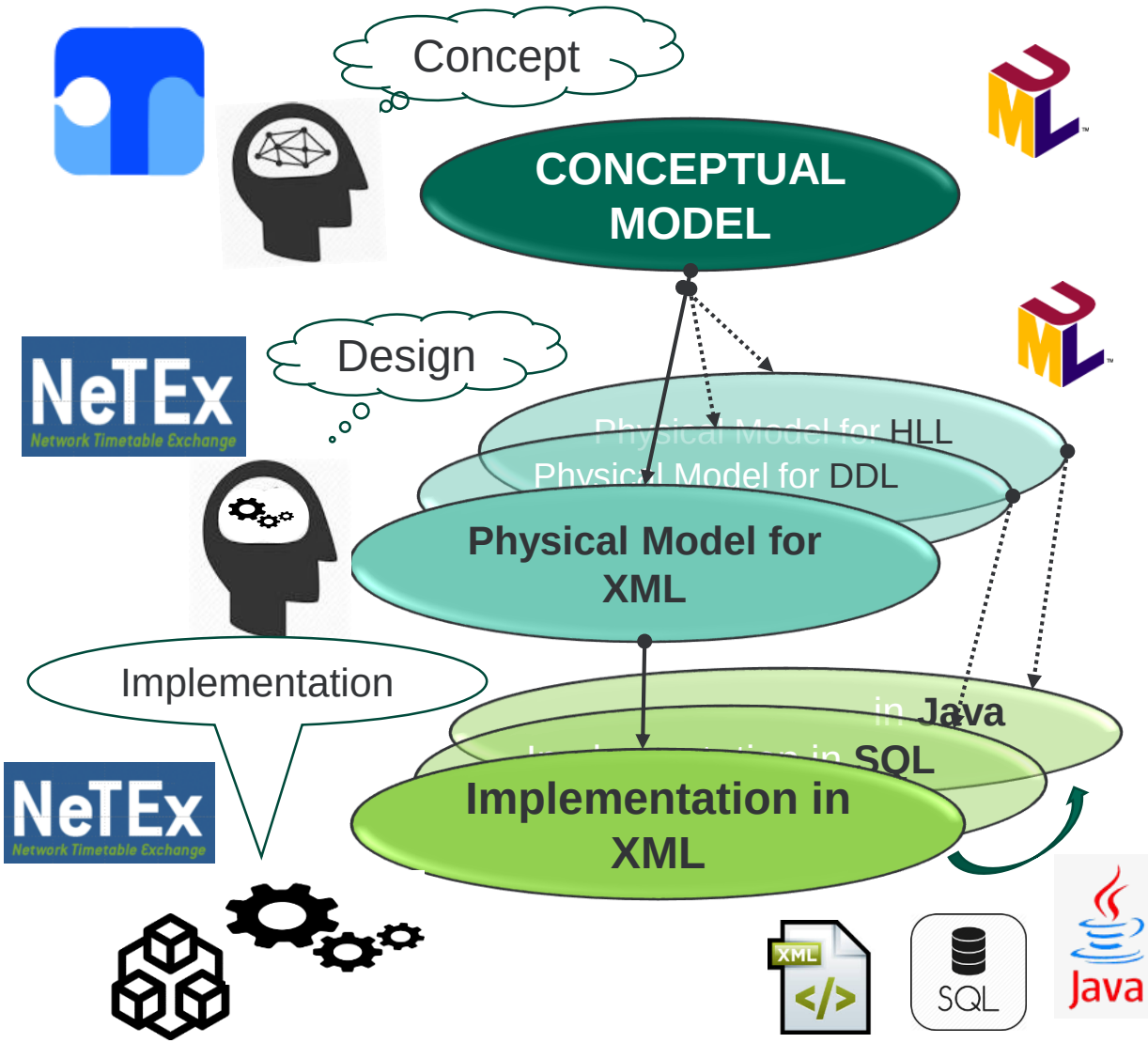
# The Transmodel / NeTEx approach

## Model Driven Design

Software engineering for robust standards

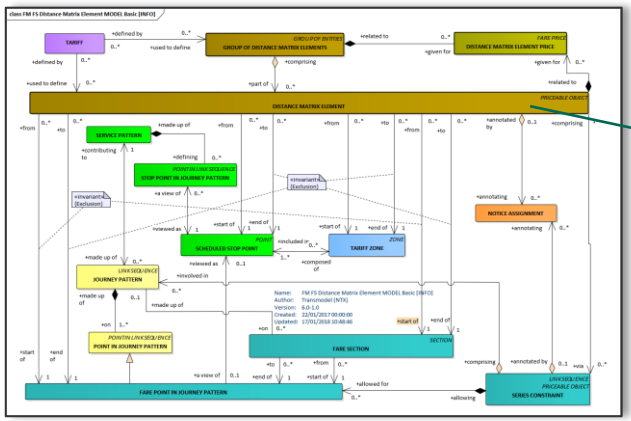
# MODEL DRIVEN DESIGN

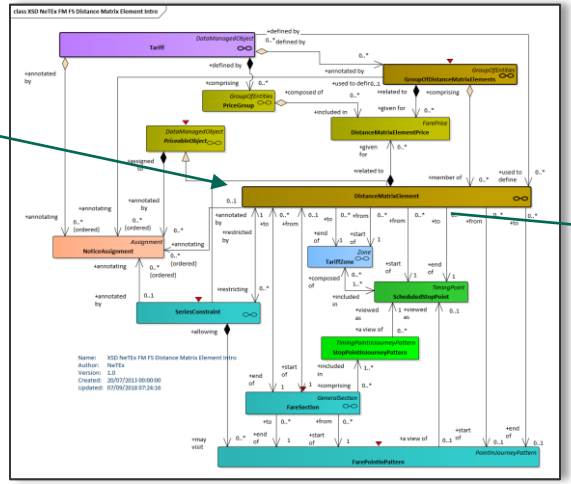
- **Conceptual Model is implementation independent**
  - Use to design
  - Described in UML
- **May have alternative Physical Models for different target implementations**
  - XML Physical design as UML
- **Implementation is derived from physical model.**
  - NeTEx XML Schema

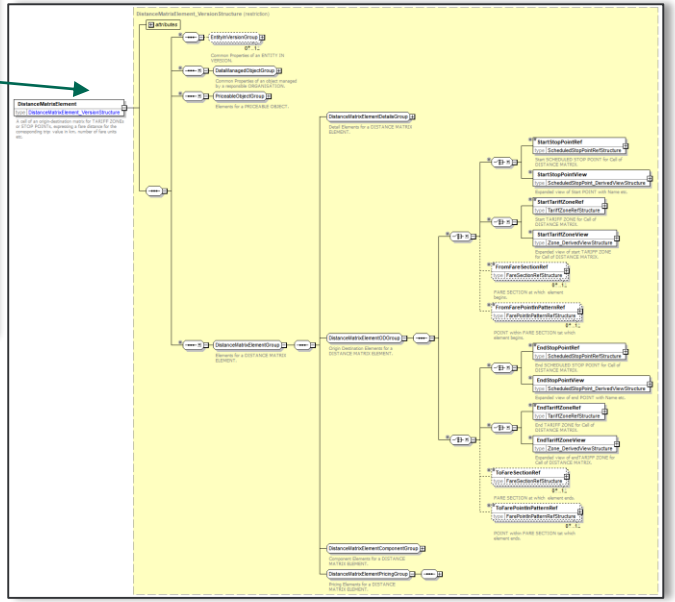


# Designing a CEN Exchange format - Package & Element level traceability

Conceptual → Physical → Schema



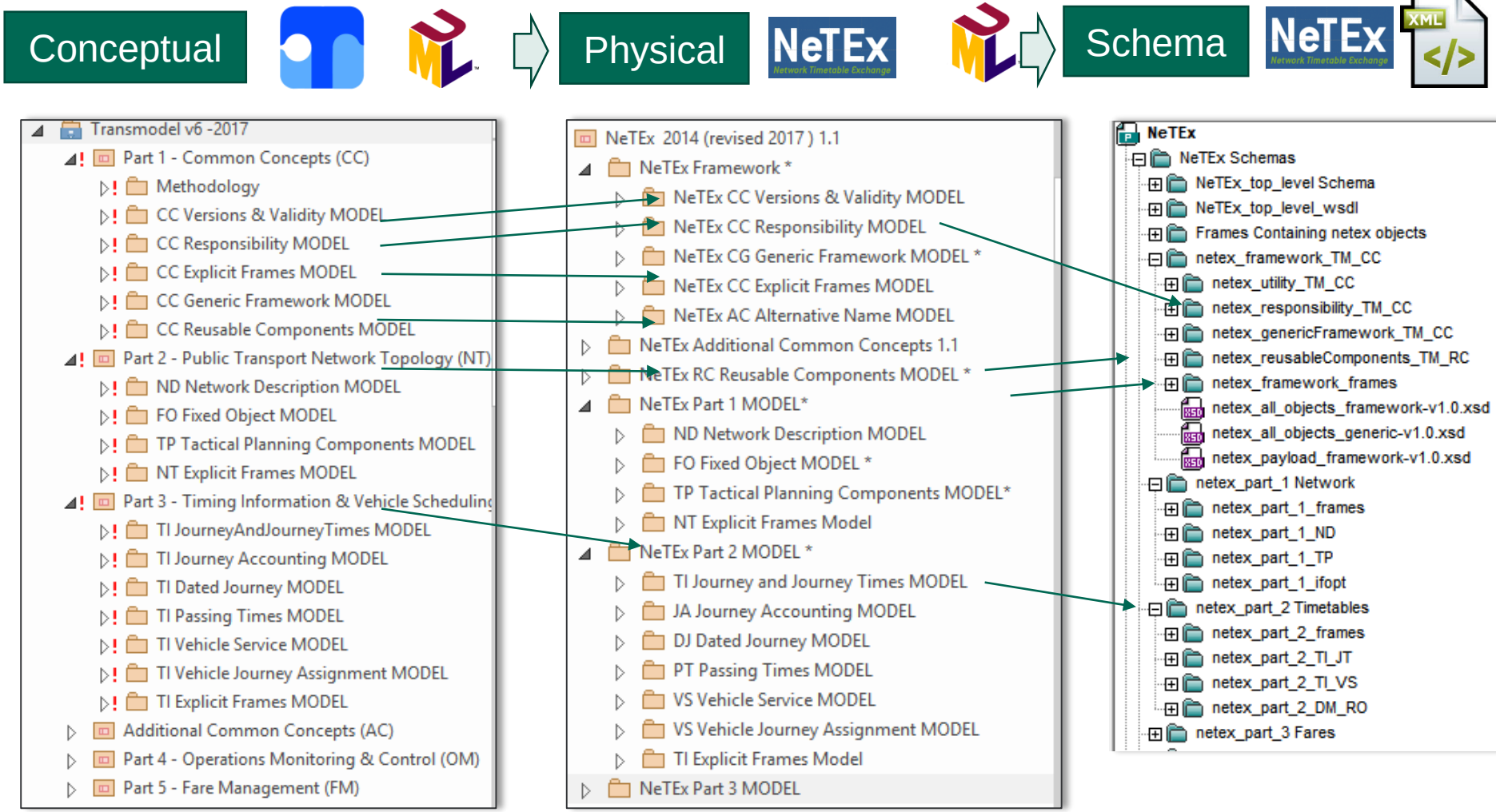




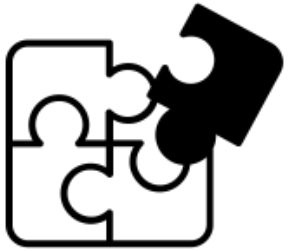
- **Traceability**
  - Equivalent elements can be found at each level
  - Physical design and Implementation each add further detail and constraints
- **Tool support (EA, XML SPY, OXYGEN, etc)**

# Designing a CEN Exchange format - Package & Element level traceability

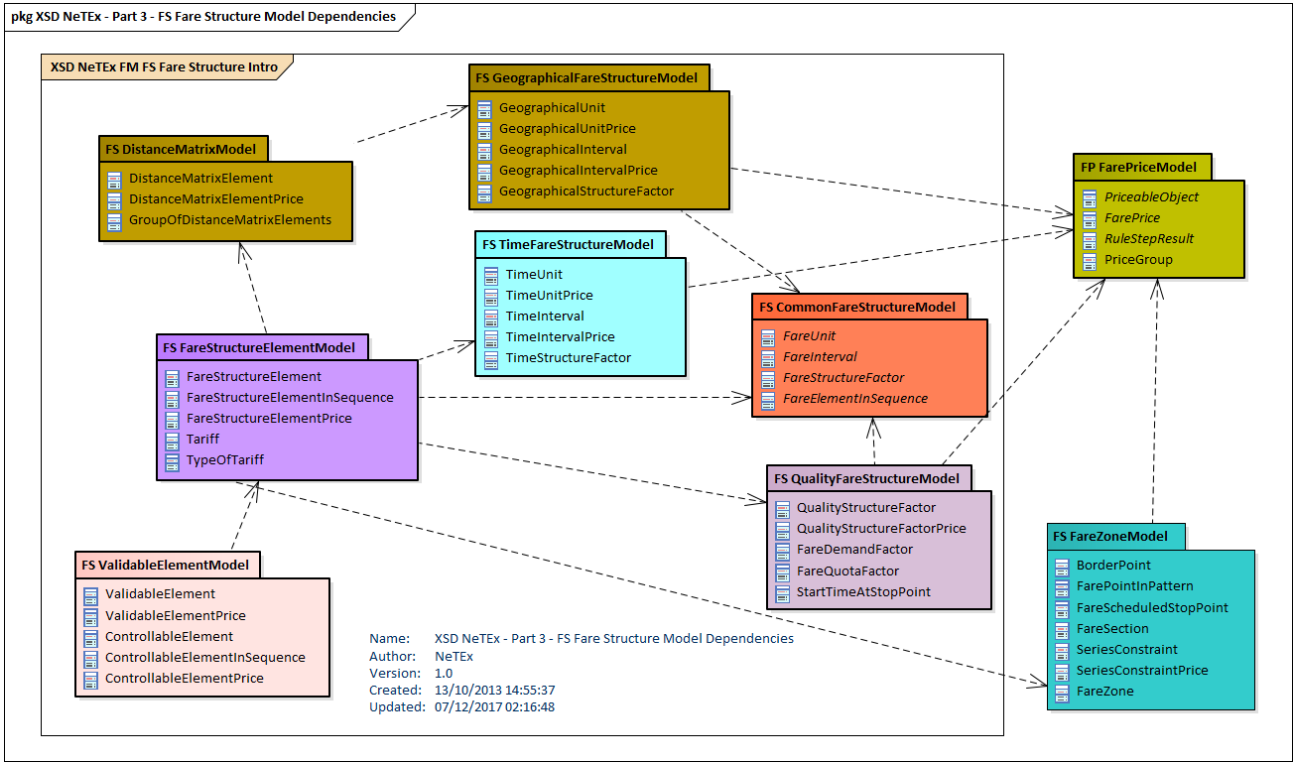
Conceptual → Physical → Schema



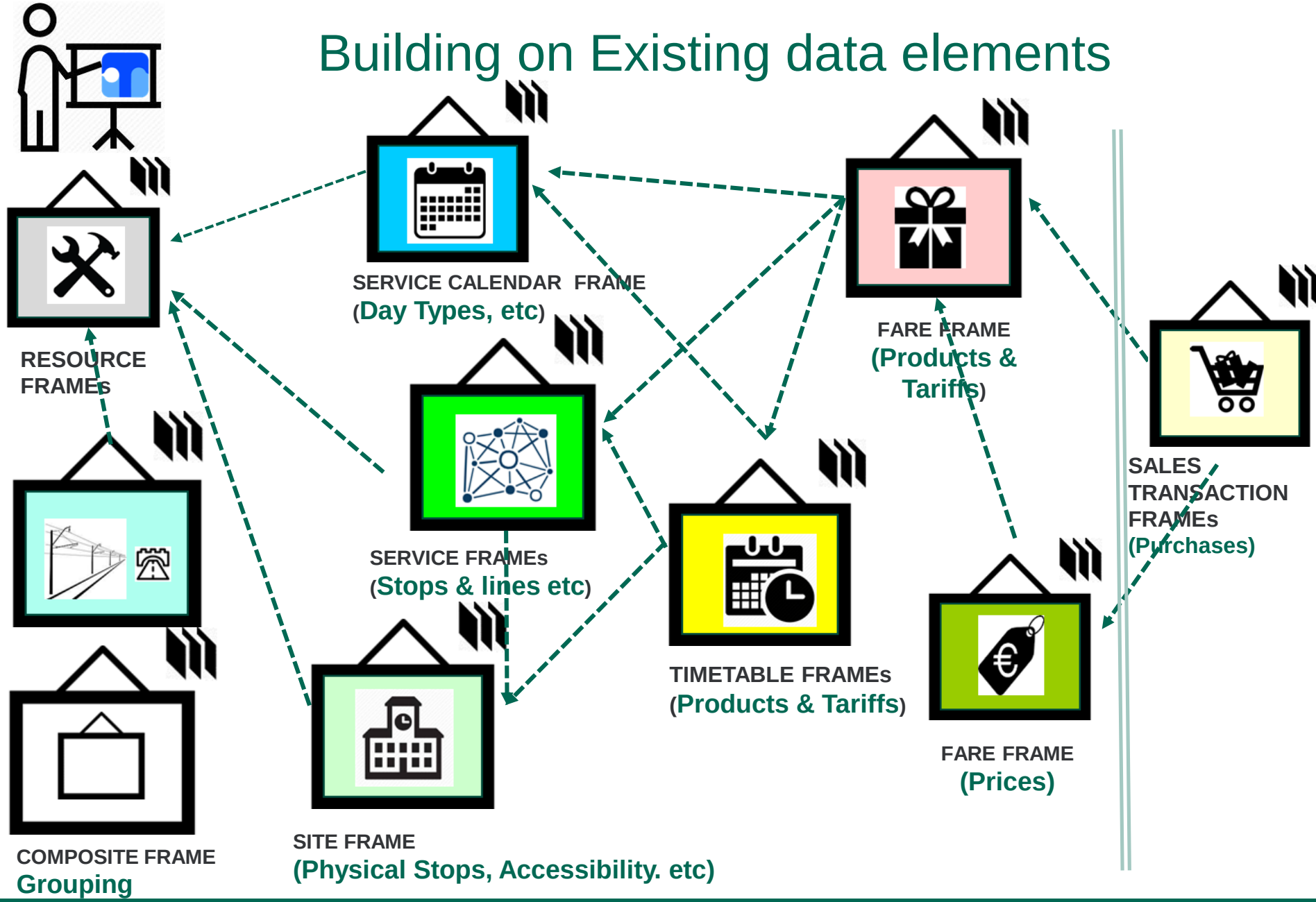
# Modularisation & Package dependencies



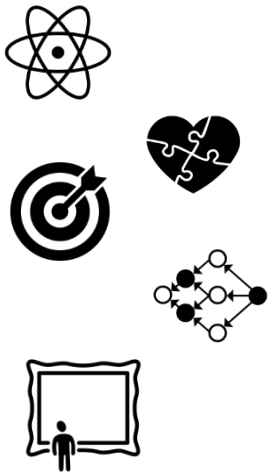
- You only need use the elements you require for your use cases
- UML model identifies dependencies -



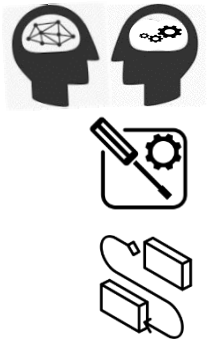
# Building on Existing data elements



# Model Driven Design

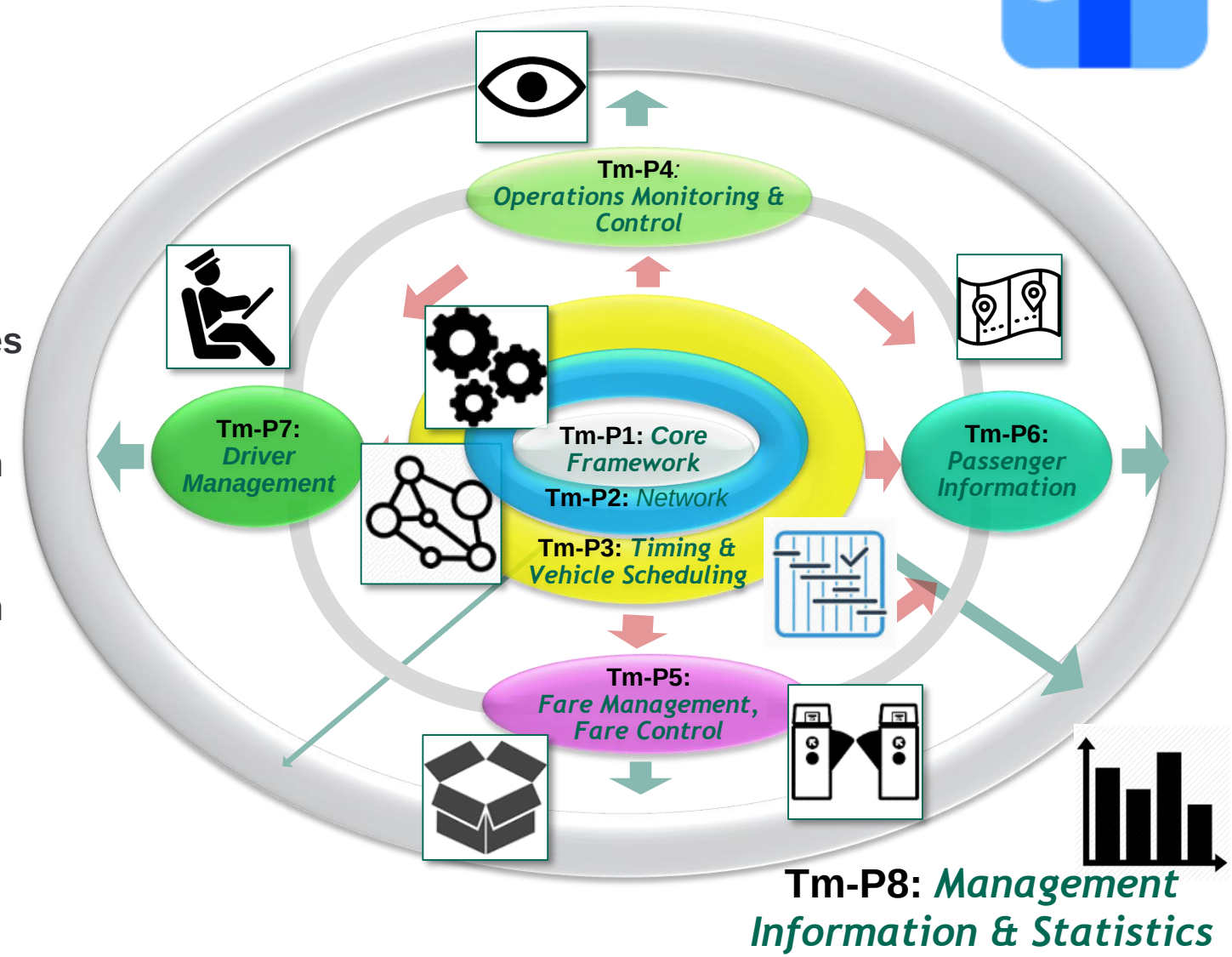


- **Conceptual model**
  - Uniform vocabulary of atomic, orthogonal, concepts
  - Clear separation of concerns,
  - Well defined relationships
  - Modularised to satisfy specific use cases
  - Joined up thinking!
- **Physical Model**
  - Uniform Mapping from Conceptual to XML
  - Systematically Engineered
  - Traceability across design levels



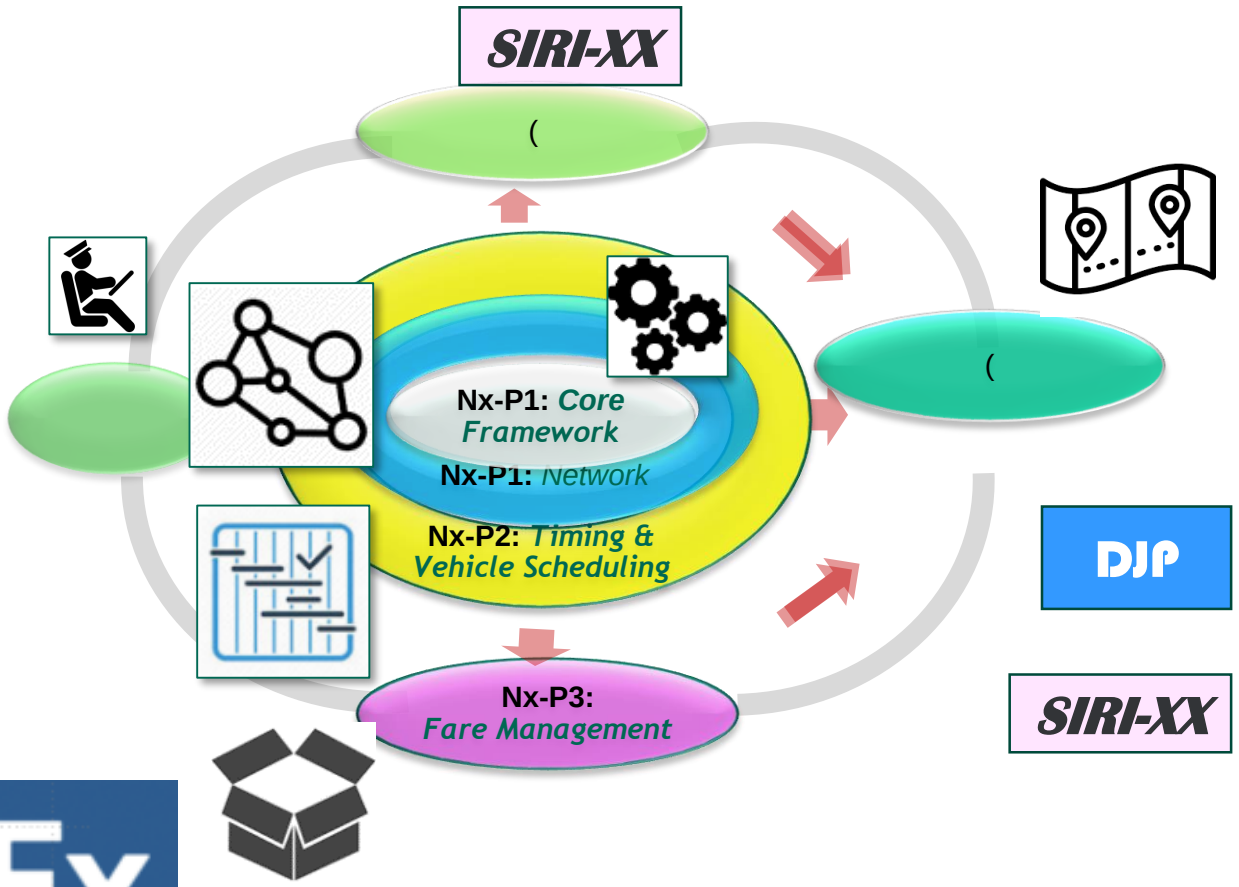
# Transmodel 6.0 Functional Areas

- Modular;
  - May be used **selectively**
  - Linear **dependencies**
- Models, not APIs
  - Use to design **exchange. formats**
  - Use to design **API payload**
  - Use to **reconcile** different formats



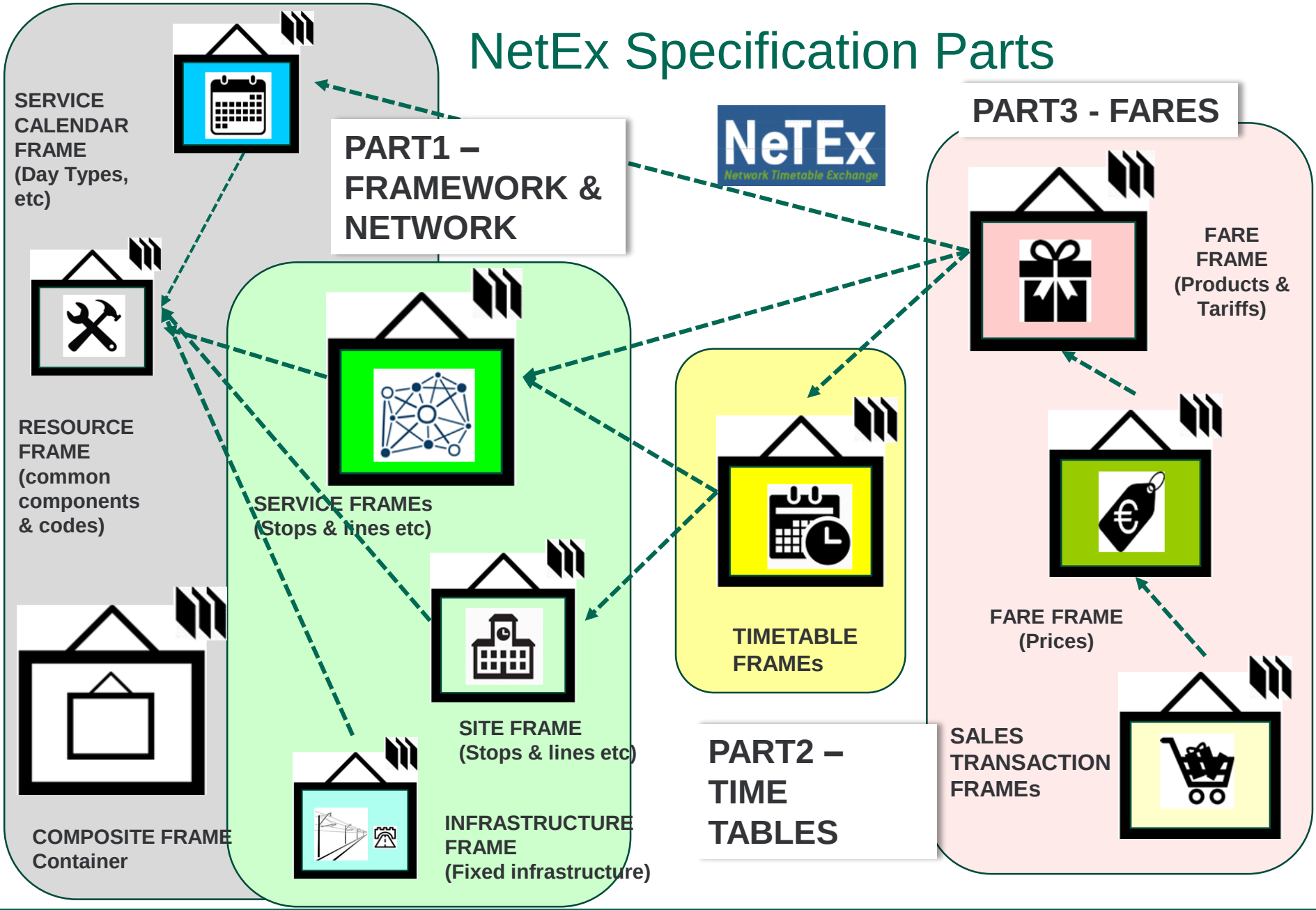
# NeTEx 1.1 Functional Areas

- **NeTEx implements only a subset of Transmodel**
  - Stops, Routes, Timetables, Fares, etc
  - Fare Management has structures & prices, but not Sales Fare Validation & Control
  - Some Operations and control APIs found in SIRI
- **NB NeTEx Specification parts are numbered differently to TM**
  - Nx-P1=Tm-P1 + P2
  - Nx-P2=Tm-P3
  - Nx-P3=Tm-P5 A SUBSET




NeTEx
Network Timetable Exchange

# NetEx Specification Parts



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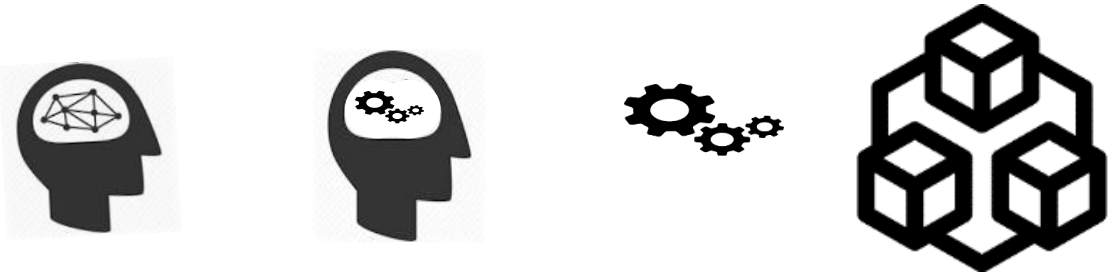
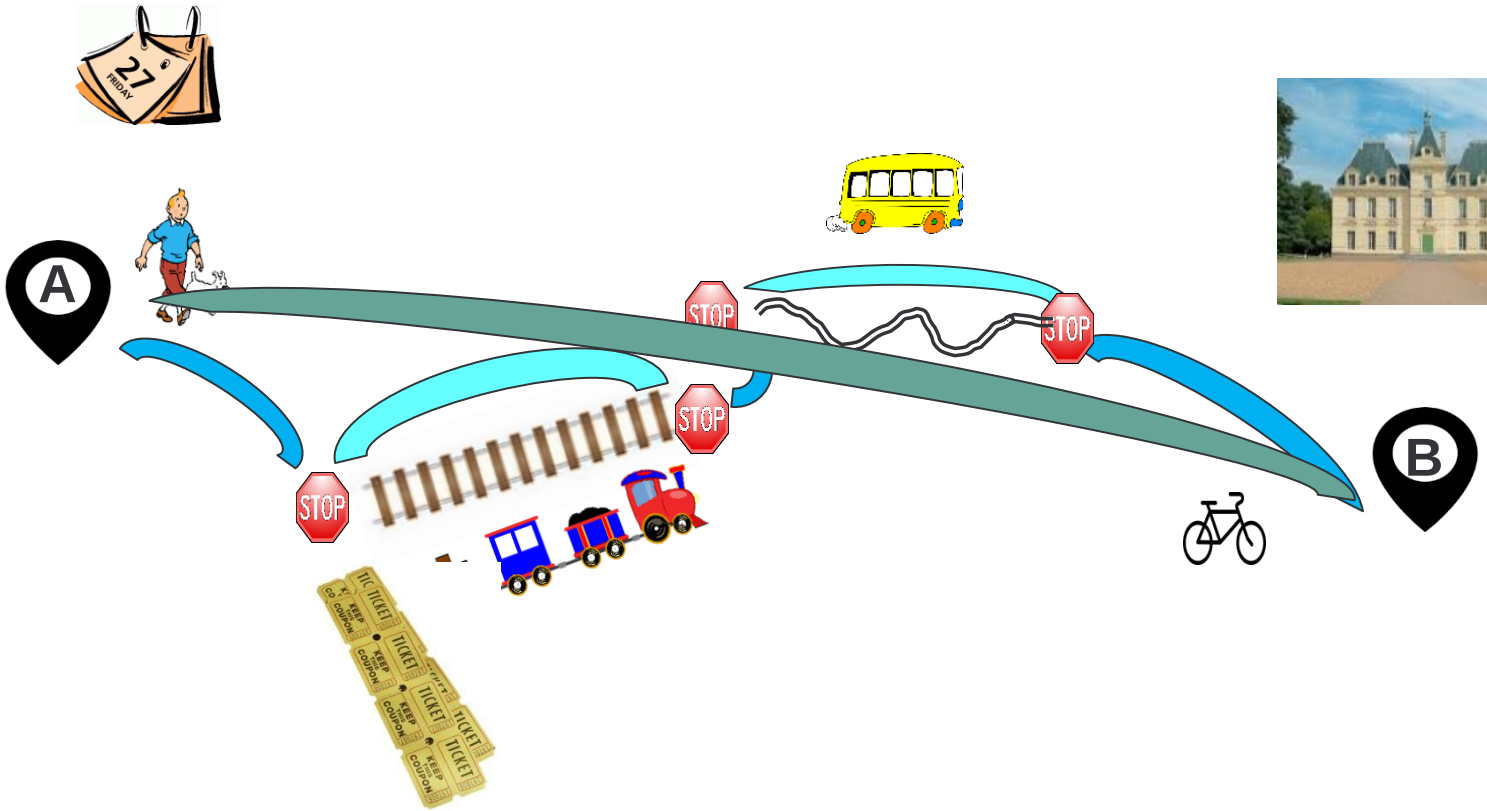
# Conceptual Modelling of Transport Systems



# Describing a simple journey from A to B – e.g. for a trip planner



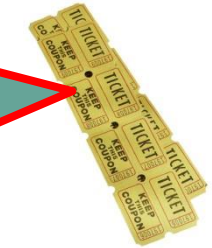
# DEFINE YOUR TERMS!

Stop ?
Station? Halt? Platform?
Interchange? Connection
Boarding Point

Journey? Trip?
Ride? Leg?

Passenger?
Customer?
User?

Bus, Coach,
Train, Vehicle,
Transport?

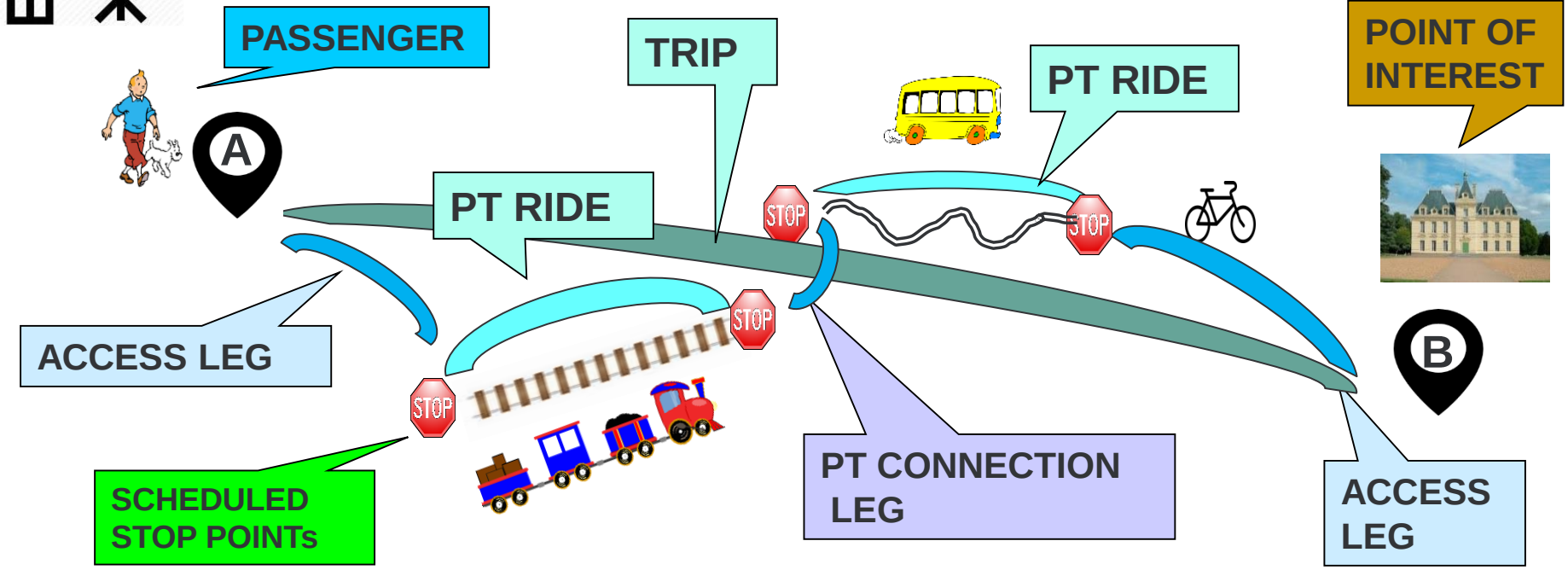


Ticket? Fare?
Fare Product? Offer?
Tariff? Fare Price?
Travel Document?

Rail? Train?
Railway? Railroad?

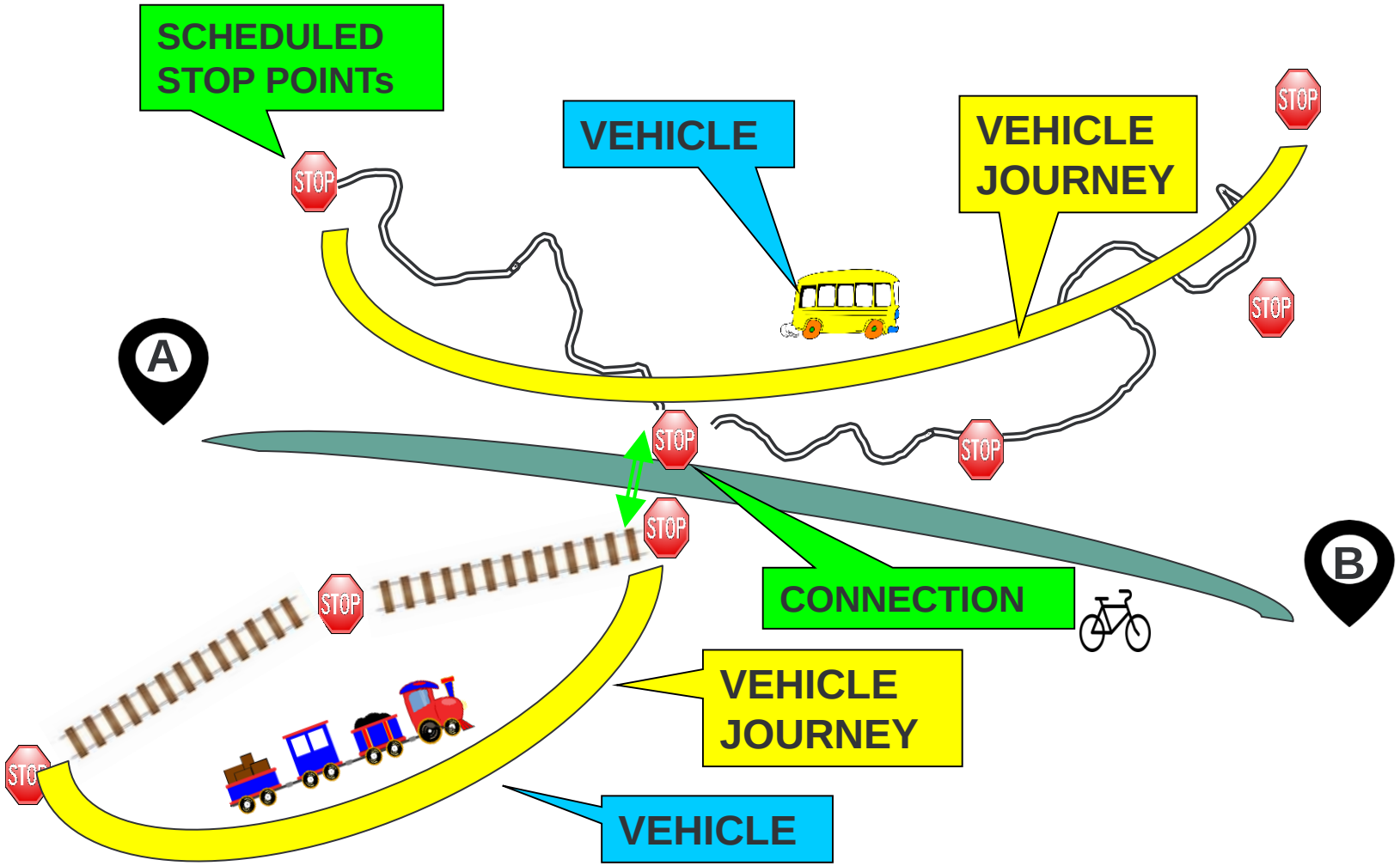
Route? Line? Track?
Service?

# A PASSENGER makes a TRIP….

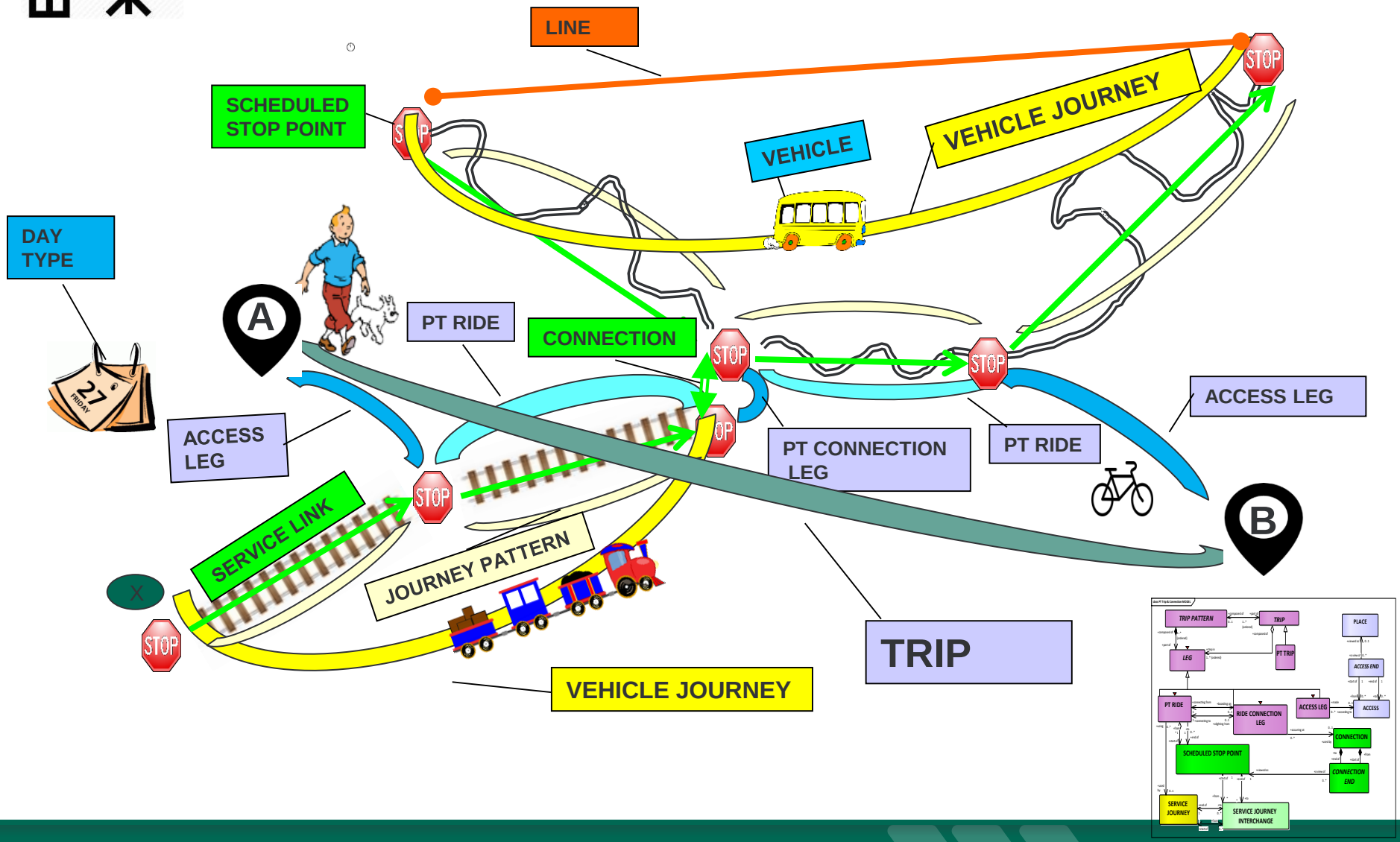



The passenger's TRIP is made up of one or more PT RIDEs, may start or end by an ACCESS LEG and may be interspersed with PT CONNECTION LEGs

# A VEHICLE makes a JOURNEY

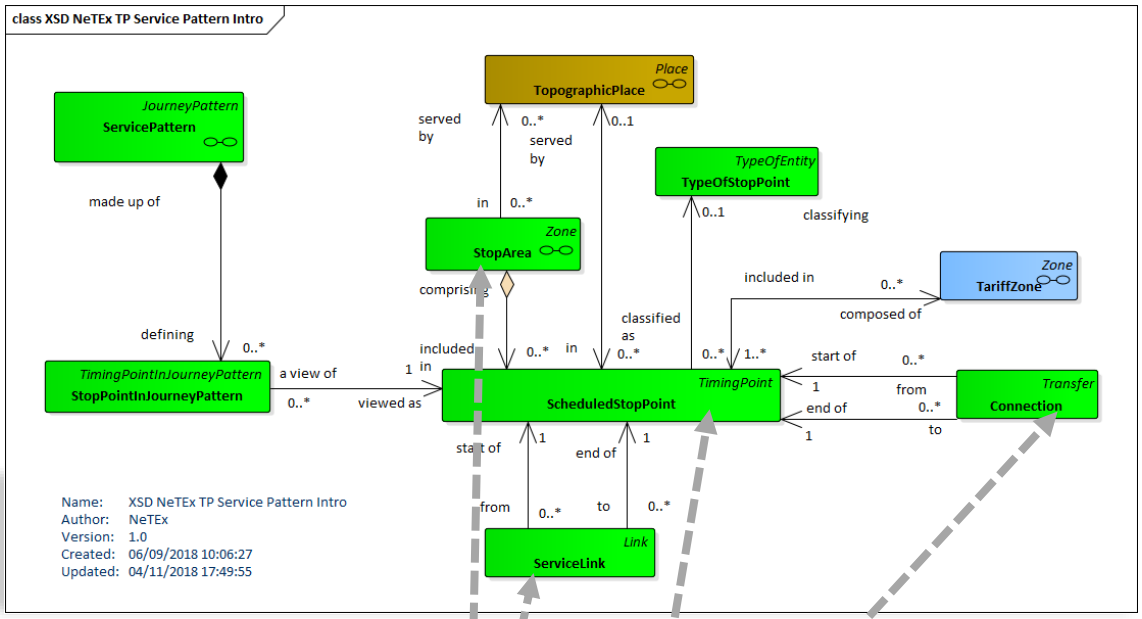


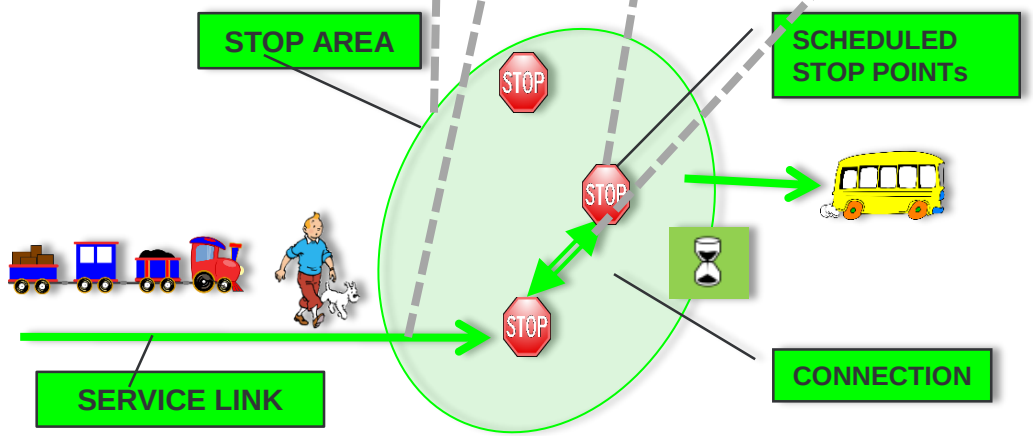
# A Common PT data Model: Atomic Components, Consistent Names



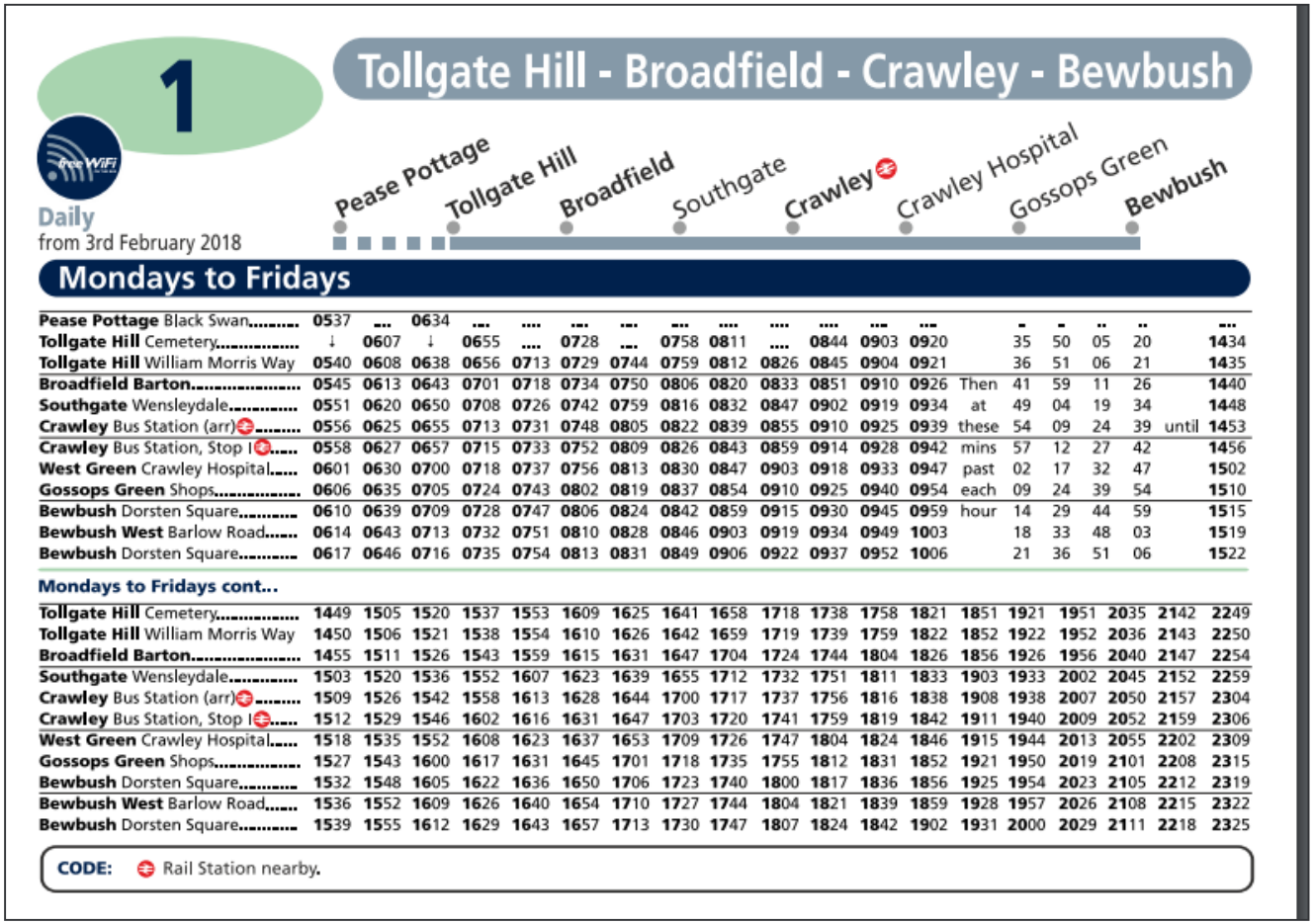
# Data Models

- Using consistent definitions allows us build a model
  - Entities & attributes
  - Relationships
    - **Association**: 1:0:, 1:0, 1:*
    - **Aggregation** 1:*, 0:*
    - **Inheritance**
- A model lets us analyse how the data elements relate to different functions
  - Separate out concerns
  - Break down into separate submodels, clear dependencies
  - Factor out reusable components



# 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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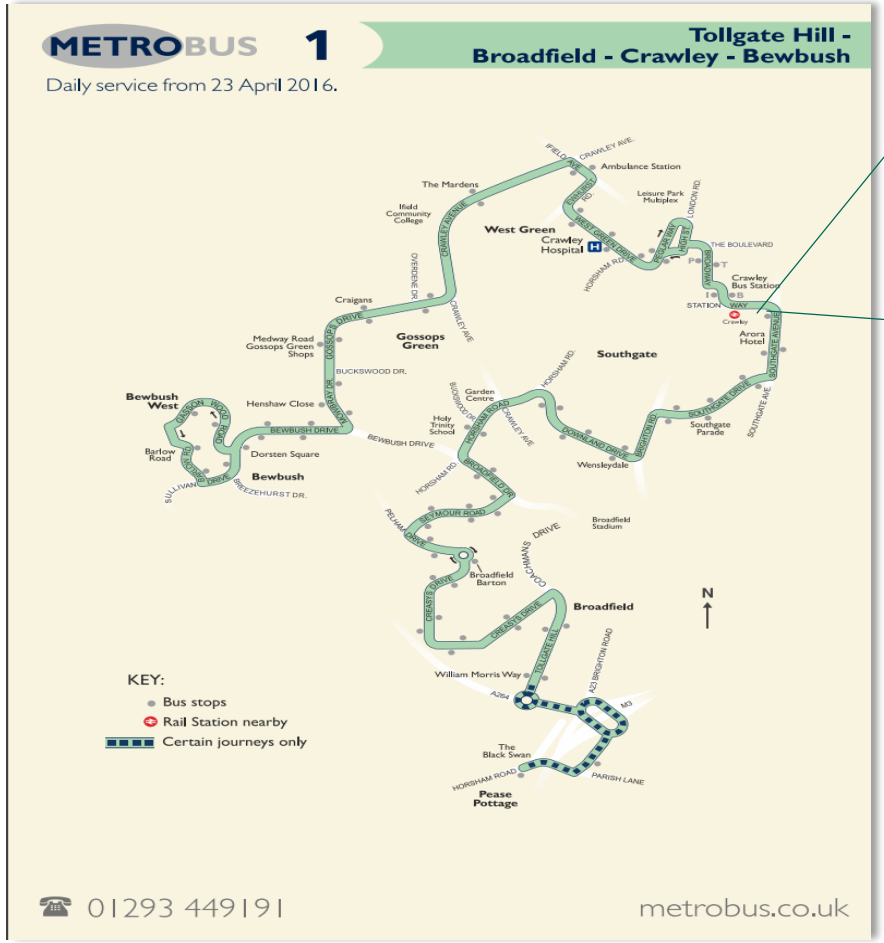
# A Typical Bus Route (Metrobus Route 1)



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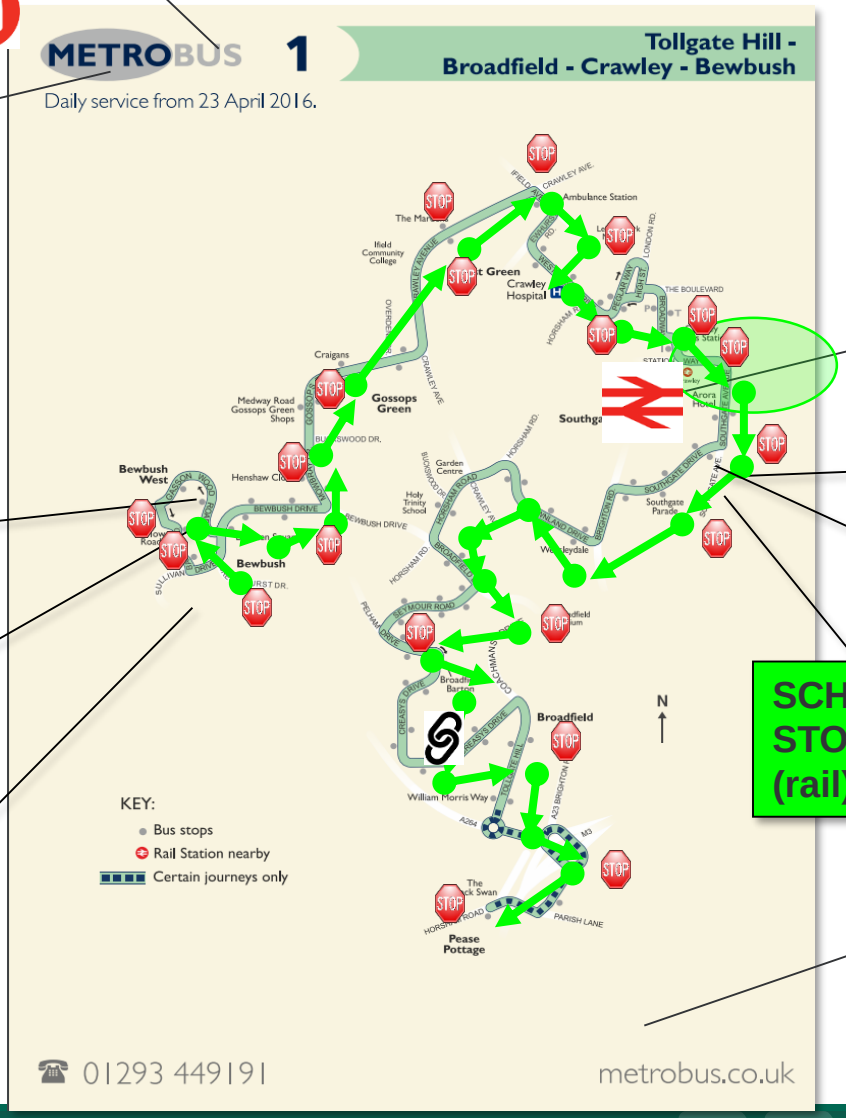
# TM: The Network Description

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

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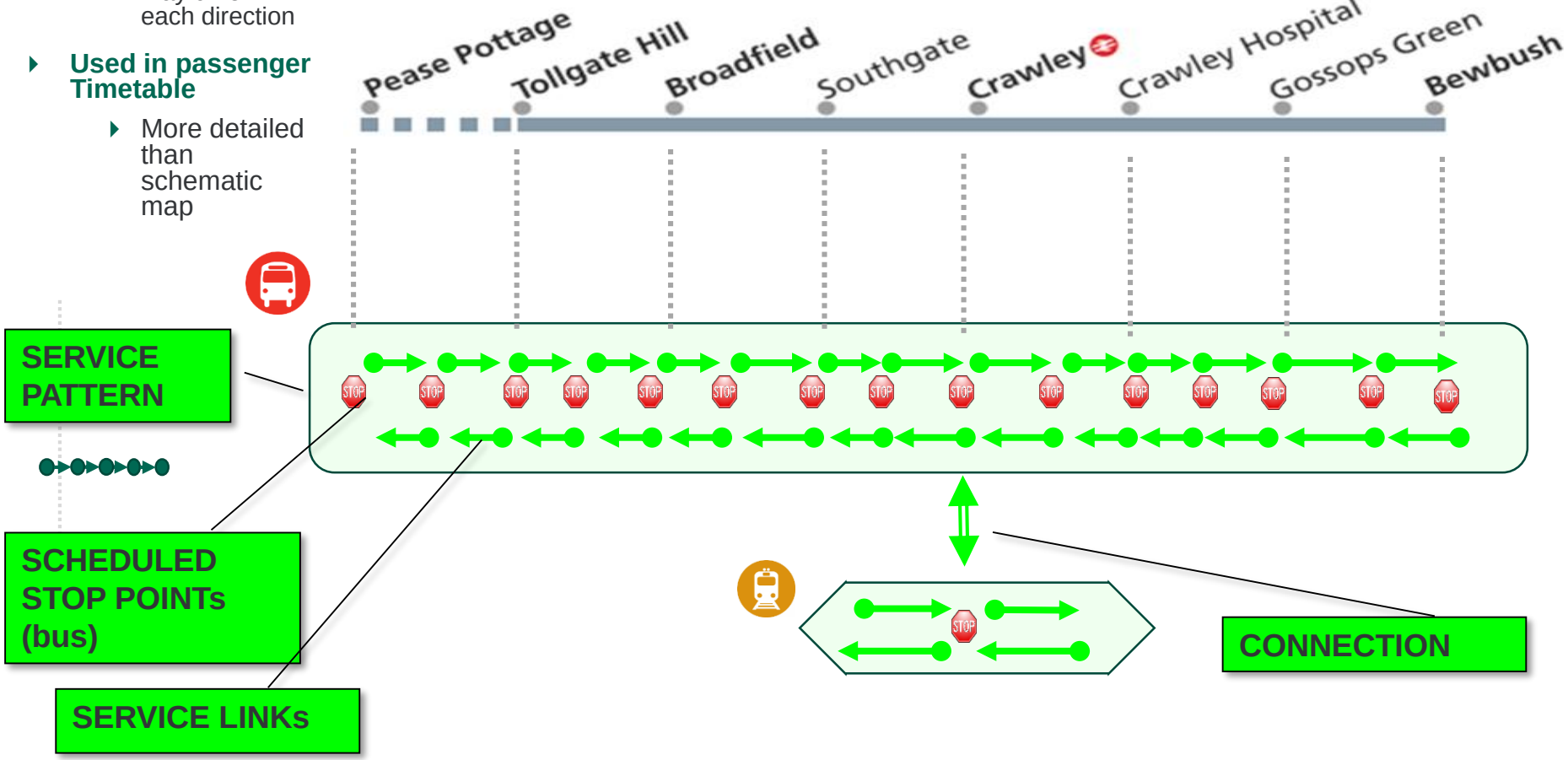
# TM: The Network as the Timetabled Stops & Links

- **Directional !**
  - May differ in each direction
- **Used in passenger Timetable**
  - More detailed than schematic map



# TM: The Network as a Physical Route

Department for Transport

MODE

LINE

ROUTE

ROUTE POINTs

ROUTE LINKs

OPERATOR

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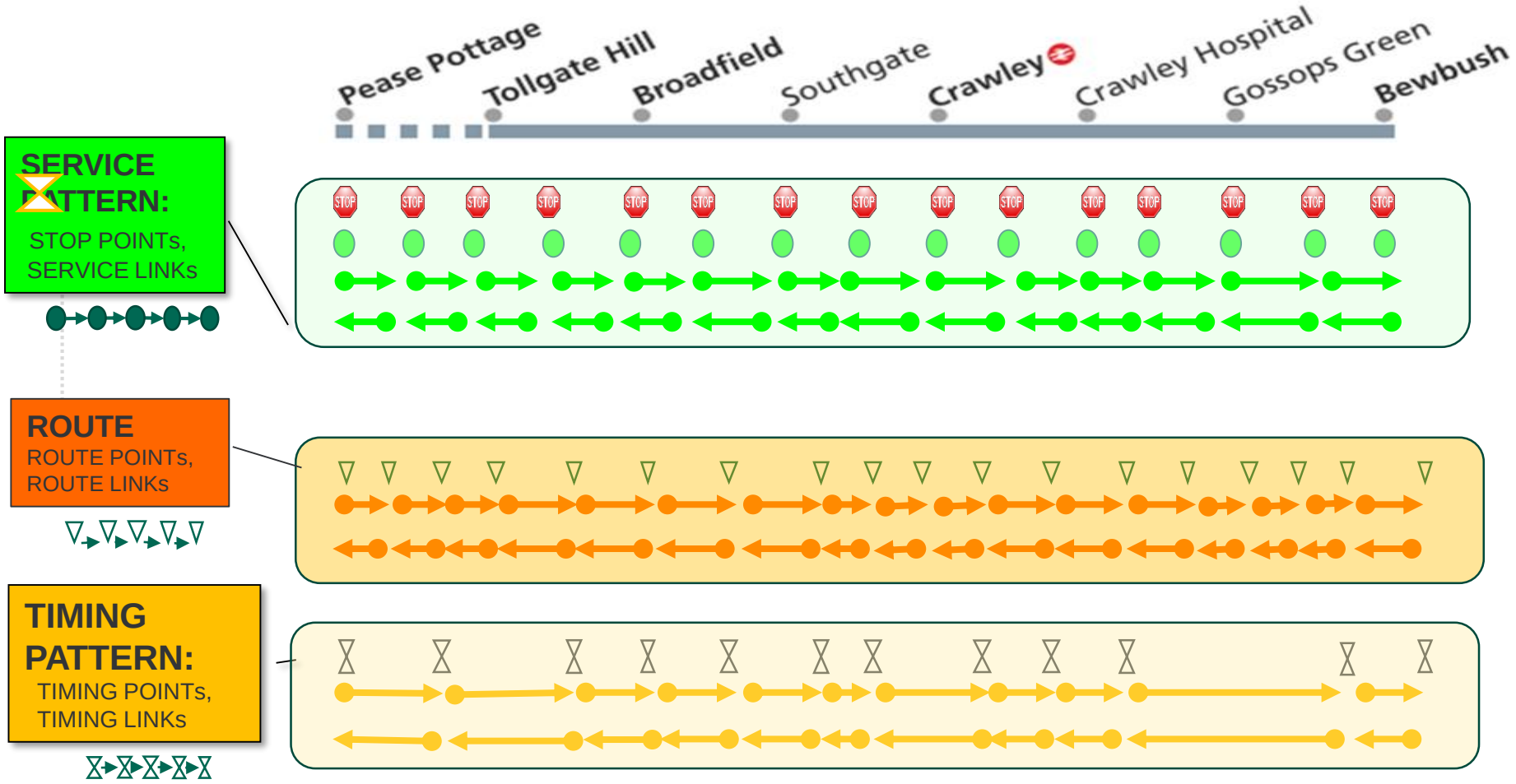
# The Network as the Operational route



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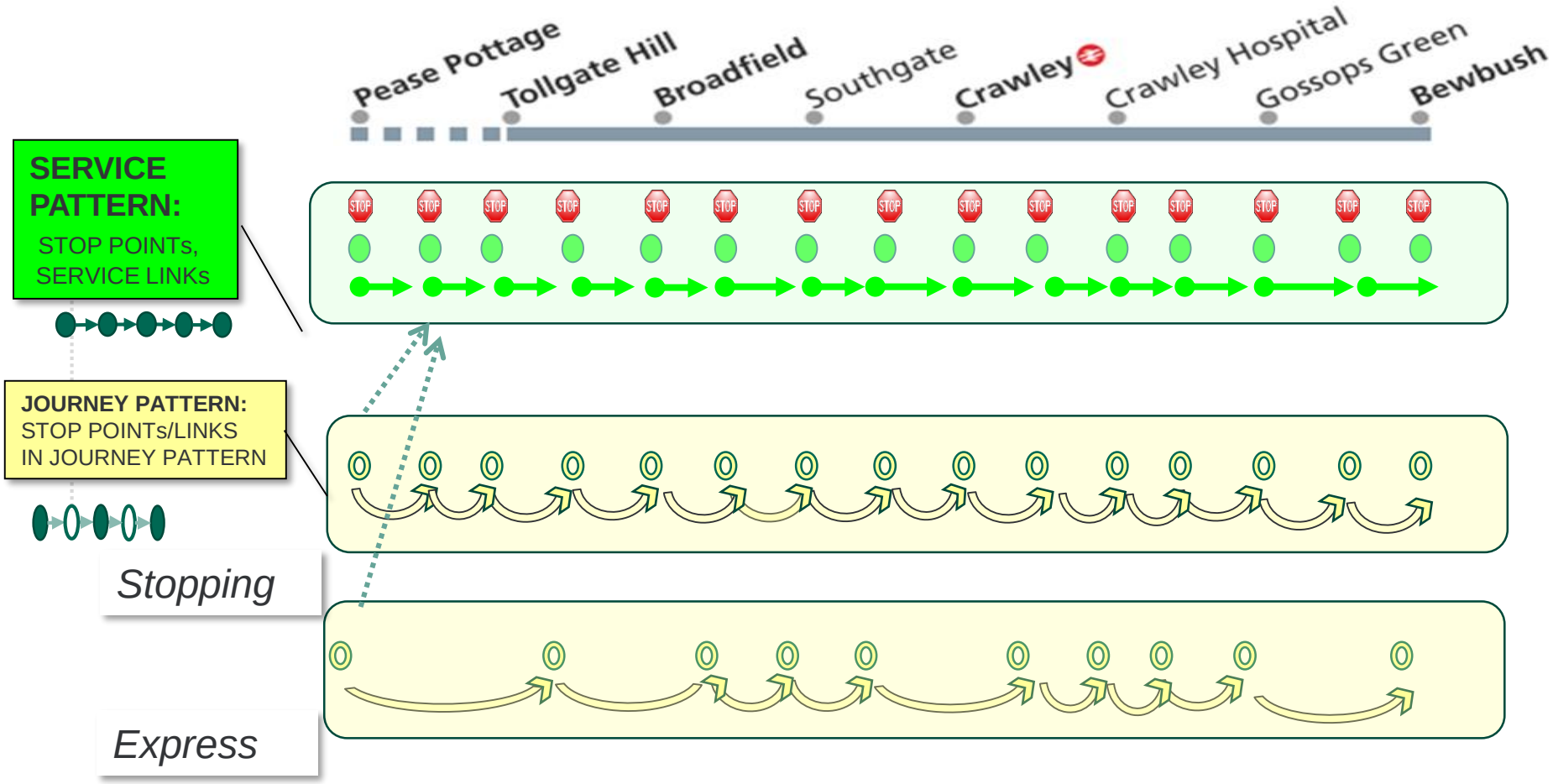
# The Network for use in timetabling



# TM: The Network Description

JOURNEY PATTERNs

POINTs IN JOURNEY PATTERN

POINTs IN JOURNEY PATTERN

OPERATOR

# TM: A Vehicle Journey

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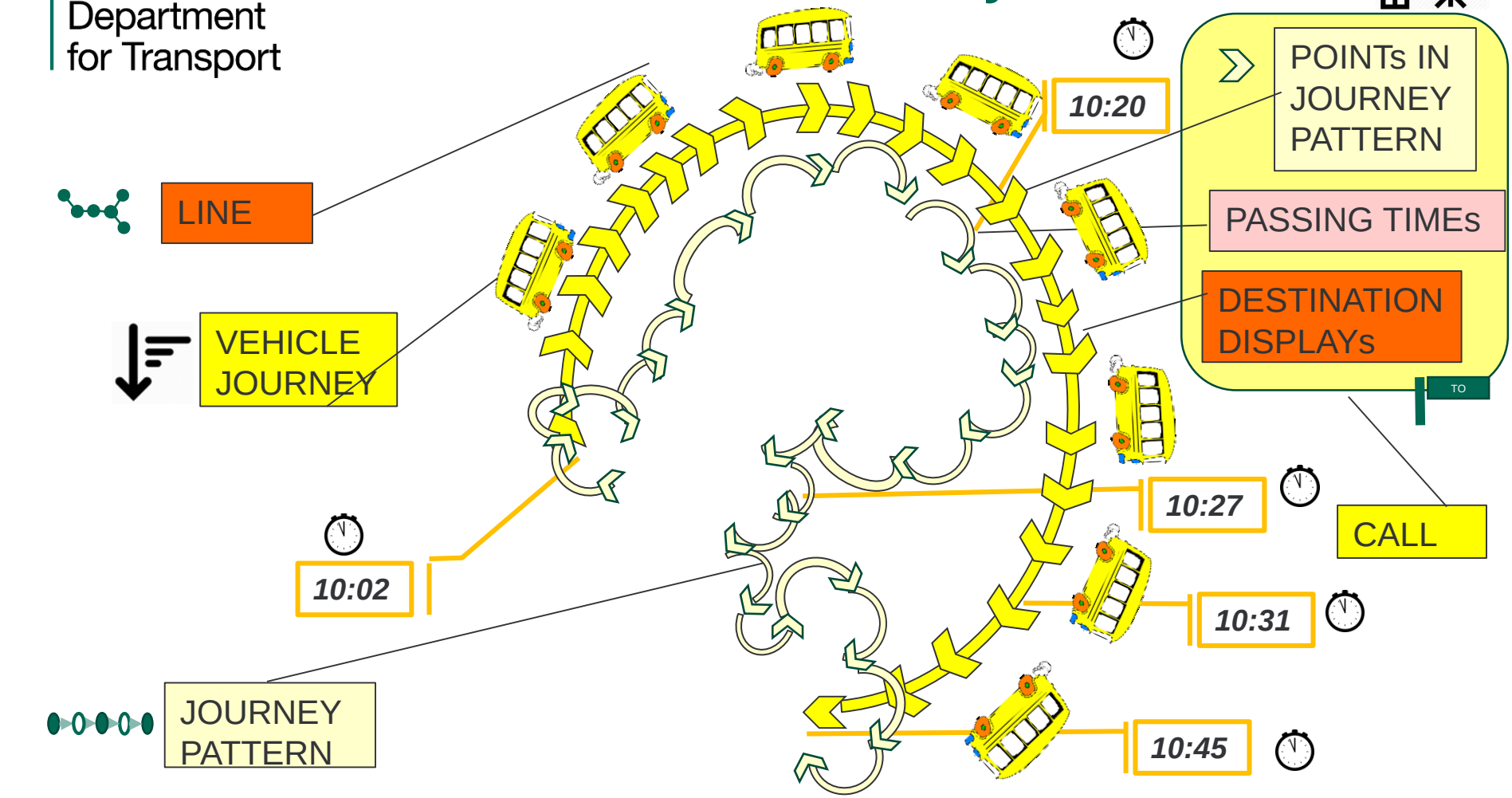
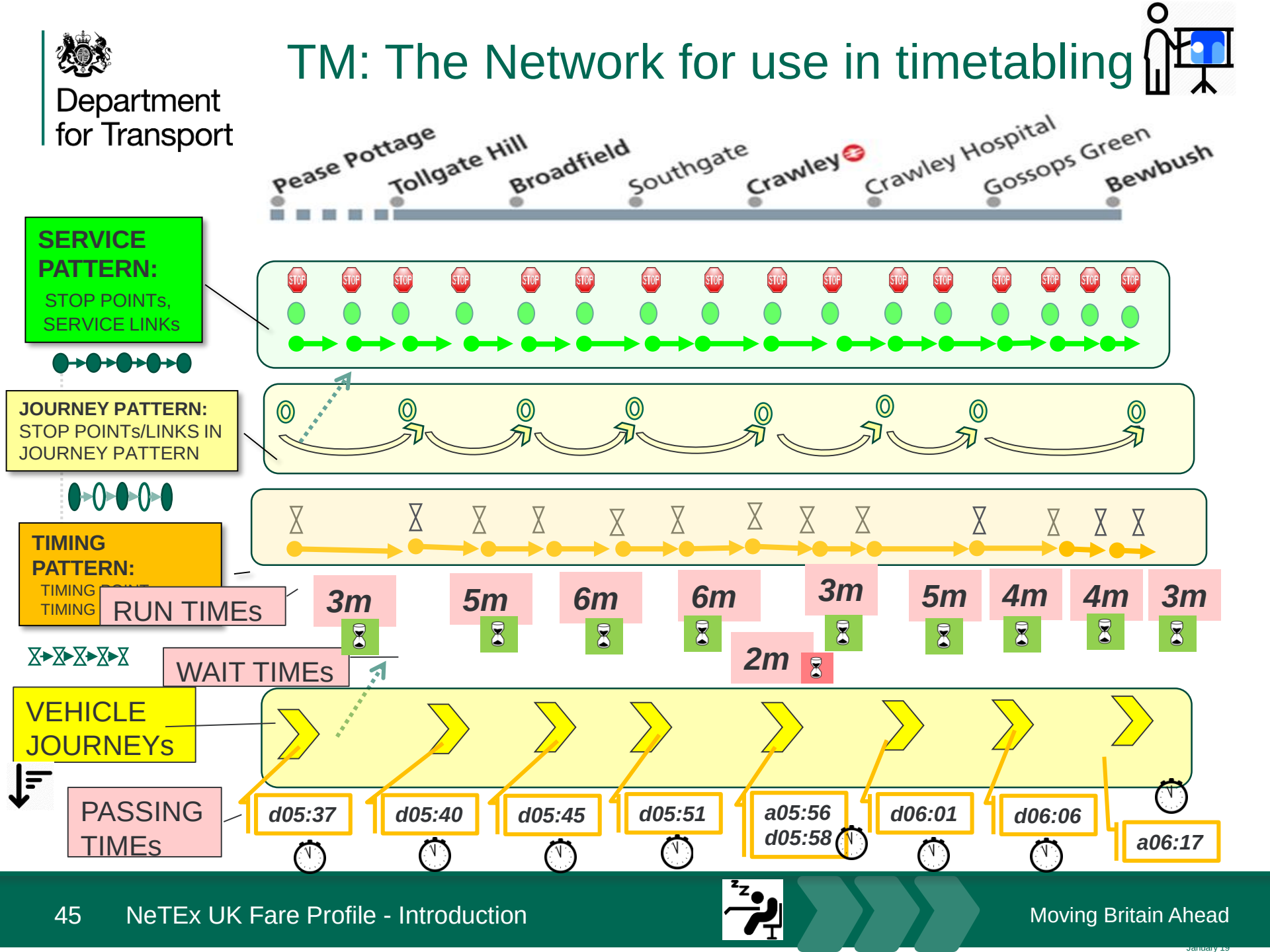


# TM: The Network for use in timetabling



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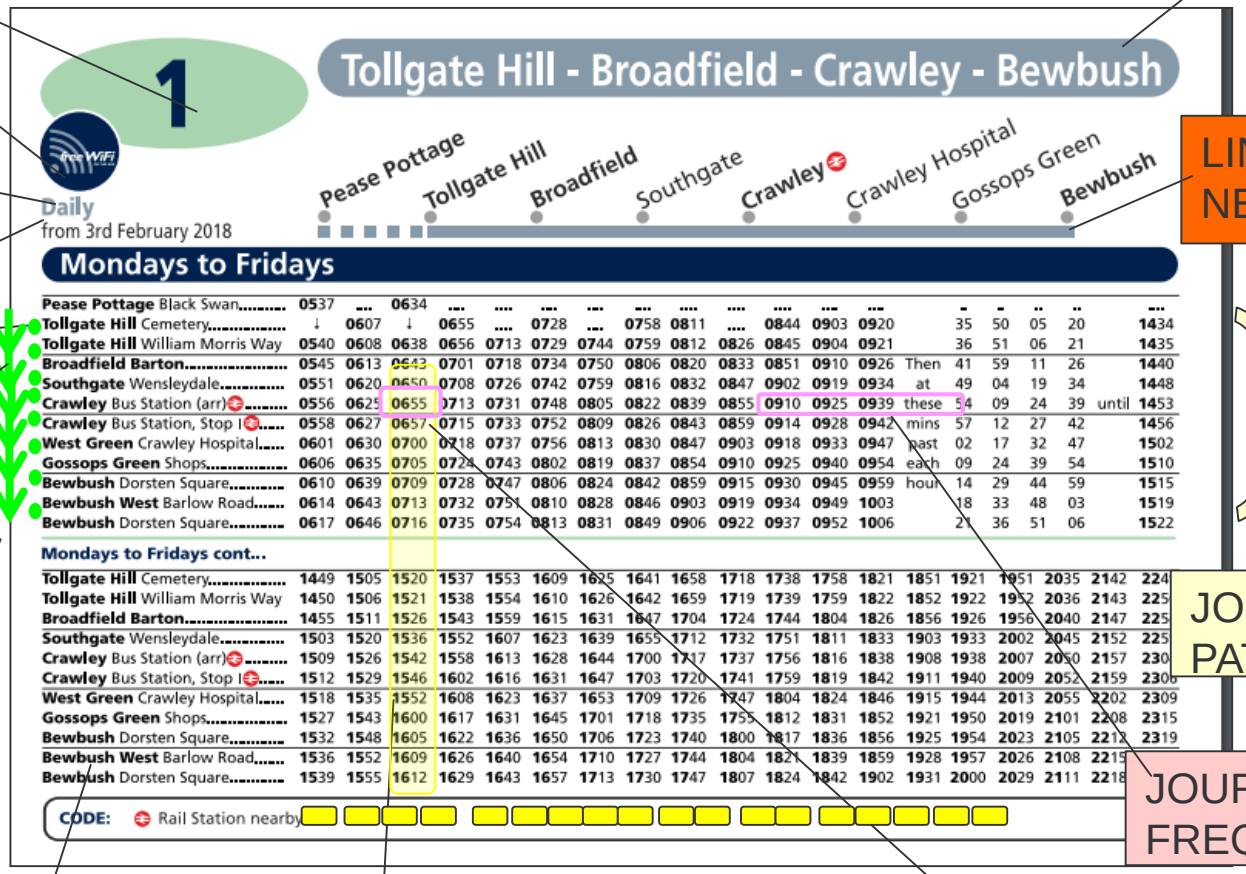
# TM: A Bus timetable as model elements




LINE

FACILITY

DAY TYPE

VALIDITY CONDITION

SCHEDULED STOP POINTs

SERVICE LINKs

CONNECTION

SERVICE PATTERN

NOTICE

VEHICLE JOURNEYs

PASSING TIMEs

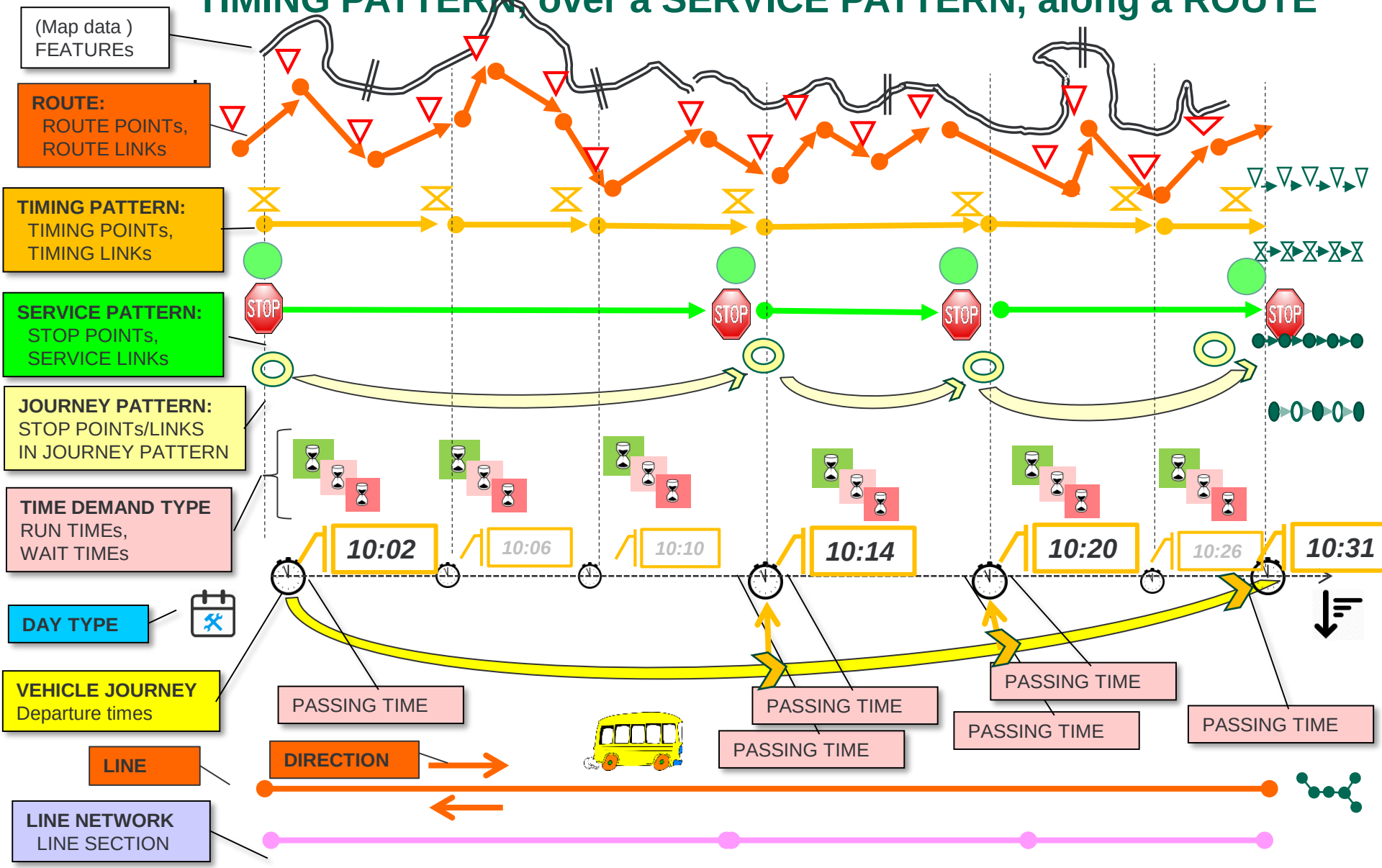
JOURNEY FREQUENCY

JOURNEY PATTERNs

LINE NETWORK

TIMETABLE

# A VEHICLE JOURNEY follows a JOURNEY PATTERN, to a TIMING PATTERN, over a SERVICE PATTERN, along a ROUTE



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# Some Transmodel principles: Separating Concerns

- Separate the different functional layers
  - E.g. Path on road (ROUTE) vs Sequence of Stops (SERVICE PATTERN)
- Separate the spatial from the temporal
  - E.g. Route vs Timings for the route
- Use a common architecture for spatial networks
  - Use a common “PATTERN of POINTs and LINKS”
  - Provide means of co-locating different layers (PROJECTION)
- Separate the Planned Calendar from the Operational Calendar
  - E.g. Day type that applies (SERVICE JOURNEY) versus assigned Calendar day (DATED JOURNEY)

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# Advantages of Model Based 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**
  - Separates data sets of different stakeholders
  - Only need to use relevant components / modules
  - Extensible, Flexible
- **Less complicated overall**
  - Single, uniform set of concepts

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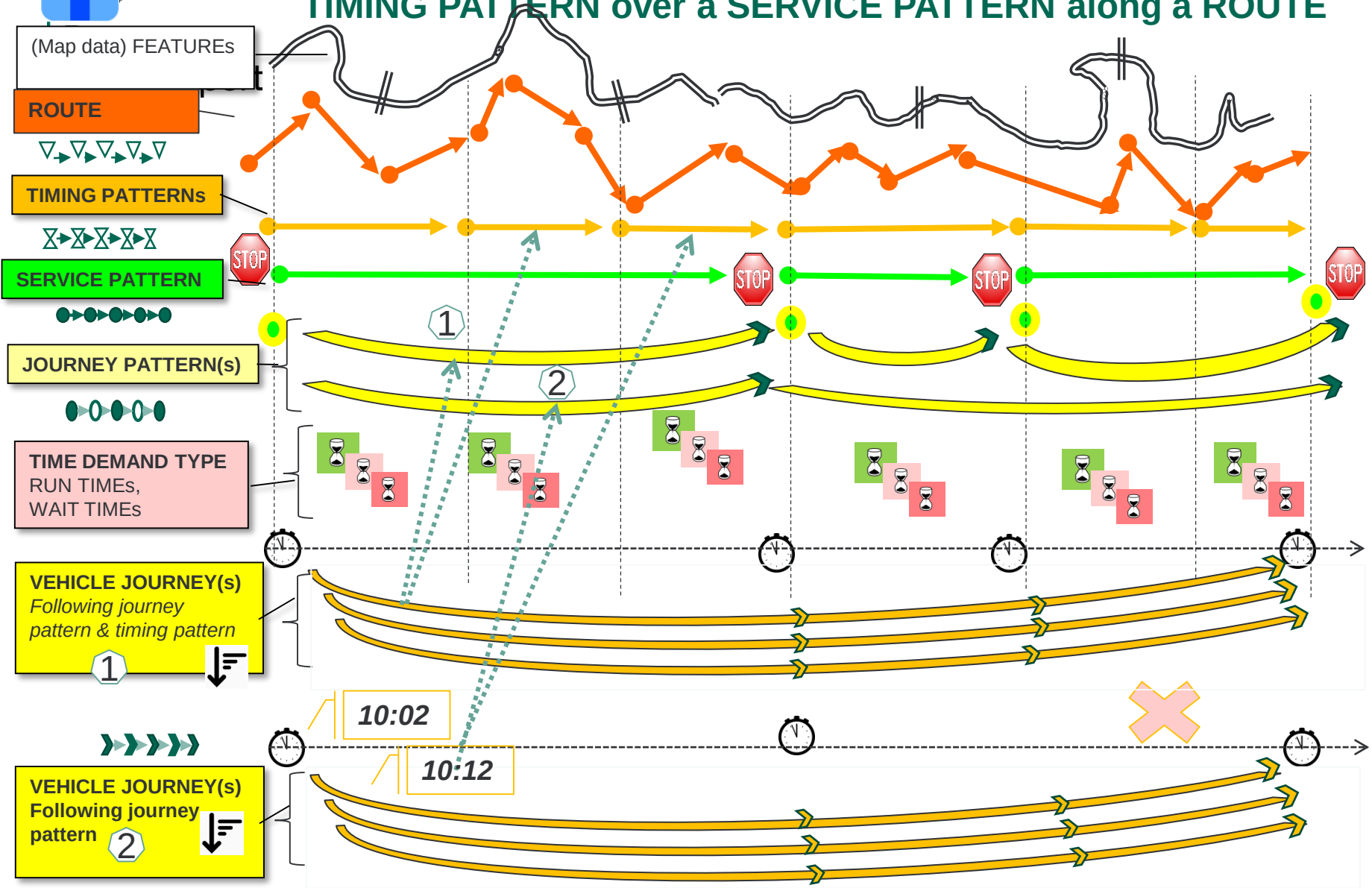
# Some further Comparisons of Transmodel/NeTEx

- GTFS
- Rail Modes
- TransXChange

# TM- A VEHICLE JOURNEY follows a JOURNEY PATTERN to a TIMING PATTERN over a SERVICE PATTERN along a ROUTE



# GTFS

# A VEHICLE JOURNEY (Gtfs-Trip ) is for a LINE

(Map data)

**ROUTE Projection (Gtfs-Shape)**

**SCHEDULED STOP POINT (GTFS-Stop)**

**VEHICLE JOURNEY(s) (GTFS-Trip)**

10:02

10:14

10:20

10:31

PASSING TIME (GTFS-Stop_times)

PASSING TIME

PASSING TIME

PASSING TIME

PASSING TIME

PASSING TIME

**LINE (GTFS-Route**

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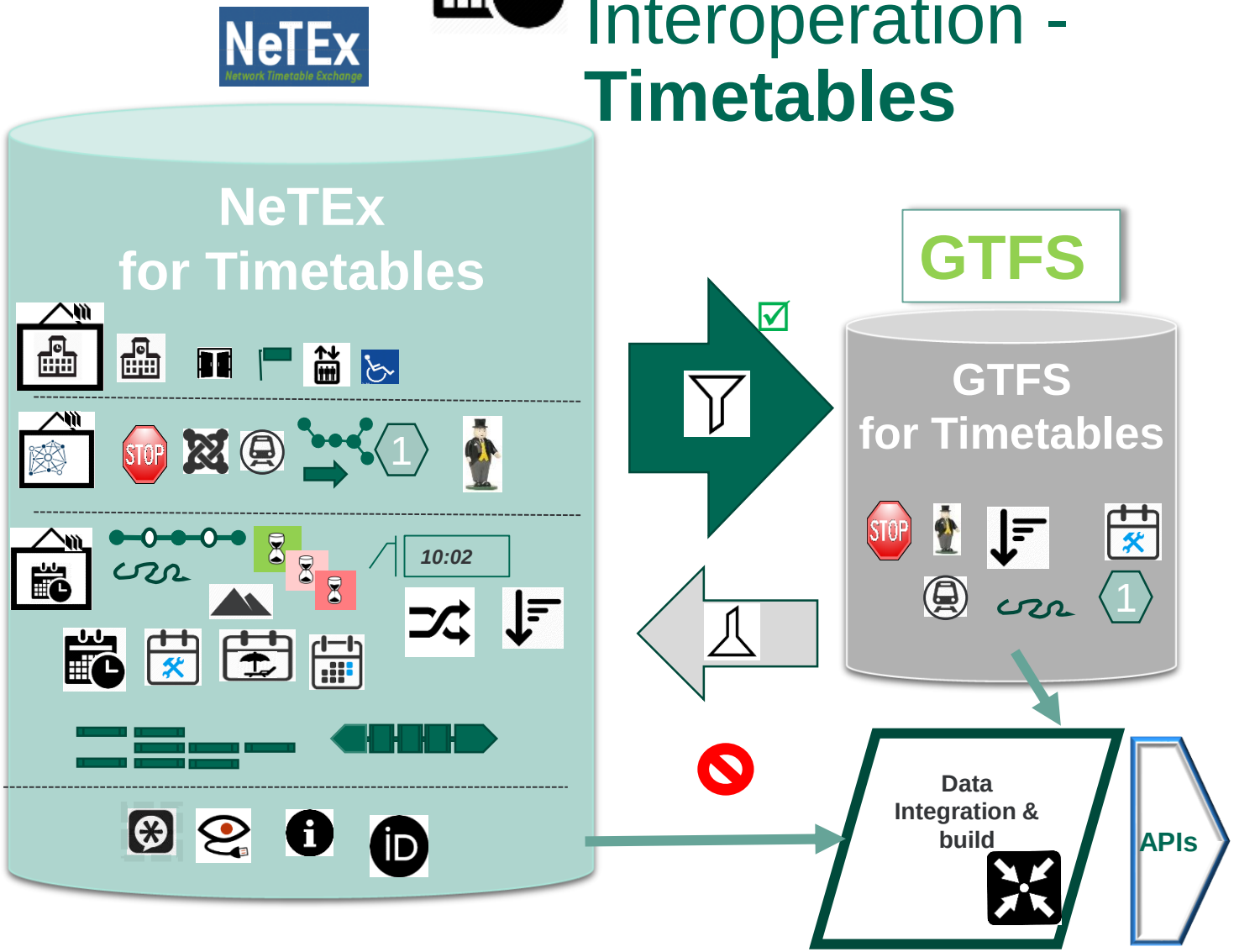
# NeTEx & GTFS Interoperation - **Timetables**

- GTFS is useful subset of timetable data for trip planning
  - Layers & times at stop resolved
  - Does not have underlying reusable elements to build
    - e.g. journey patterns, routes.
  - Does not cover complex aspects
    - e.g. grouping, connections , join/spilt, makeup, etc
  - Does not cover some operational data
- Round trip is “Lossy”
  - Lose some elements
  - Interpolation errors



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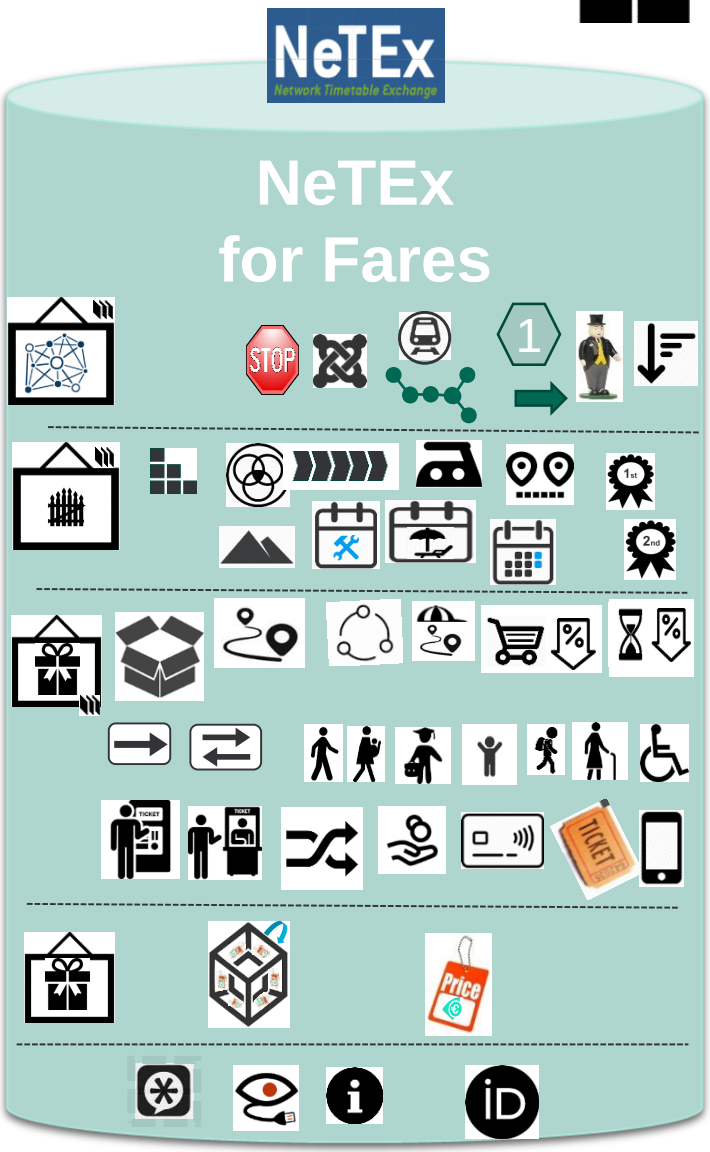
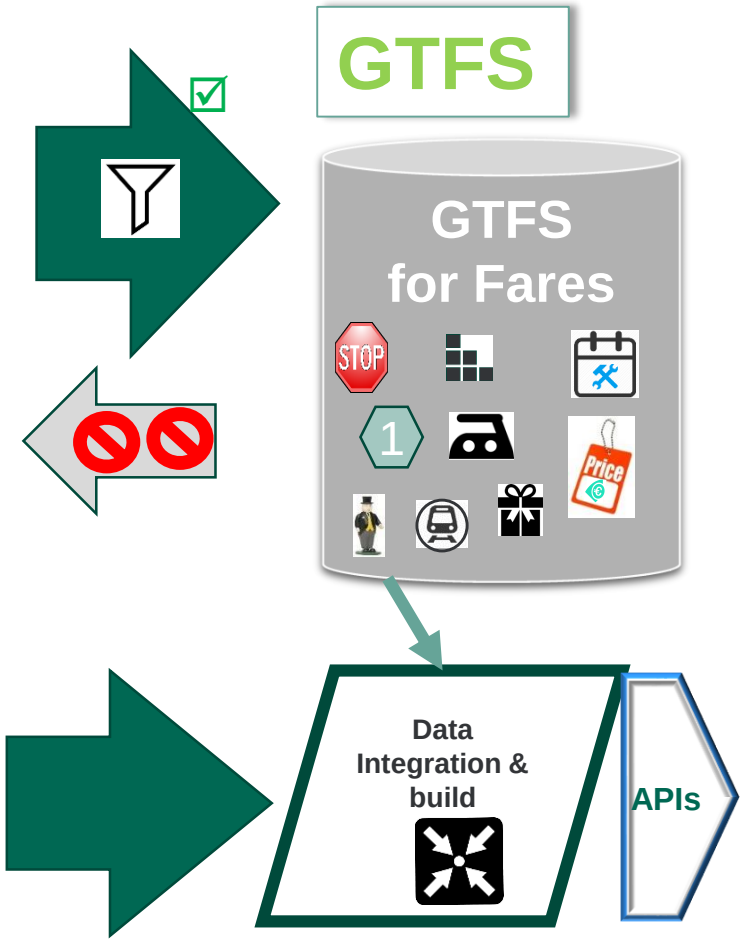
# NeTEx & GTFS Interoperation – **Fares & Prices**

- **GTFS is very basic subset of fare data**
  - Flat & P2P structures
  - Simple absolute prices
  - Minimal "product" definition
  - Missing many common distinctions
- **Round trip is very, very "Lossy"**



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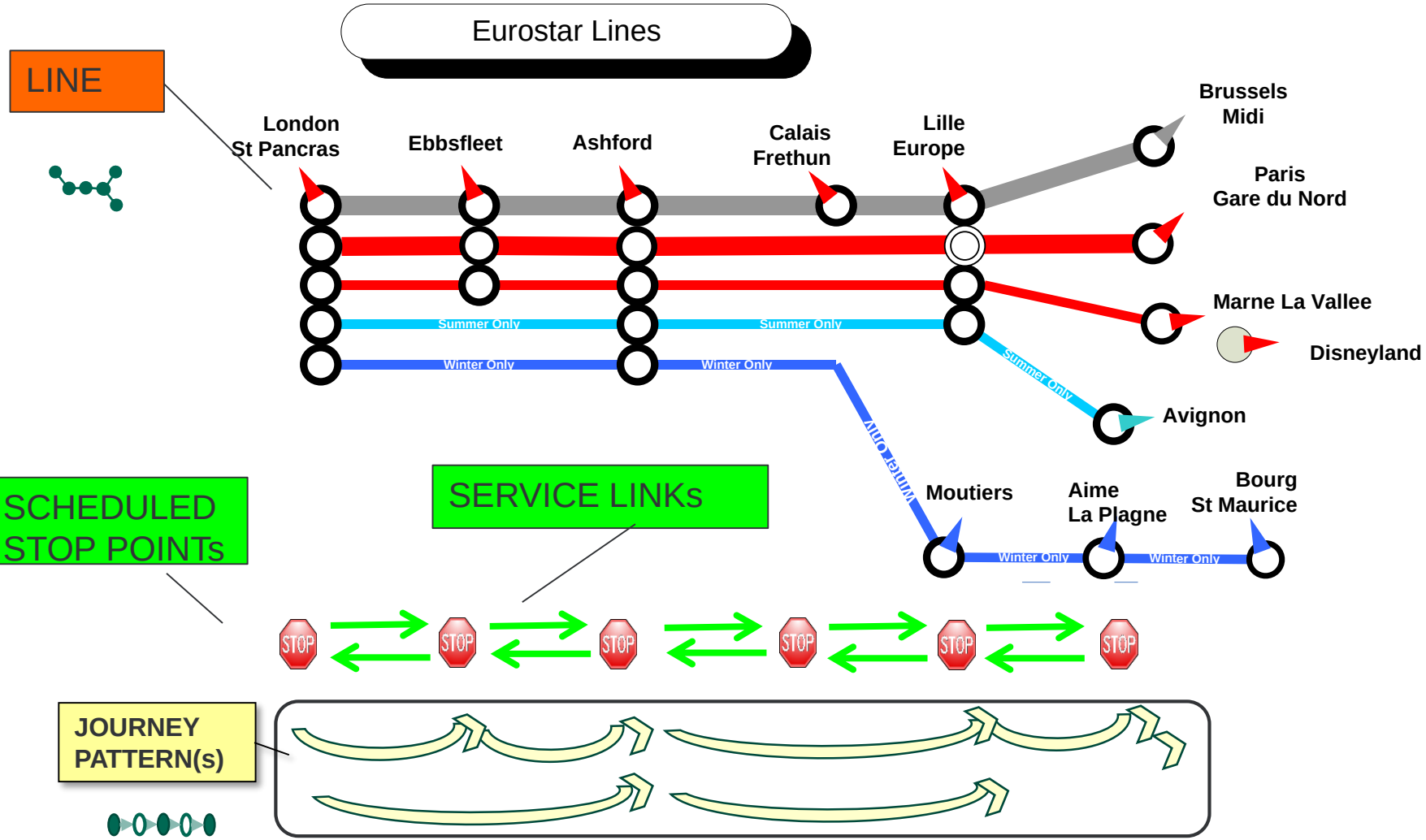
# This works for any mode - e.g. Eurostar Routes & Destinations



TIMETABLE

Eurostar timeta

SCHEDULED STOP POINTs

SERVICE PATTERN

OPERATOR

SERVICE LINKs

LINE

DAY TYPE

VALIDITY CONDITION

PASSING TIMEs

TRAIN NUMBERs

BRUSSELS > LILLE / LONDON

| Notes | Mon | Tue | Wed | Thur | Fri | Sat | Sun | BRUSSELS Midi/Zuid | LILLE Europe | CALAIS Fréthun | ASHFORD International | EBBSFLEET International | LONDON St Pancras Intl | Train no. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ✓ | - | - | - | - | - | - | 06:56 | 07:35 | - | - | - | 07:59 | 9109 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | 07:56 | 08:35 | - | - | - | 08:59 | 9113 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | 08:52 | 09:30 | 10:01 | - | - | 09:57 | 9117 |
| 2 | - | - | - | - | ✓ | - | - | 10:56 | 11:35 | - | - | - | 11:57 | 9125 |
| 4 | ✓ | ✓ | - | - | - | - | - | 10:56 | 11:35 | - | - | - | 11:57 | 9125 |
| 3 | - | - | ✓ | ✓ | - | - | - | 10:56 | 11:35 | - | - | - | 11:57 | 9125 |
| | - | - | - | - | - | - | ✓ | 11:56 | 12:35 | - | - | - | 12:57 | 9131 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | 12:52 | 13:30 | 14:01 | - | 13:45 | 14:05 | 9133 |
| | - | - | - | - | - | - | ✓ | 14:52 | 15:30 | 16:01 | - | 15:45 | 16:05 | 9141 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | 14:56 | 15:35 | - | - | 15:45 | 16:05 | 9141 |
| 1 | - | - | - | - | - | - | ✓ | 15:56 | 16:35 | - | - | - | 16:57 | 9145 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | 16:56 | 17:35 | - | 17:34 | - | 18:06 | 9149 |
| 1 | - | - | - | - | - | - | ✓ | 16:56 | 17:35 | - | 17:34 | - | 18:06 | 9149 |
| 2 | - | - | - | - | - | - | ✓ | 16:56 | 17:35 | - | - | 17:45 | 18:03 | 9149 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | - | - | 17:56 | 18:35 | - | - | 18:45 | 19:03 | 9153 |
| 1 | - | - | - | - | - | - | ✓ | 17:56 | 18:35 | - | - | 18:45 | 19:03 | 9153 |
| 2 | - | - | - | - | - | - | ✓ | 17:56 | 18:35 | - | 18:35 | - | 19:10 | 9153 |
| 1 | - | - | - | - | - | - | ✓ | 18:52 | 19:30 | 20:01 | - | 19:45 | 20:03 | 9159 |
| 2 | - | - | - | - | - | - | ✓ | 18:56 | 19:35 | - | - | - | 19:57 | 9159 |
| 4 | - | - | - | - | ✓ | - | - | 18:56 | 19:35 | - | - | - | 19:57 | 9159 |
| | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | - | 19:52 | 20:30 | 21:01 | - | 20:45 | 21:03 | 9163 |
| 6 | - | - | - | - | - | - | ✓ | 19:52 | 20:30 | 21:01 | - | 20:45 | 21:03 | 9163 |

- DAY TYPES
- 6 SCHEDULED STOP POINTs
- 5 SERVICE LINKs (Each way)
- 5 JOURNEY PATTERNs

NOTICE

1 Runs from 1 April 2018
2 Runs until 31 March 2018
3 Runs from 4 May 2018
4 Runs until 5 January and from 4 February until 30 March 2018
5 Runs until 19 March 2018
6 Runs until 12 April 2018
4 February 2018

JOURNEY PATTERNs

VEHICLE JOURNEYs

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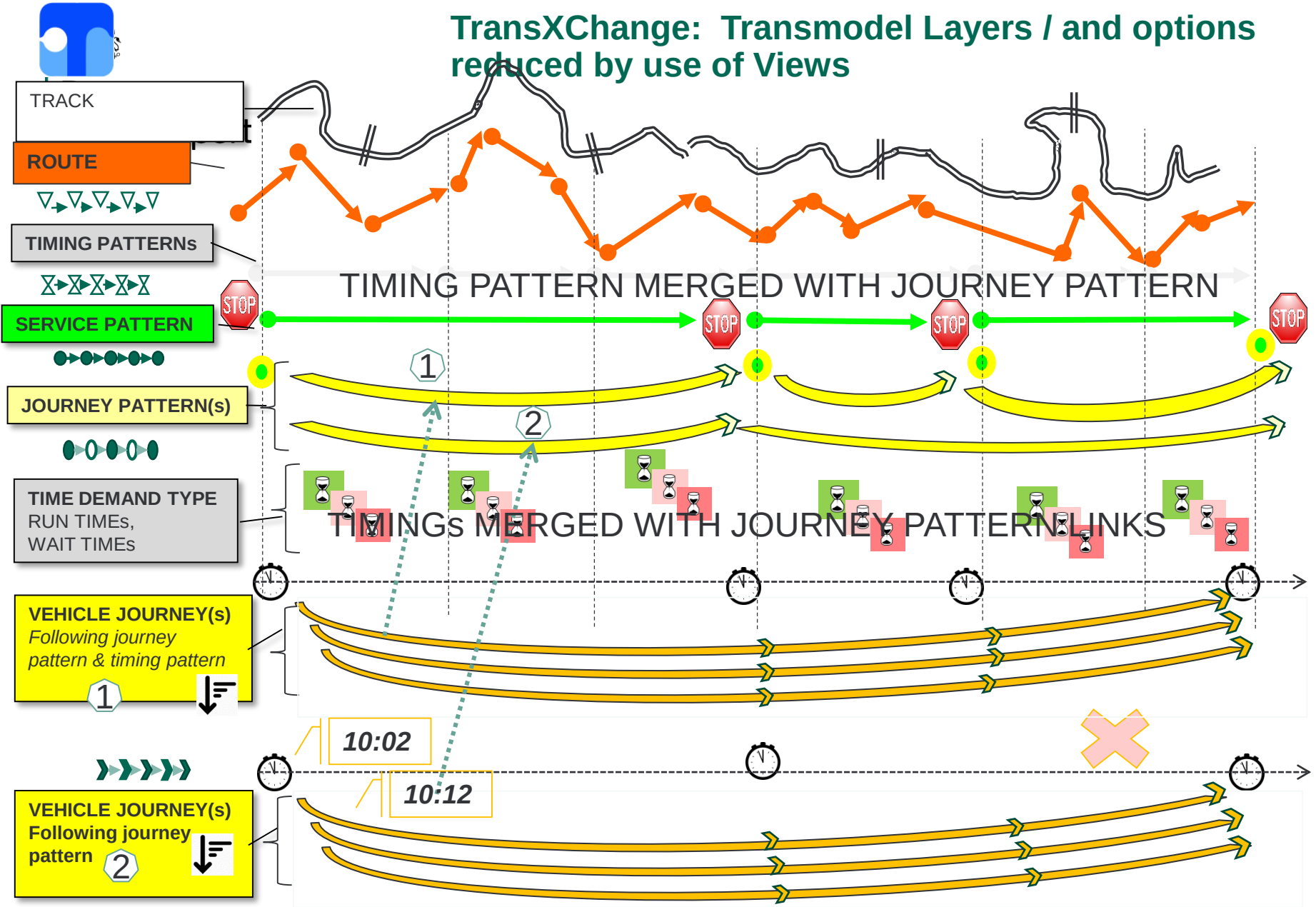
# TransXChange vs Transmodel

- Some use of views in TXC  to combine TM elements to simplify
  - (E.g. Timing  Patters & Service Patterns)
  - E.g. TimingLink + Runlime , Usage + Wait time
- Some changes in TM since TM 5.1
  - E.g. Routes vs Service Patterns
  - E.g. Separate Logical and Physical stops
- Some discrepancies in TXC
  - E.g. TXC Day types (TXC: “Operating Profile”)
  - are not first class entities E.g. Dead Runs
- Some UK Specific Features
  - E.g. EBSR Registrations

# TransXChange: Transmodel Layers / and options reduced by use of Views



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# Some other useful PT things that TM/ NeTEx can model

- Stations & Transport Interchanges
- Navigation & Accessibility
- Journey Interchanges & Timings
- Journey Accounting (e.g. Subsidies)

- Journey Coupling, Train Make up, etc

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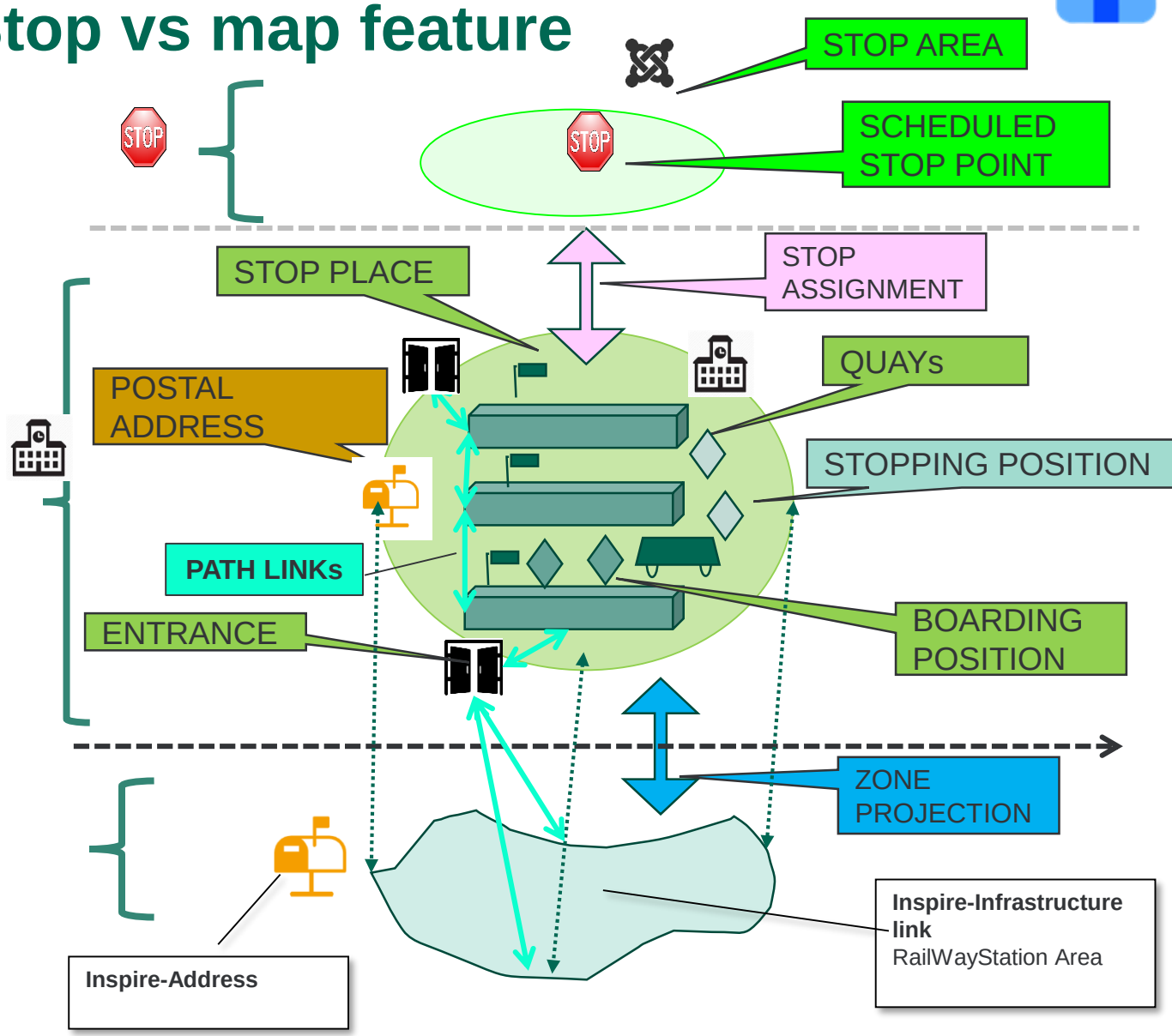
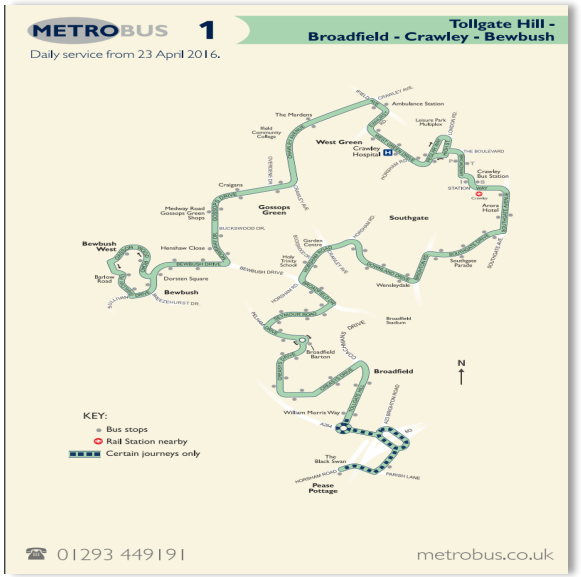
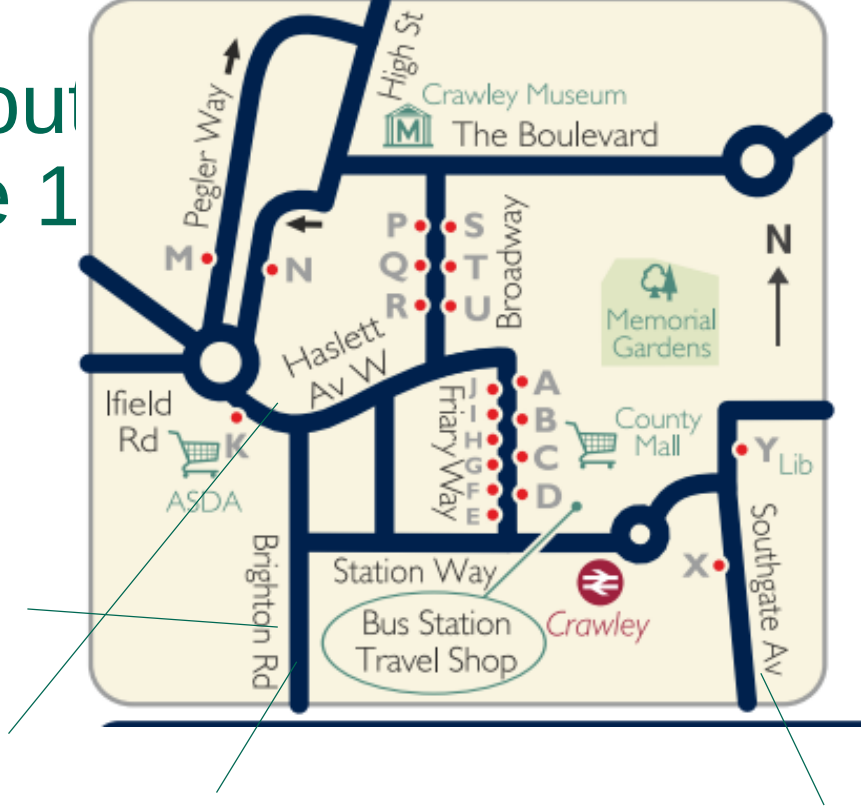
# Logical Stop vs Physical Stop vs map feature

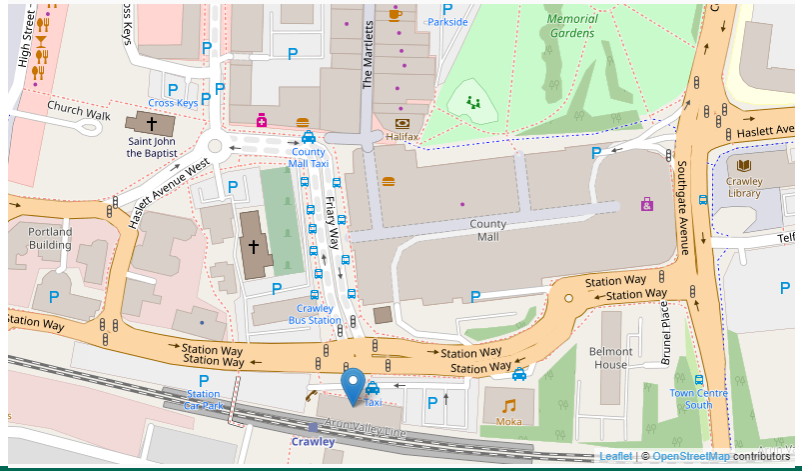
- Transmodel: PT layers for SITES
  - 2D areas as ZONEs
  - Physical Stop is distinct from logical stop
  - Multiple layers, separation of concerns
  - “Projection” spatial mapping between layers as polygons
  - Any location system (OS, WGS etc)
- Can be integrated with Spatial data eg Inspire
  - Areas as Polygons



# A Typical Bus Rou
# (Metrobus Route 1

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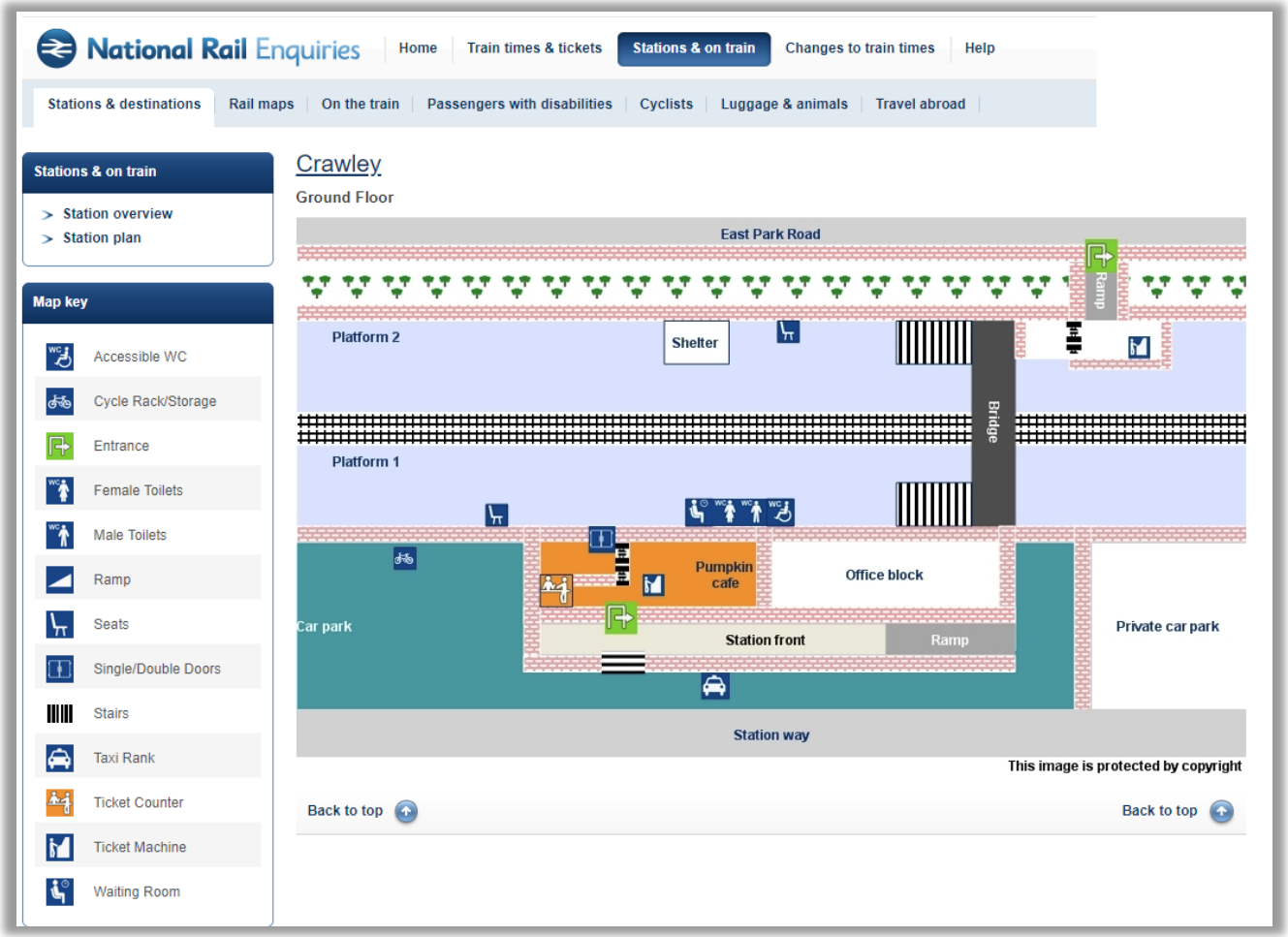
# Crawley Station - Accessibility

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http://www.nationalrail.co.uk/stations-and-destinations/stations-made-easy/crawley-station-plan

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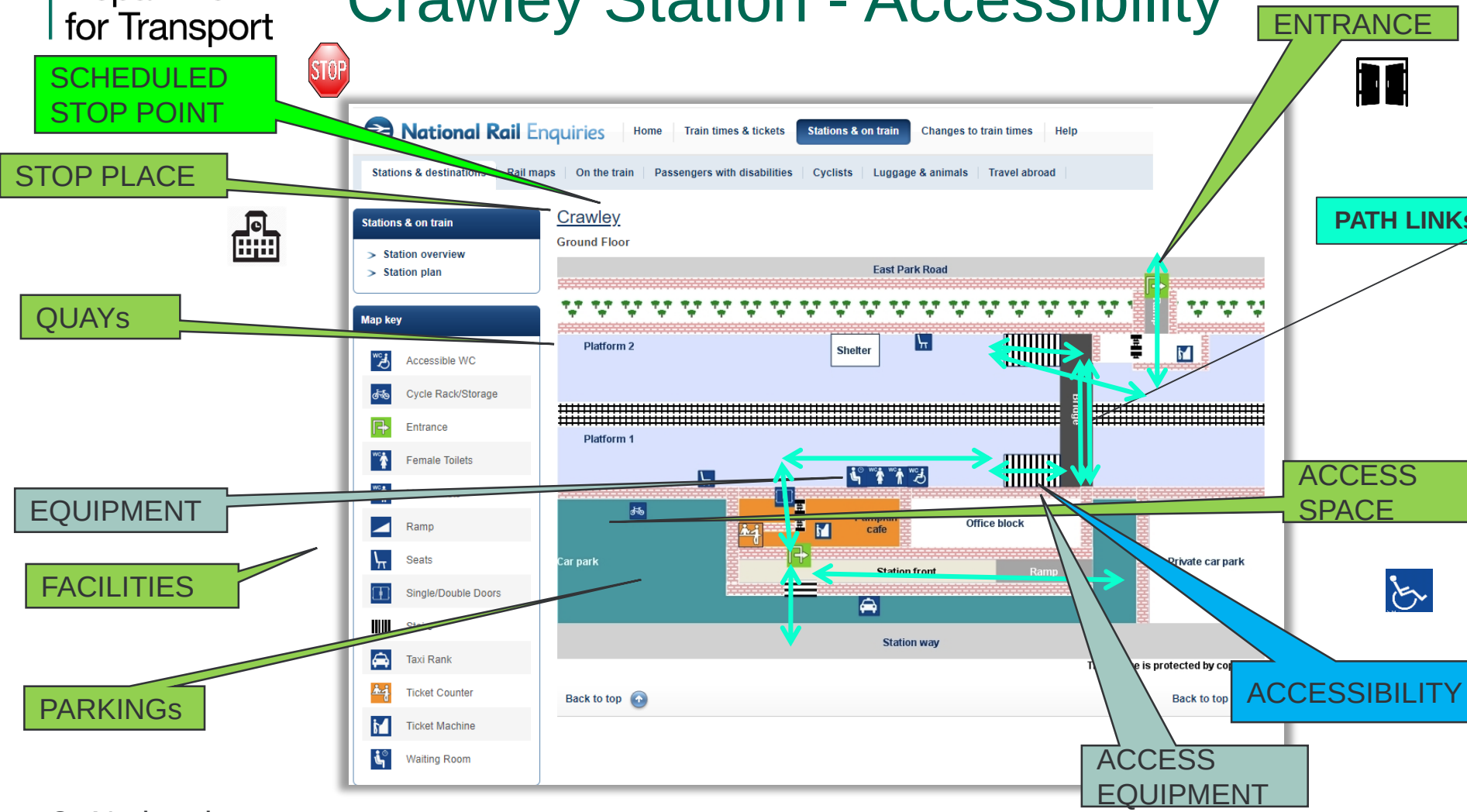
# Crawley Station - Accessibility




© National Rail Enquiries

http://www.nationalrail.co.uk/stations-and-destinations/stations-made-easy/crawley-station-plan

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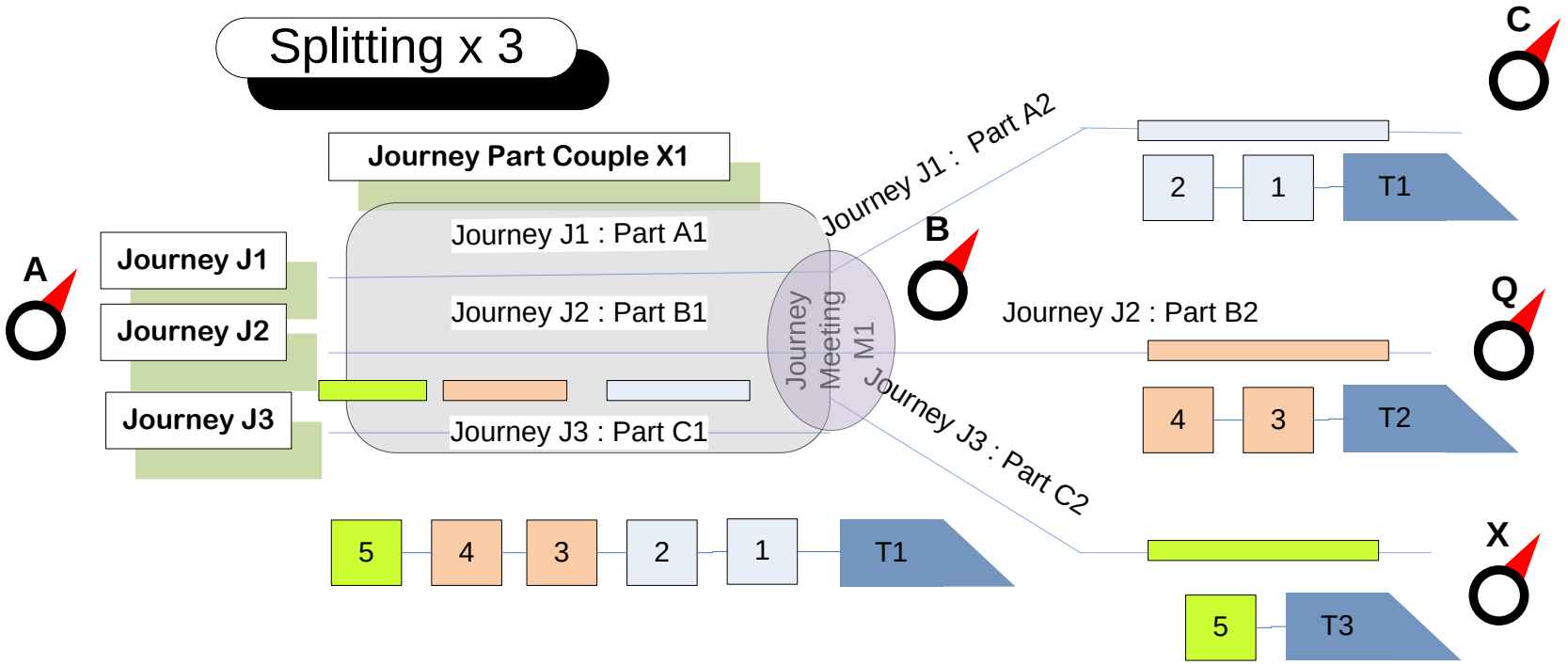
# Journeys that split or join, Train Makeup




- VEHICLE JOURNEY, JOURNEY PARTs, JOURNEY PART COUPLEs, JOURNEY MEETINGs, etc
- TRAIN, TRAIN COMPONENT, etc

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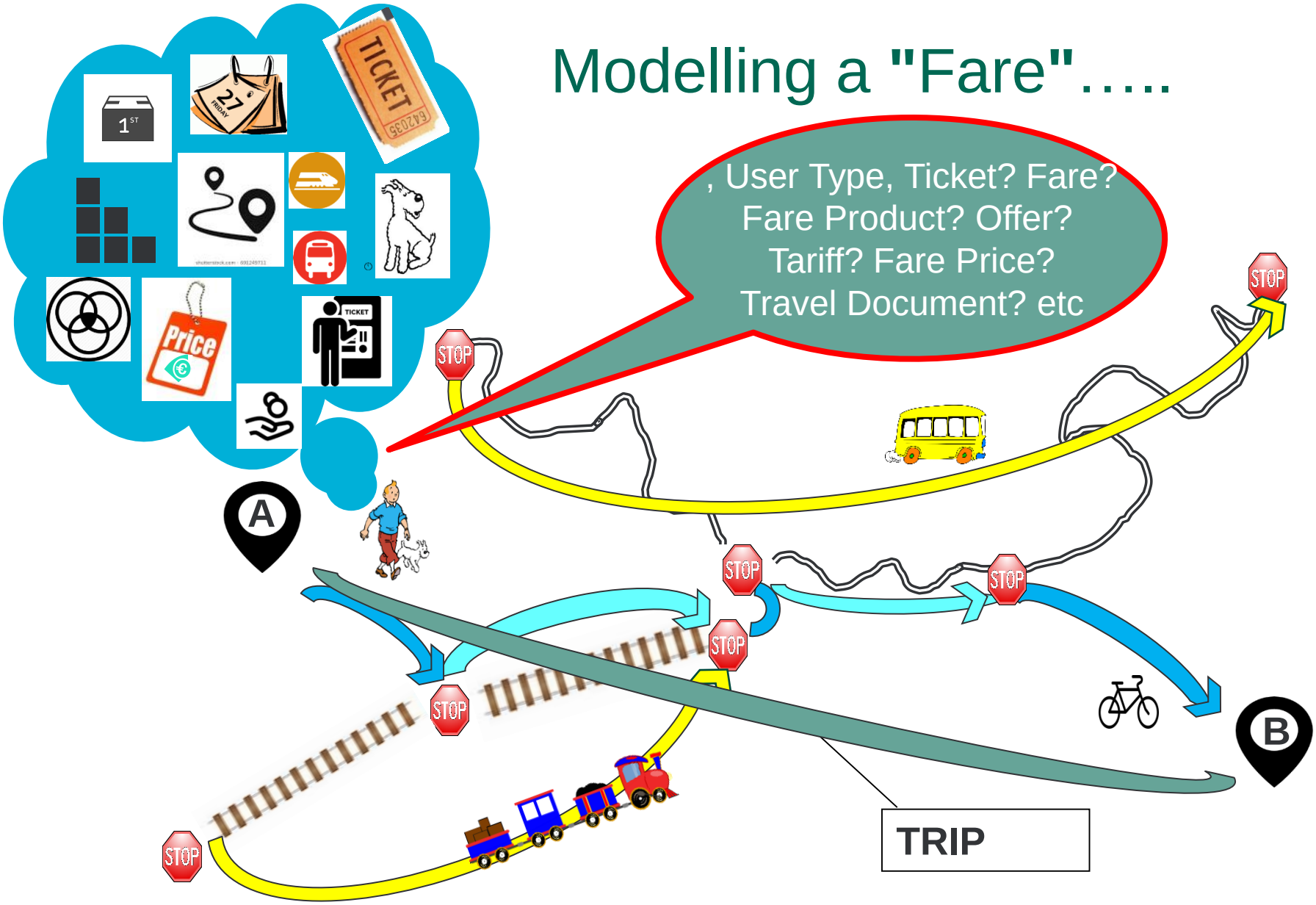
# A Conceptual Model for Fares - an introduction

# Modelling a "Fare"…..



# Describing Fares with Transmodel / NeTEx

**Pricing**

Prices attached to elements
Pricing rules
*Adult flexible single costs £30*
*Child = 50% Adult price*

Network Basis

Tariff Structure

Access Rights

Fare Products

Sales Offer Packages

Travel Specification

Fulfilment & Payment
Control & Validation
Billing &Clearing

**Network**
- stops, tariff zones, line, operator
- *Zone 1 contains 8 stops….,Line 1 runs…*

**Fare policy / tariff structure:**
- space-, time-based…access rights
- *P2p fare, Stage fare, Flat fare*

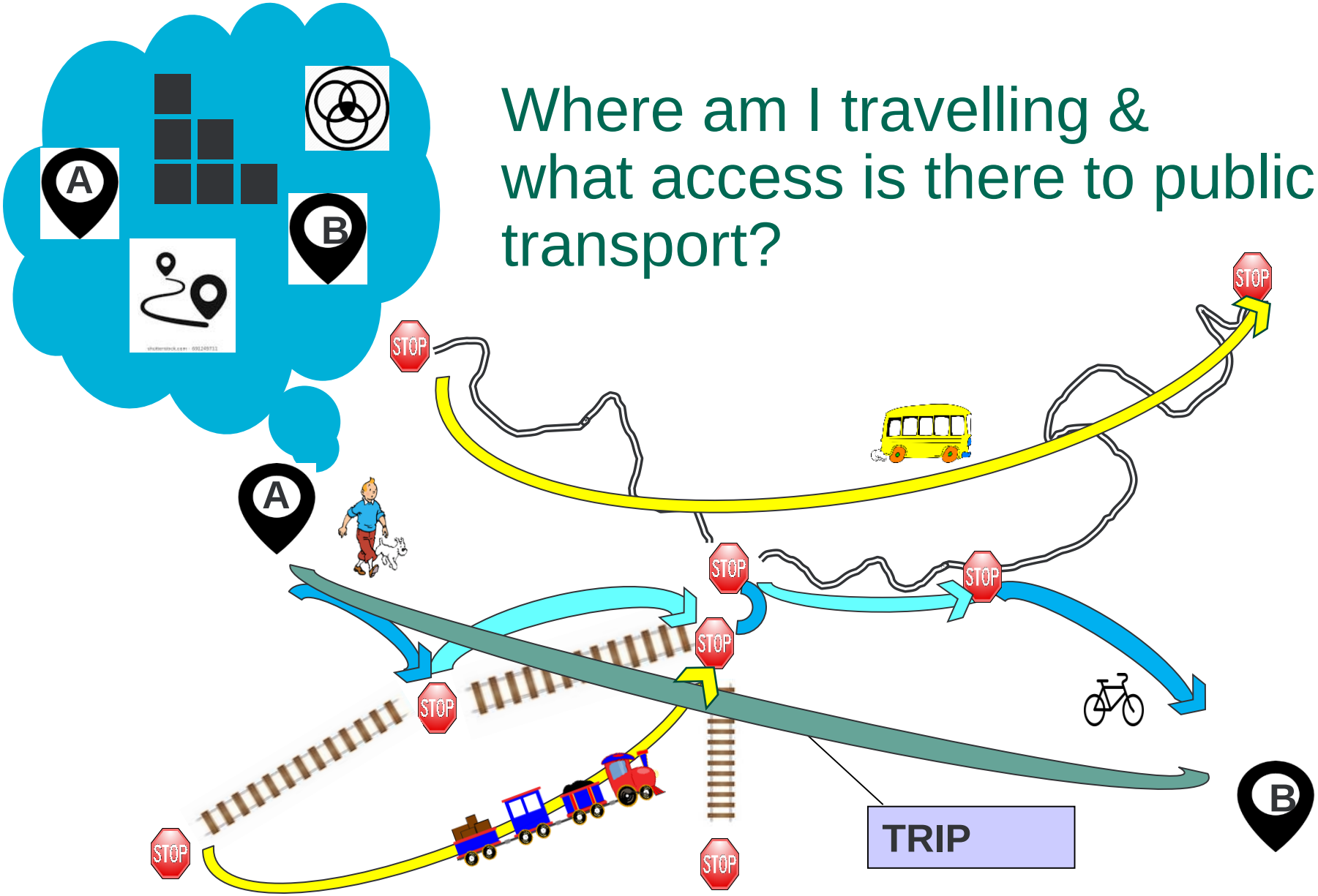
**Rights to access & consume services:**
- scope and order of use
- validity and usage rules
- *bus trip stop X to stop Y, metro trip 3 zones*

**Marketable combinations of access rights**
- validity & usage limiting parameters
- & charging moments
- *off peak metro trip 3 zones followed by bus trip 2 zones ,no interchange, Child reduction*

**Sales Offer Description:**
- media & travel document types
- distribution channels & contracts
- *Paper ticket at ATM, carnet of 10, smartcard*

**Travel Specification**
- Specific set of choices to purchase
- *Adult single A to B on a smartcard*

# Where am I travelling & what access is there to public transport?

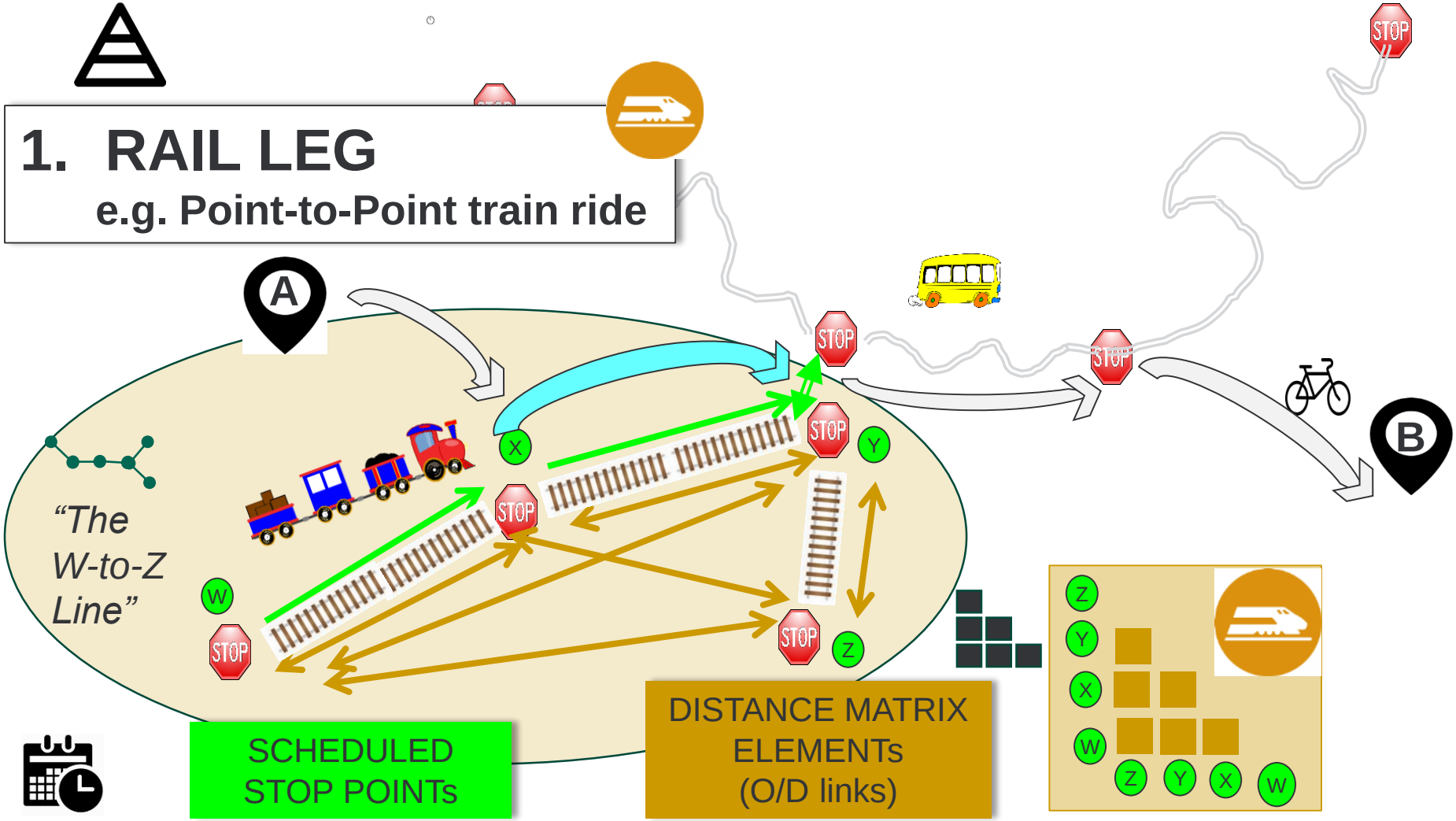


Tariff Structure

# The tariff structure describes the basis of fares in terms of network and time elements (as already used to define timetables, etc)

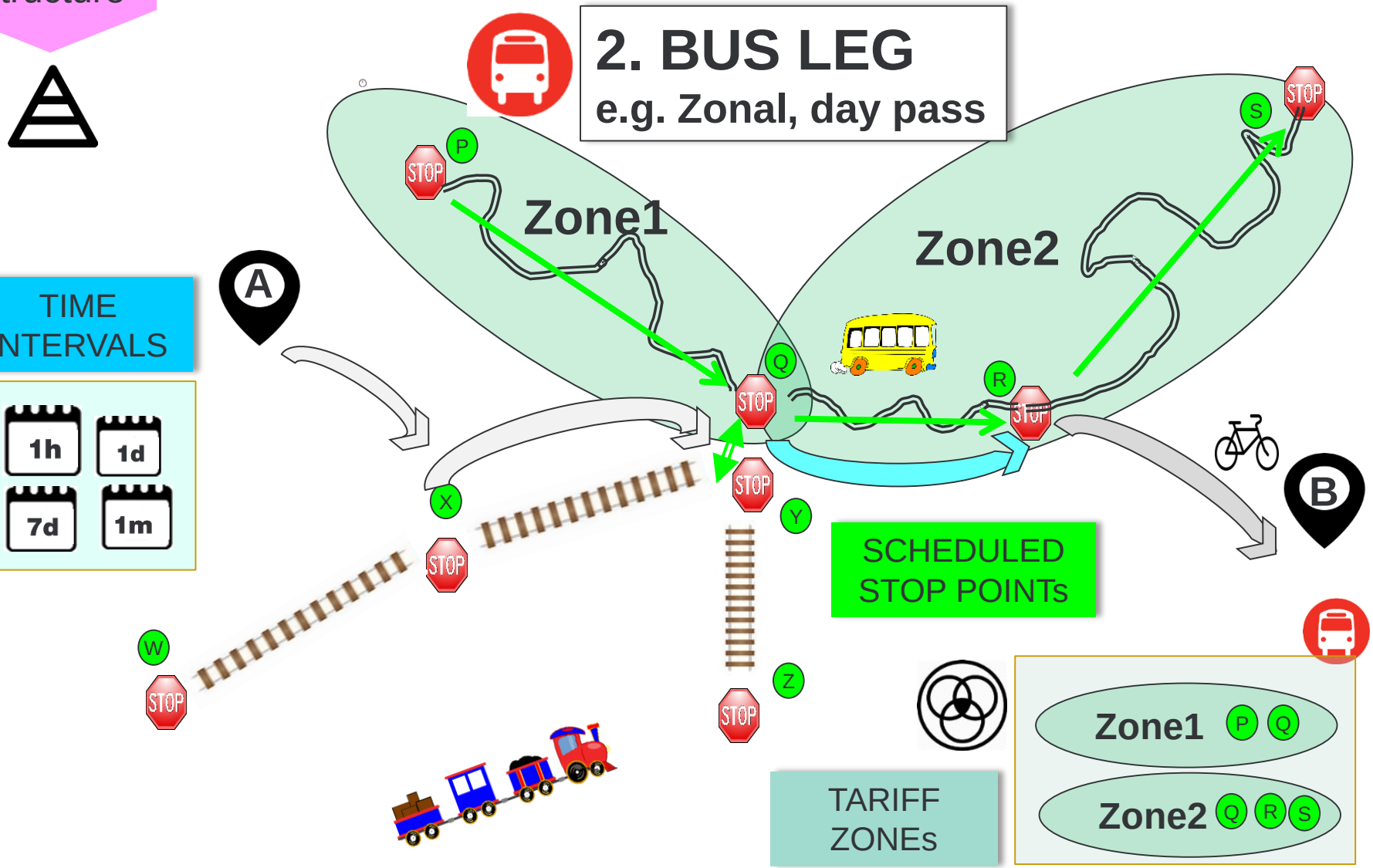
## 1. RAIL LEG

**e.g. Point-to-Point train ride**

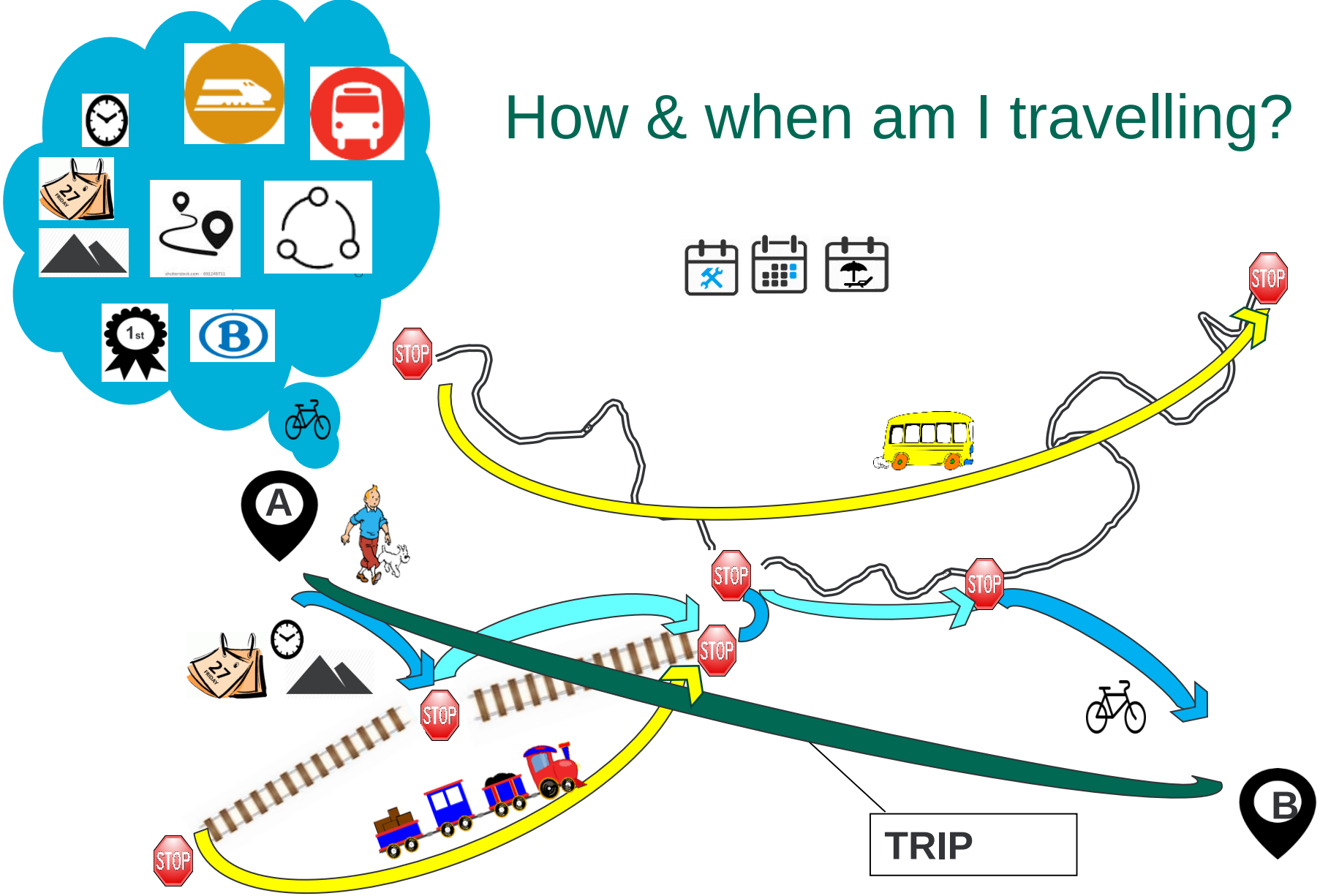


Tariff Structure

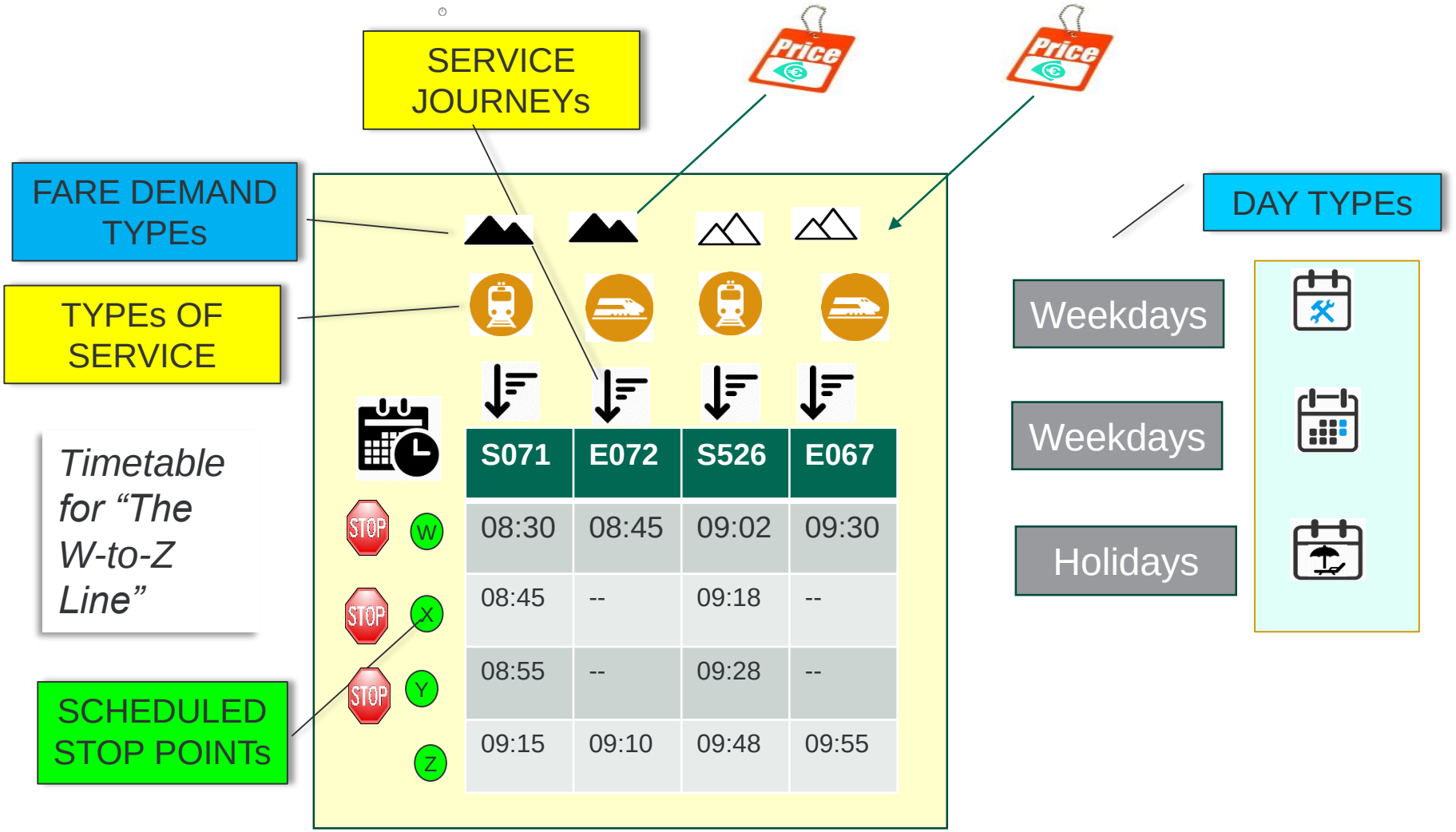
# Fare structures may be Point-to-point, Zonal, flat, zone counting, distance based, time-based, etc



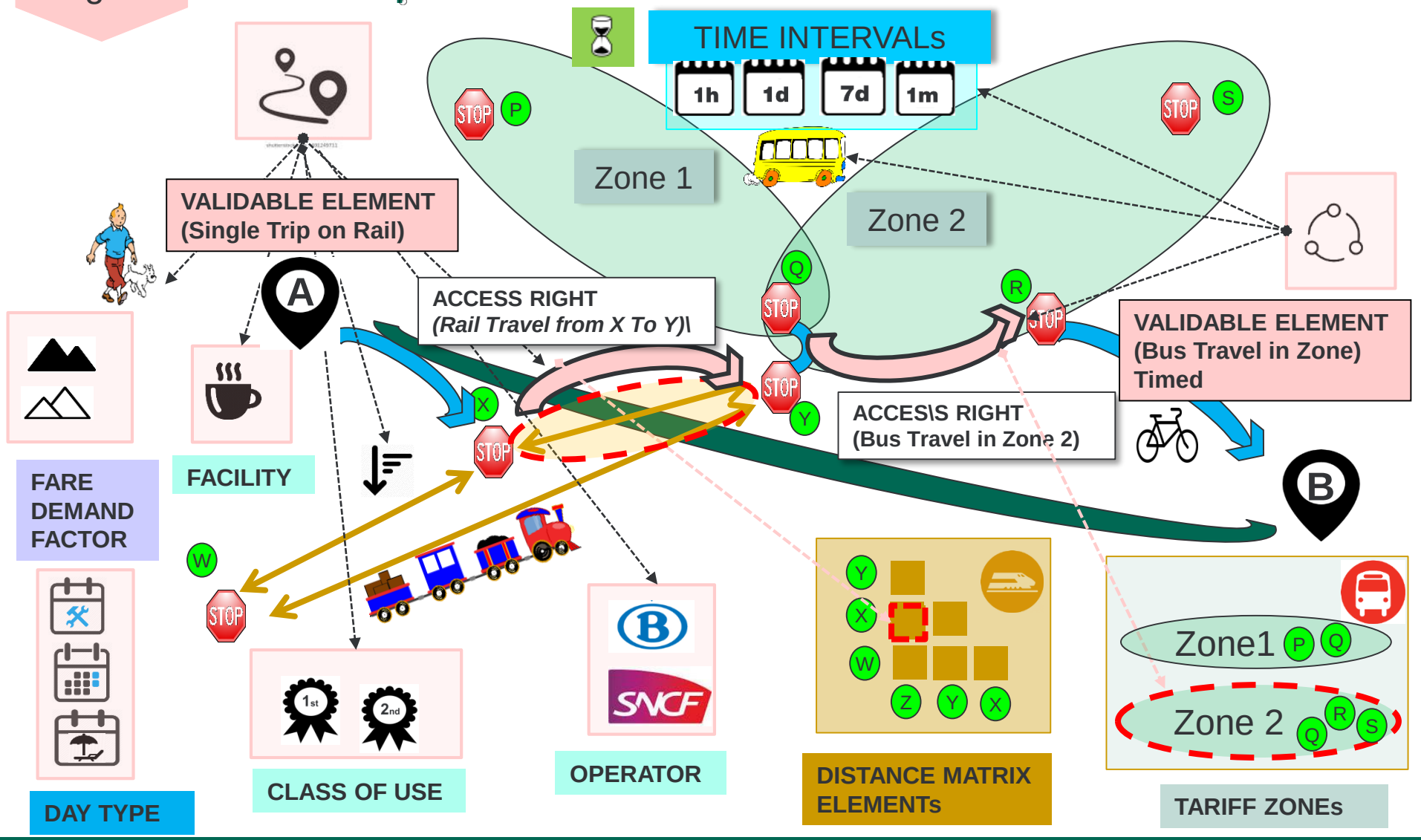
# How & when am I travelling?



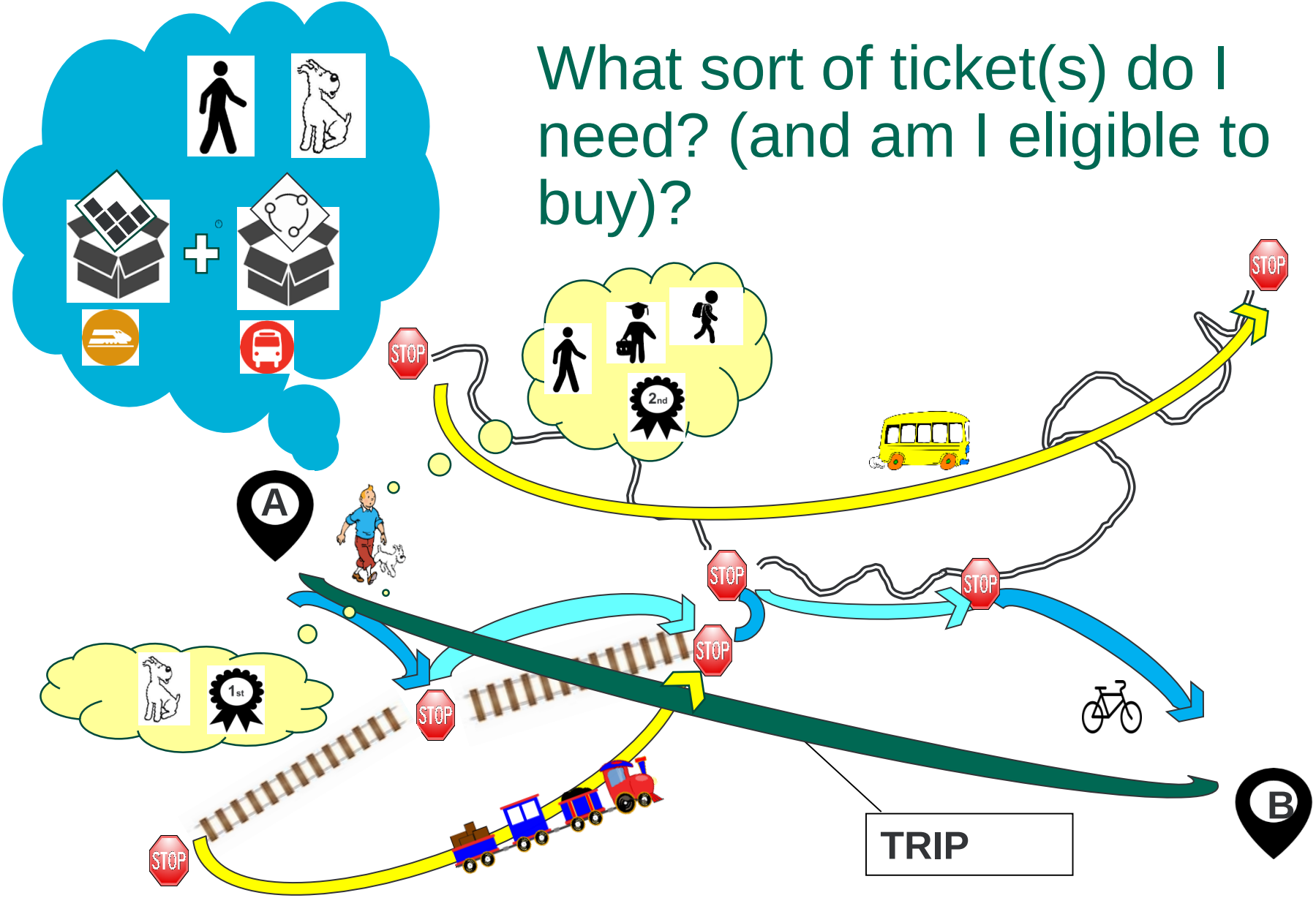
# The tariff structure may also be based on Schedule related aspects, e.g. fare demand type (Peak, Off-peak, etc), train category, specific services, etc



# ***Access Rights*** specify which transport services can be consumed

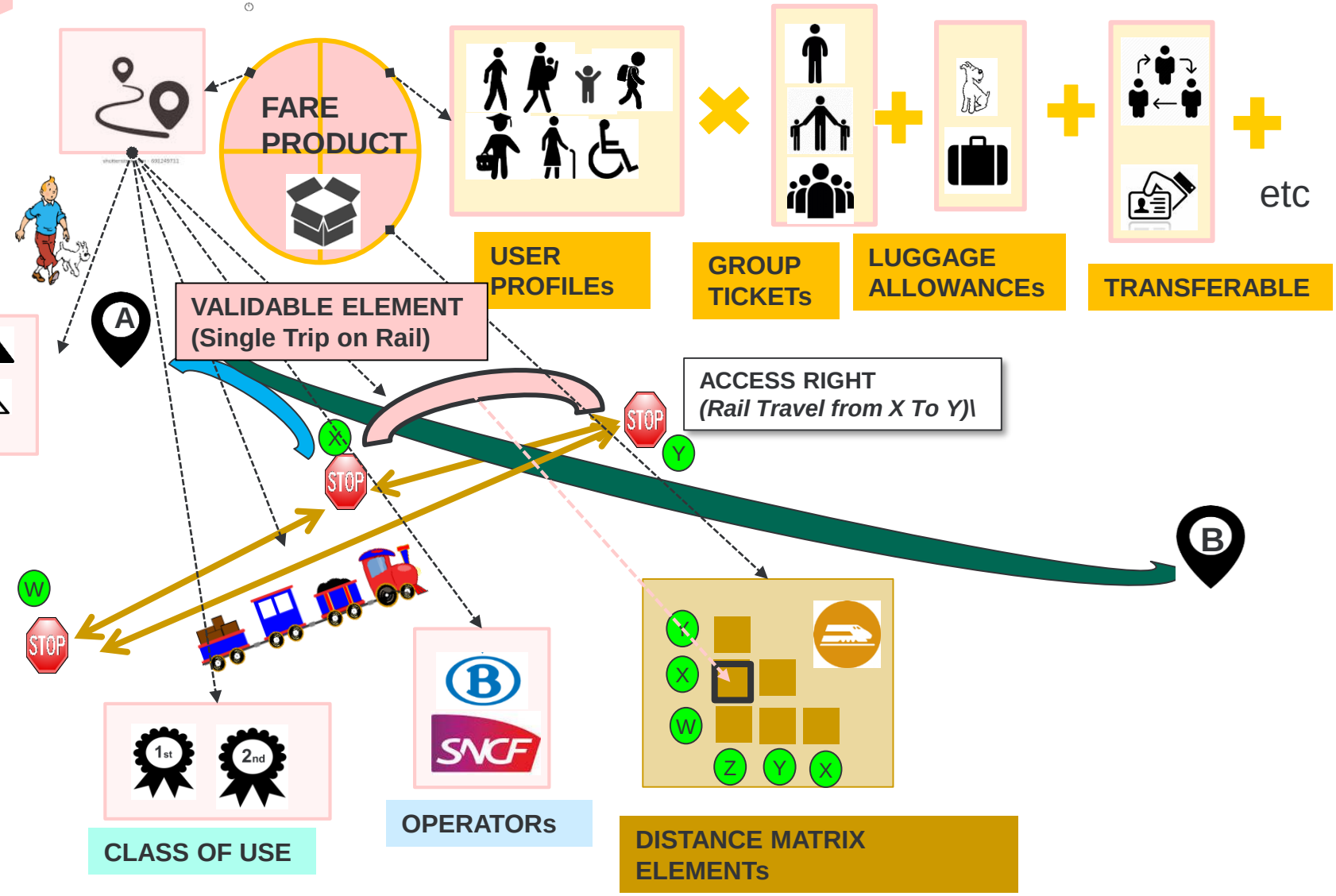


# What sort of ticket(s) do I need? (and am I eligible to buy)?

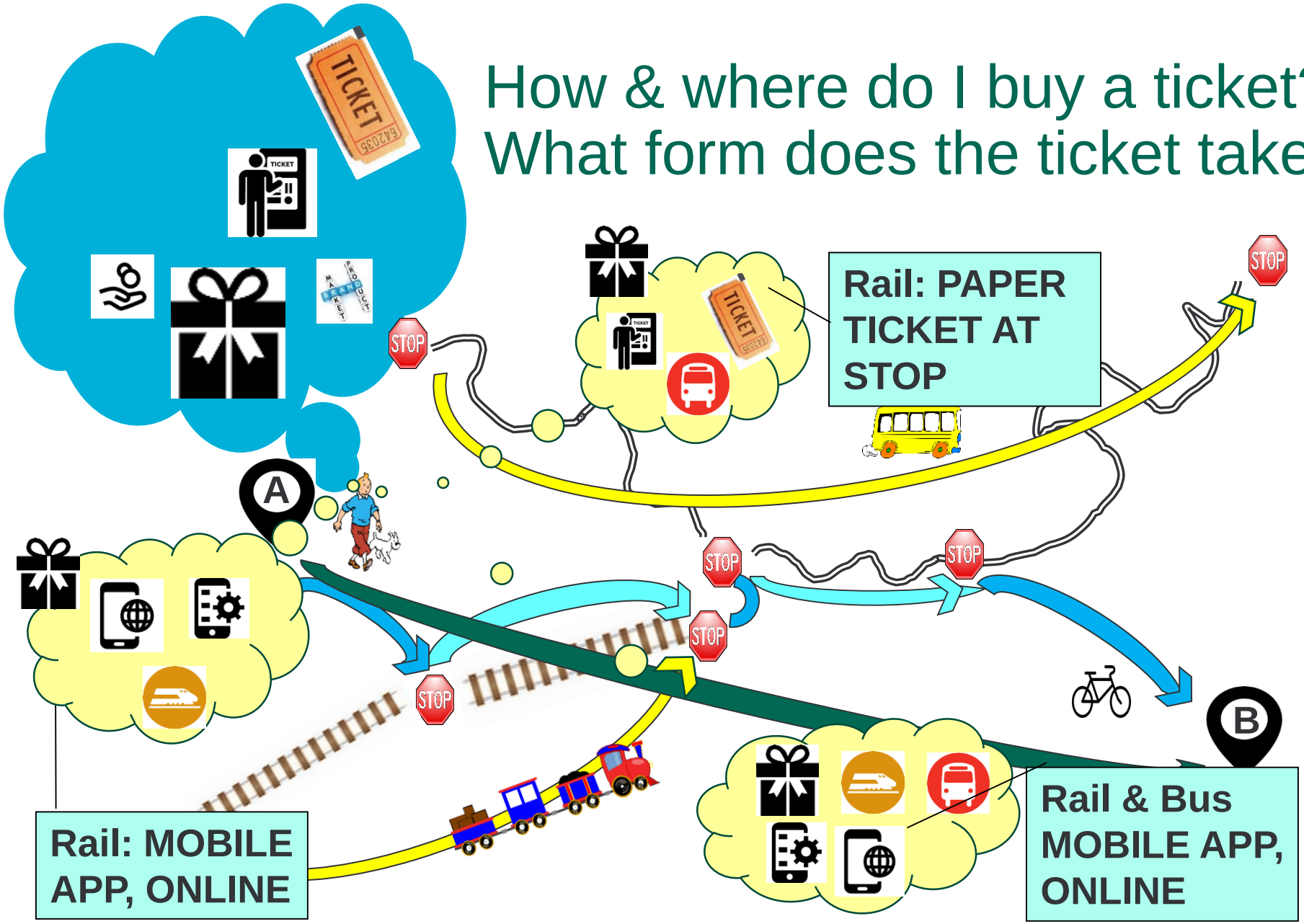


Fare Products

# a FARE PRODUCT is a marketable set of access rights & other validity parameters

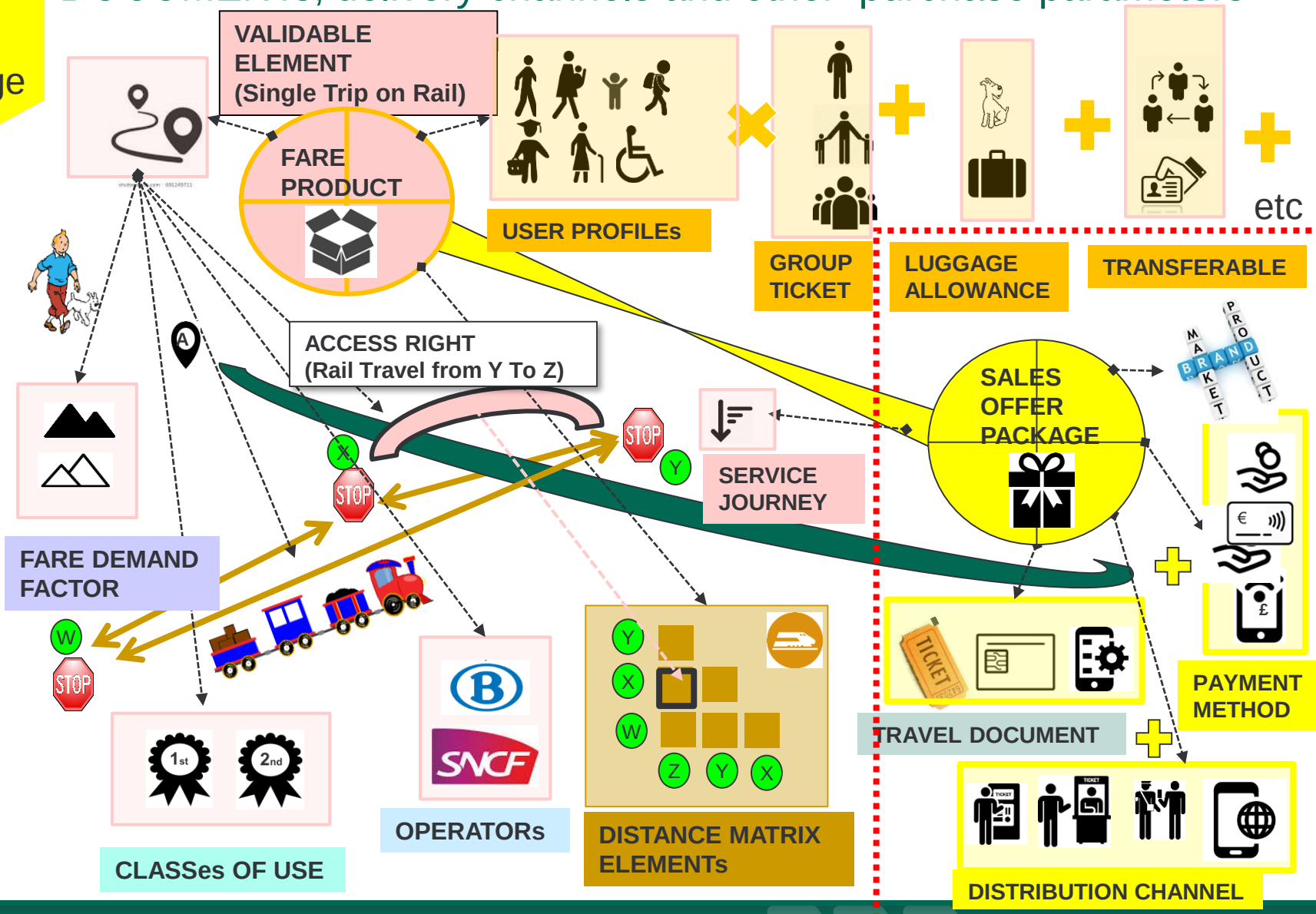


# How & where do I buy a ticket? What form does the ticket take?

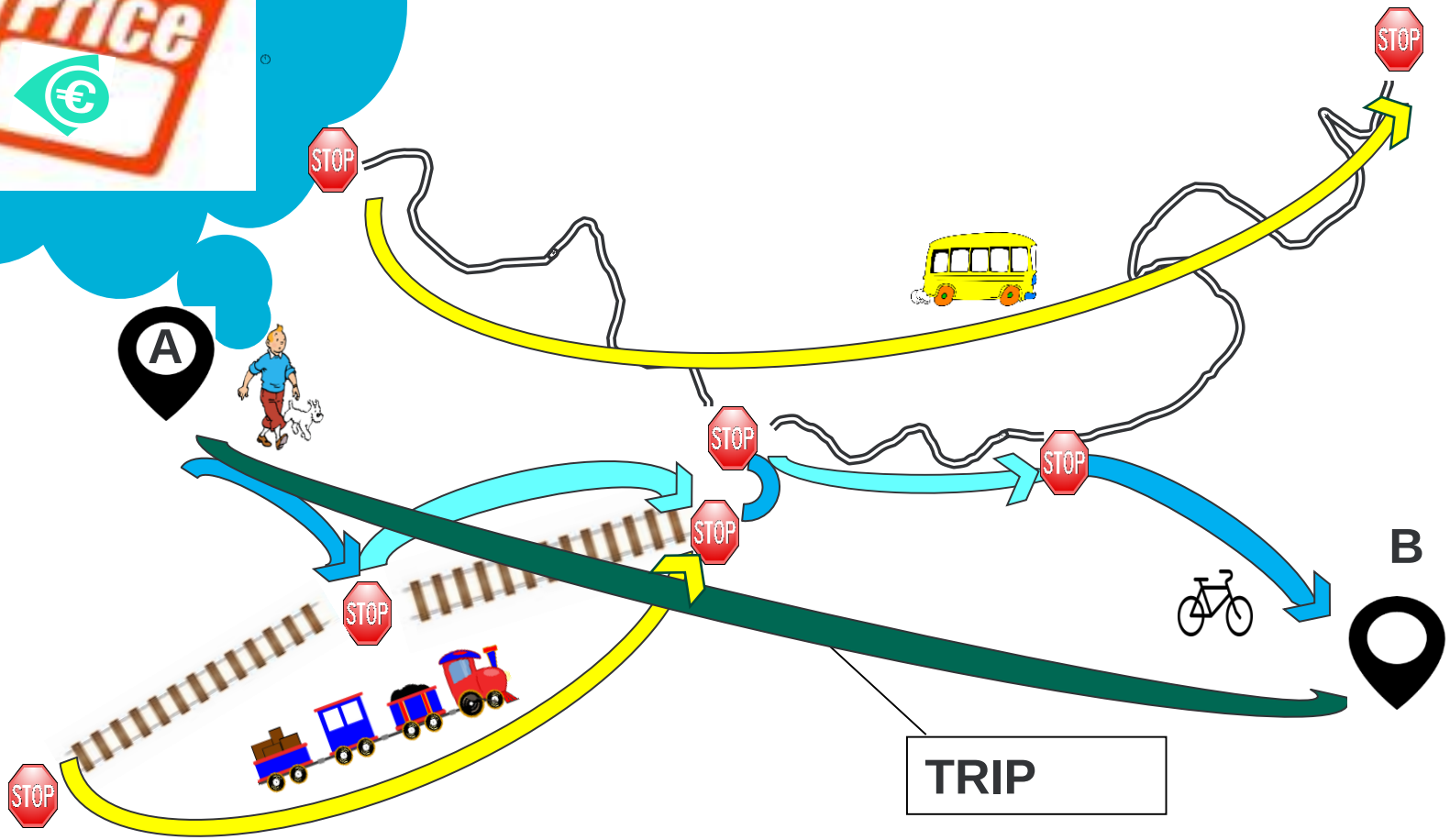


Sales Offer Package

# A SALES OFFER PACKAGE specifies available TRAVEL DOCUMENTs, delivery channels and other purchase parameters

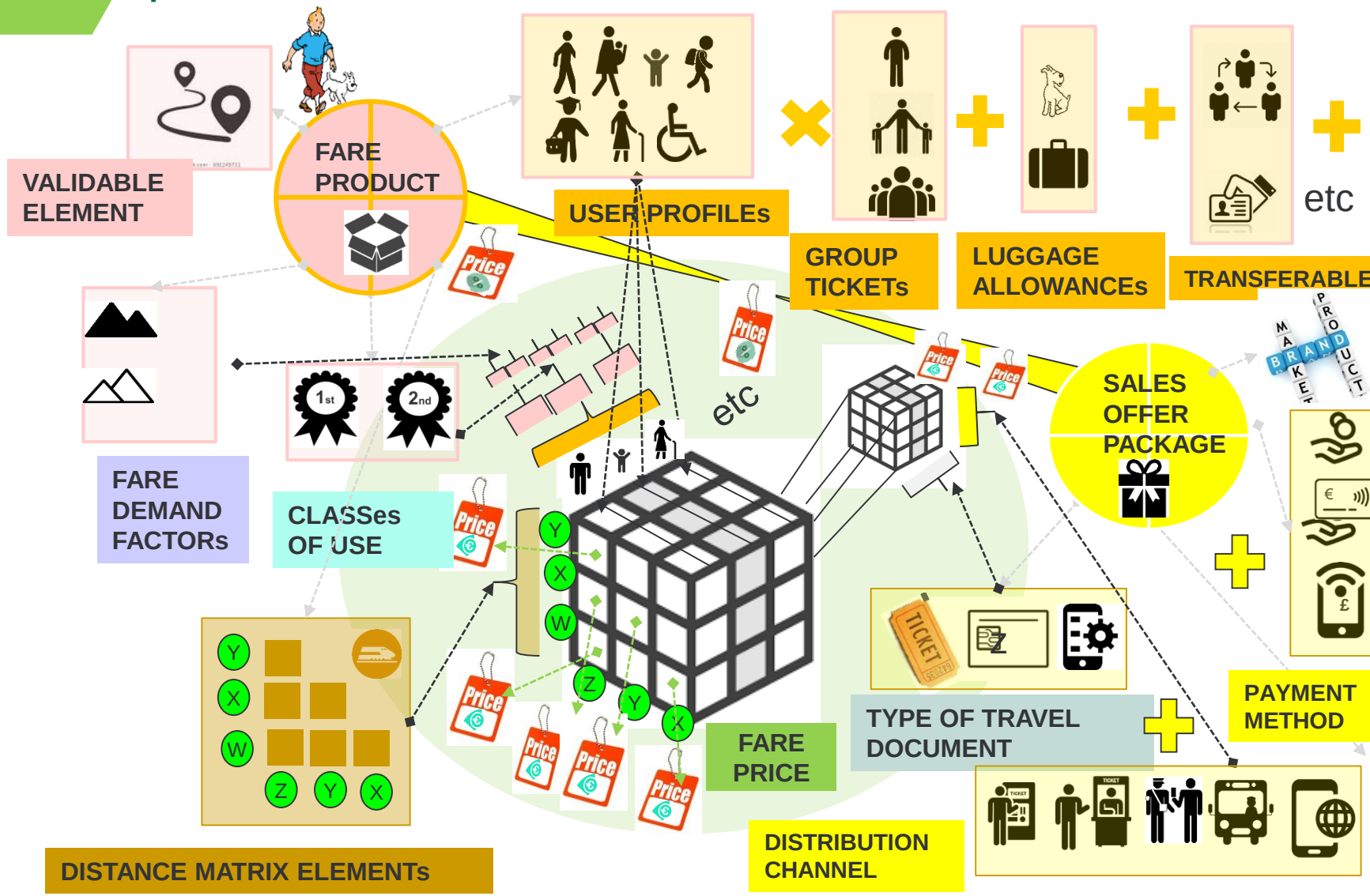


# What does it cost?…..



Pricing

# FARE PRICEs are separate. There may be distinct prices for each available combination of fare elements



Pricing

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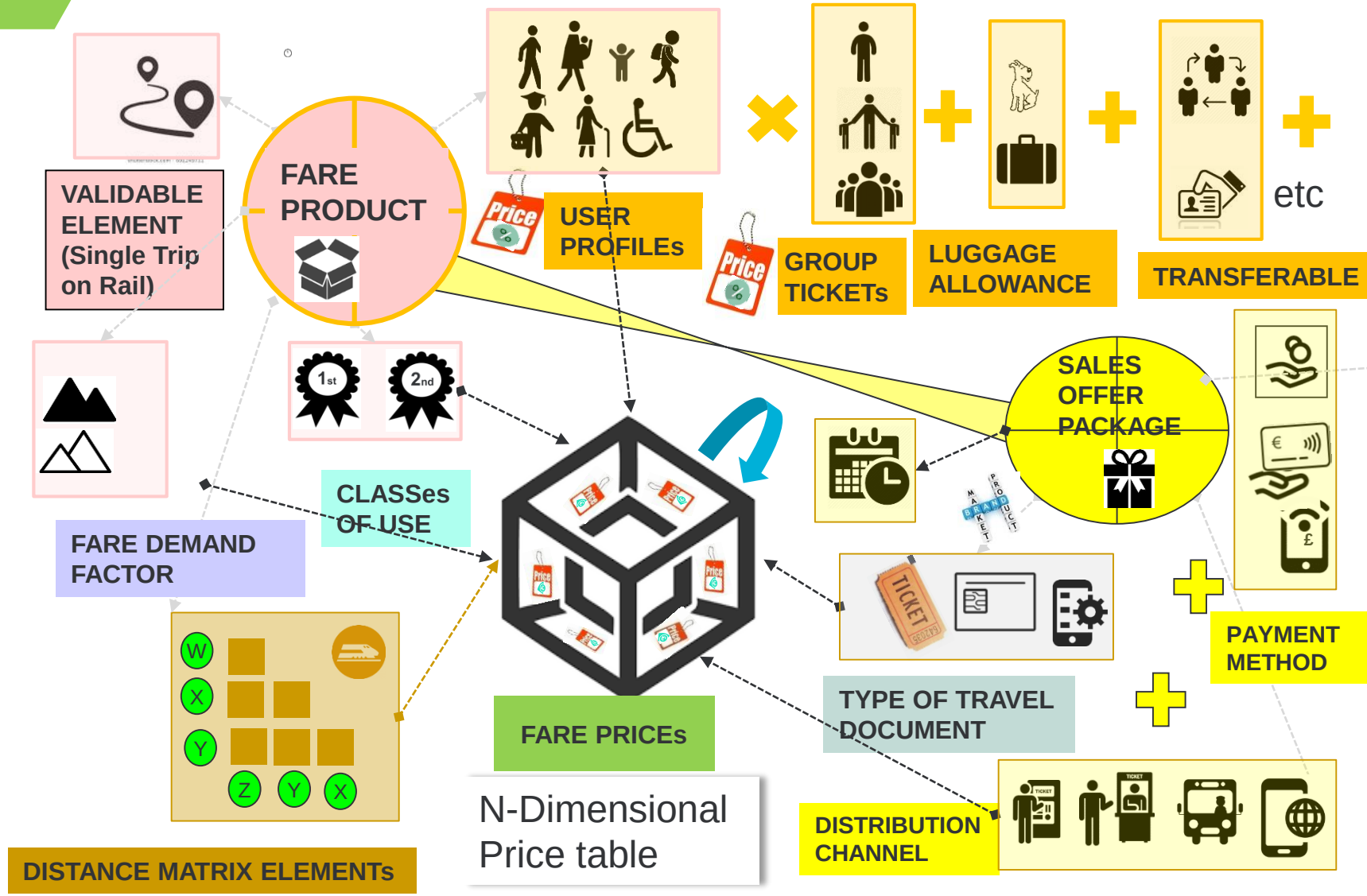
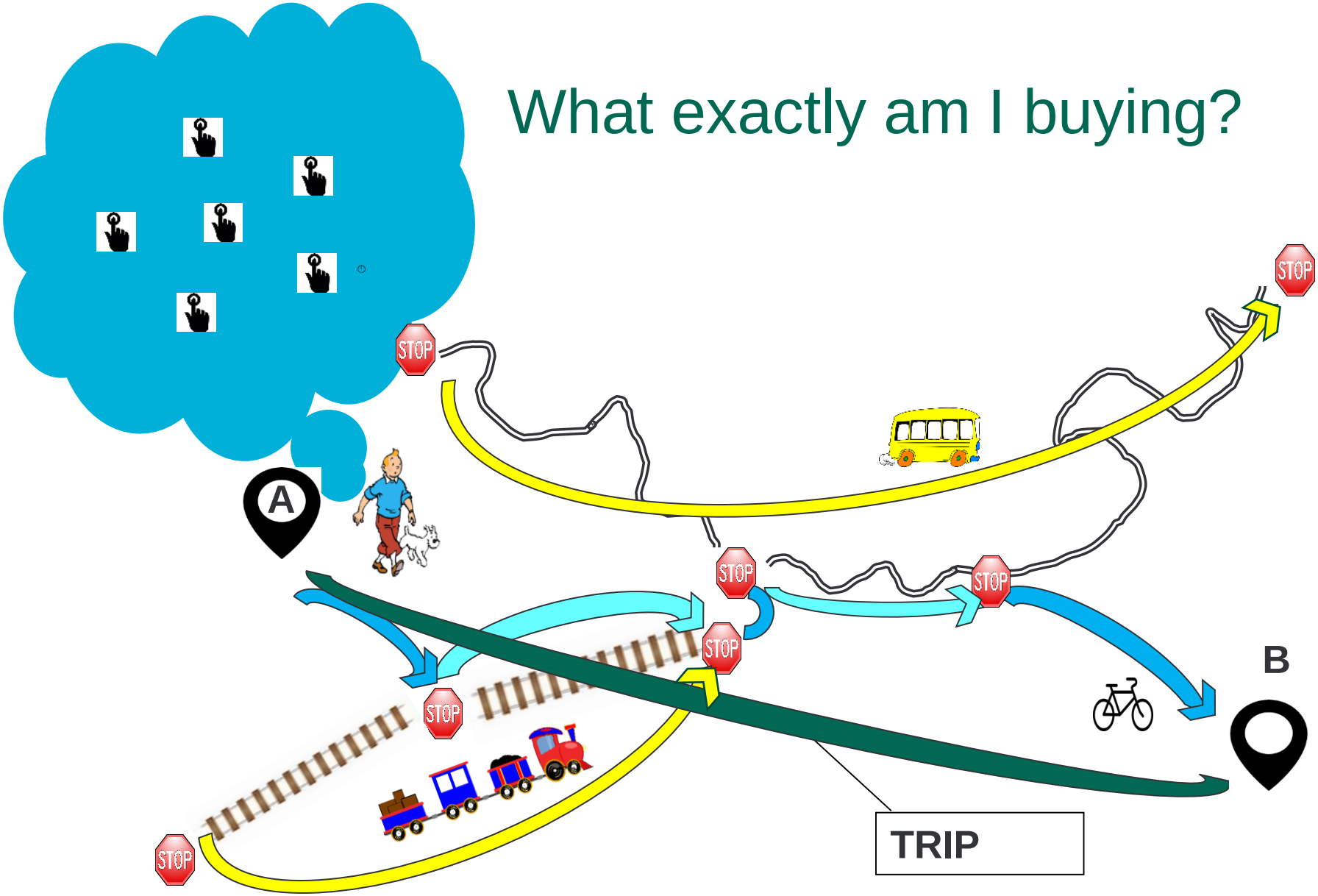
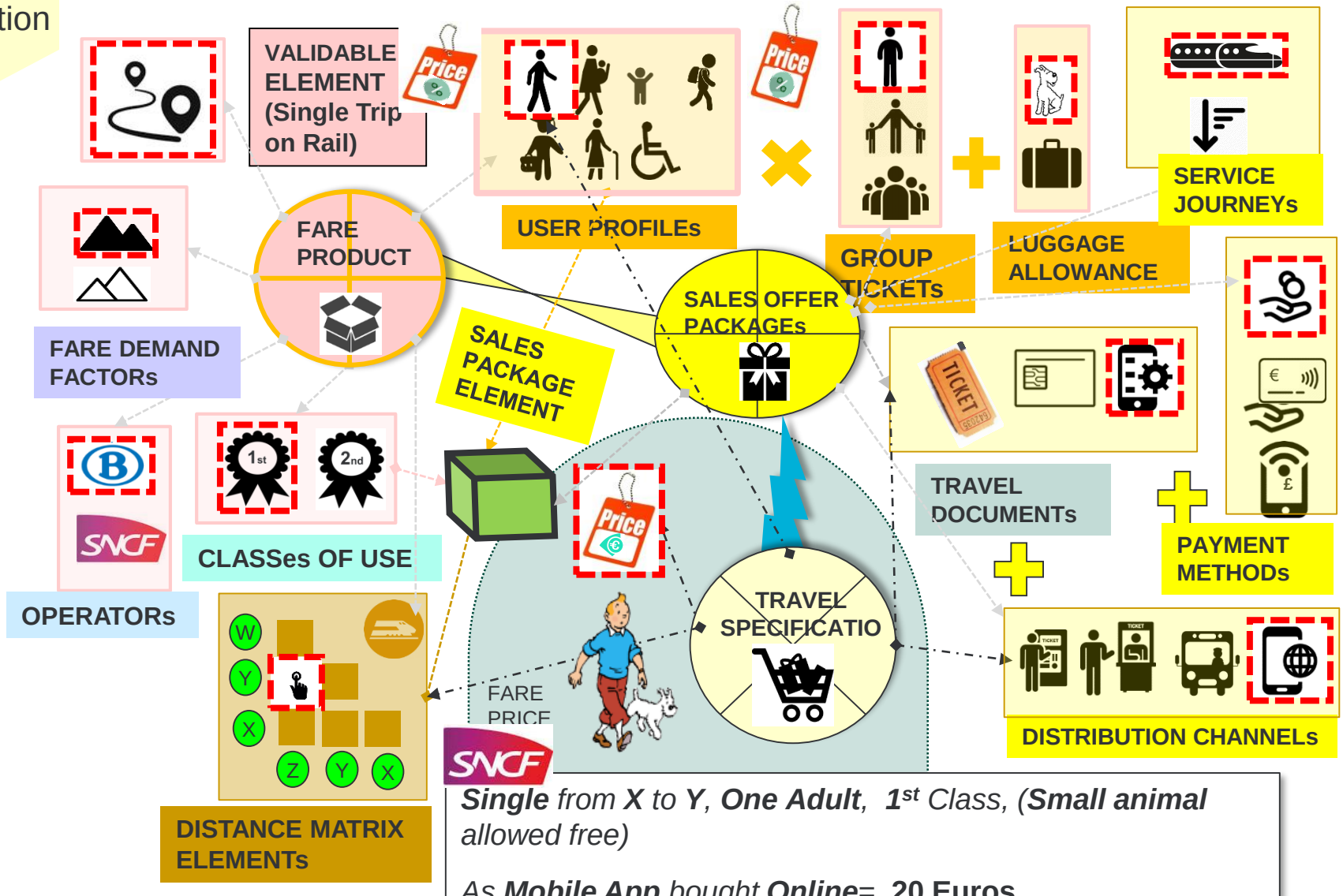


# What exactly am I buying?



Travel Specification

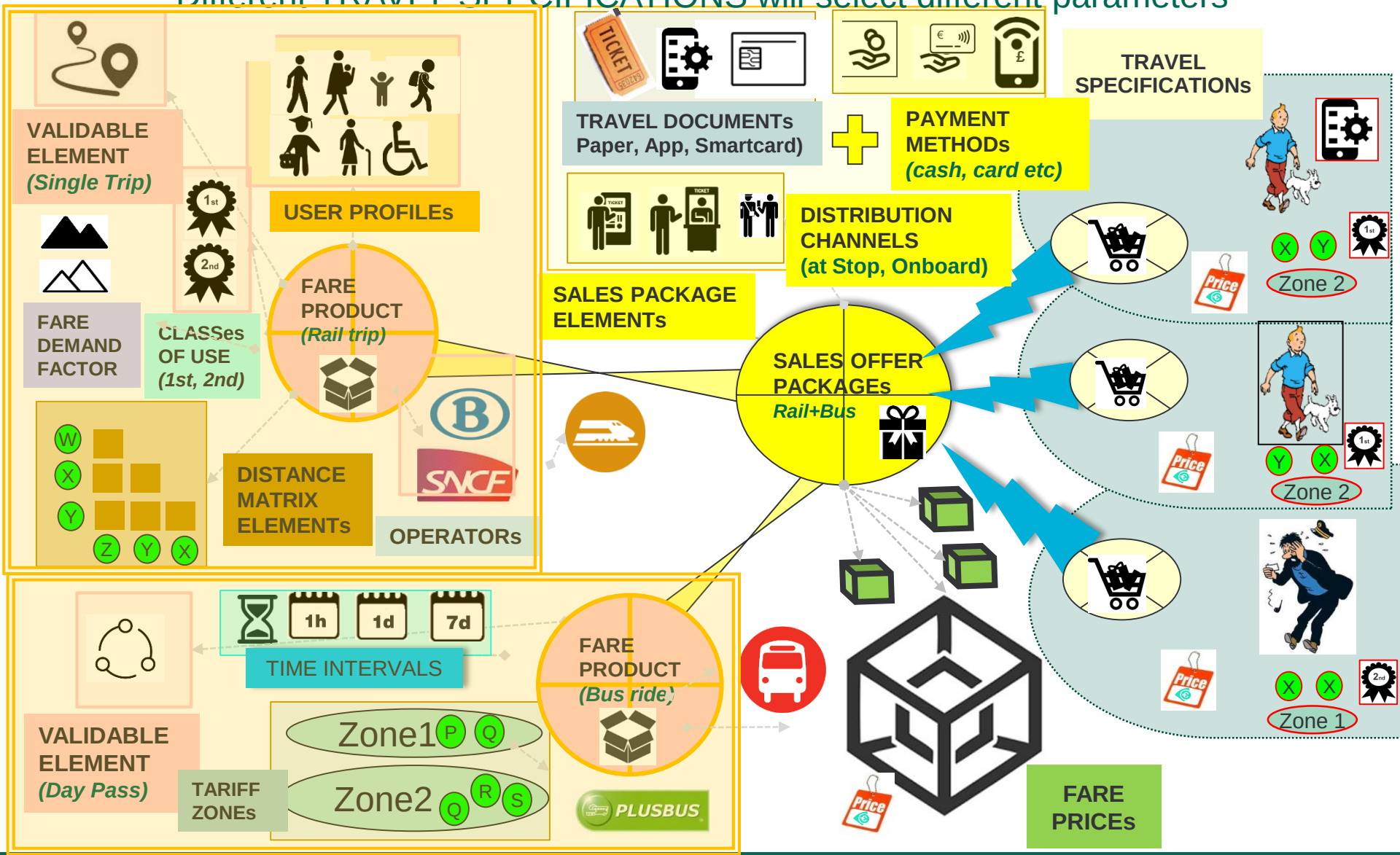
# A TRAVEL SPECIFICATION describes the specific choices of access rights & parameters for a given TRIP.



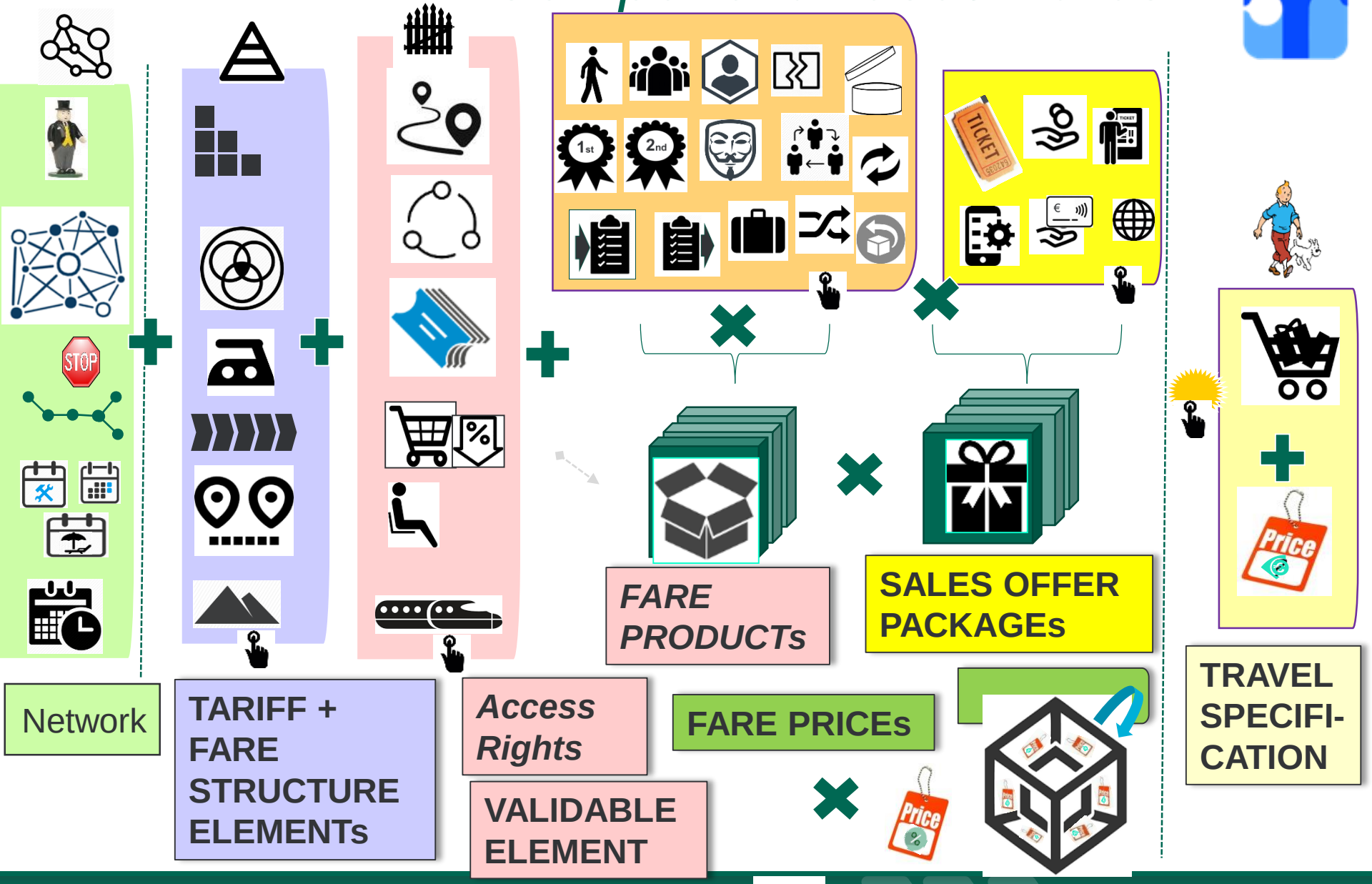

***Single** from **X** to **Y**, **One Adult**, **1st** Class, (**Small animal** allowed free)*

*As **Mobile App** bought **Online**= **20 Euros***

A SALES OFFER PACKAGE may include several different products.
A FARE PRODUCT may be used in different SALES OFFER PACKAGES.
Different TRAVEL SPECIFICATIONS will select different parameters



# Component Based Fares



Department for Transport

# COMPONENT BASED FARES

We can describe any fare / tariff structure/ price if we break it down into separate concerns:

- TARIFF STRUCTUREs
  - Spatial (Point to Point, Zone)
  - Temporal (Intervals)

- ACCESS RIGHTS
  - Tariff, Mode, Class of Use, Service, etc

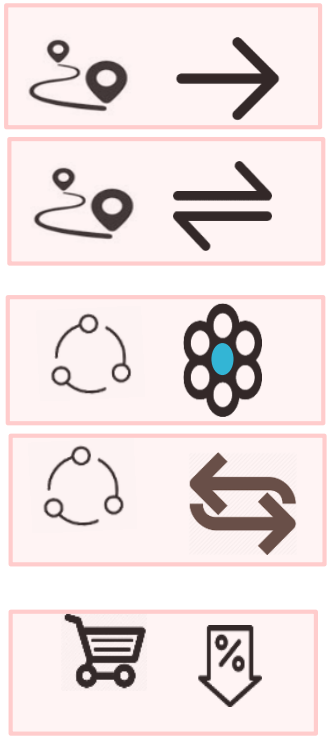
- PRODUCTs
  - Parameters, *User Types, Travel, After Sales,* etc

- SALES OFFER PACKAGEs
  - Type of Ticket, Media, Distribution,

- PRICEs
  - Base & Derived

Department for Transport

# A product gives specific access rights



- That can be validated…
  - *E.g. A single trip between two points*
  - *E.g. A return trip to be made within a given period*
  - *E.g. Unlimited travel within a zone for a given period*
  - *E.g. Unlimited travel along a route between two points for a given period*
  - *E.g. The right to buy other products at a discount for a given period*

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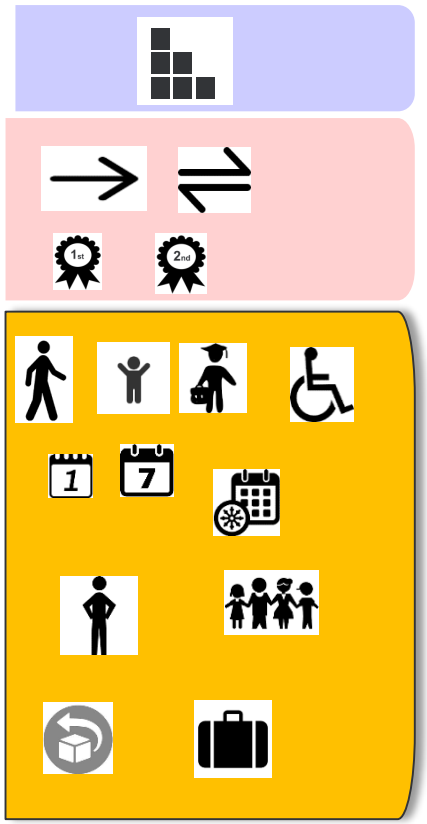
# A Fare Product is a set of options



- A single FARE PRODUCT may includes **all** the alternate choices (with different prices for the combinations):
  - *E.g. All permitted Origin & Destination pairs*
  - *E.g. Single or Return trip*
  - *E.g. 1st & 2nd Class accommodation*
  - *E.g. Adult & Child & Student users*
  - *E.g. Valid for a period: for 7 or 30, 180 days*
  - *E.g. One, or many travellers*
  - *E.g. Refundable / Not Refundable*
  - *E.g. With Luggage allowance*

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# Combining products to make offers

With a simple visual notation for showing product choices and offer packages

(NB This is not part of the official standard)

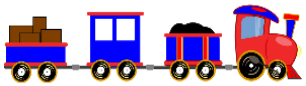
Department for Transport

# Fare Products can be combined into Sales offers

- The same components may need to be combined in many different ways to meet specific business requirements
  - One SALES OFFER PACKAGE may bundle multiple products
    - E.g. Plusbus = Rail ticket + Bus day pass
  - The same product may be in used in many SALES OFFER PACKAGEs
    - E.g. Rail ticket by itself or in Plusbus bundle
    - E.g. Mobile App ticket or paper Ticket
    - E.g. Same rail ticket sold by different operators

Department for Transport

# Q1. What is available to purchase?
## *"Rail Trip Offer + Bus Day Pass Offer"*



**Offer:** ***"Rail Trip, walk-up purchase"***

- **Available:** *At stop (at discount), or on-board (no discount);*
- **Pay with:** *cash or card (at stop only).*
- **Travel Document:** *Printed ticket;*

**Offer:** ***Rail Trip, Online purchase***

- **Available:** *online (at extra discount)*
- ***Pay with:*** *debit card or credit card (extra fee) only*
- ***Travel Document:*** *Mobile app*

***Product;*** *Rail Trip*

- **Tariff Structure:** *P2P,*
- **Access Rights**: *Trip, Single or Return, 1st or 2nd Class*
- **Fare Demand Types**: *Peak or | off Peak*
- **User Profiles:** *Adult, Child, Student; Senior, handicapped (different prices)*
- **Conditions:** *Cannot break journey; No interchange; Not Transferable)*
- **Luggage Allowance:** *Pets, 3 Suitcases free*

**Offer:** ***Bus trip, walk-up purchase***

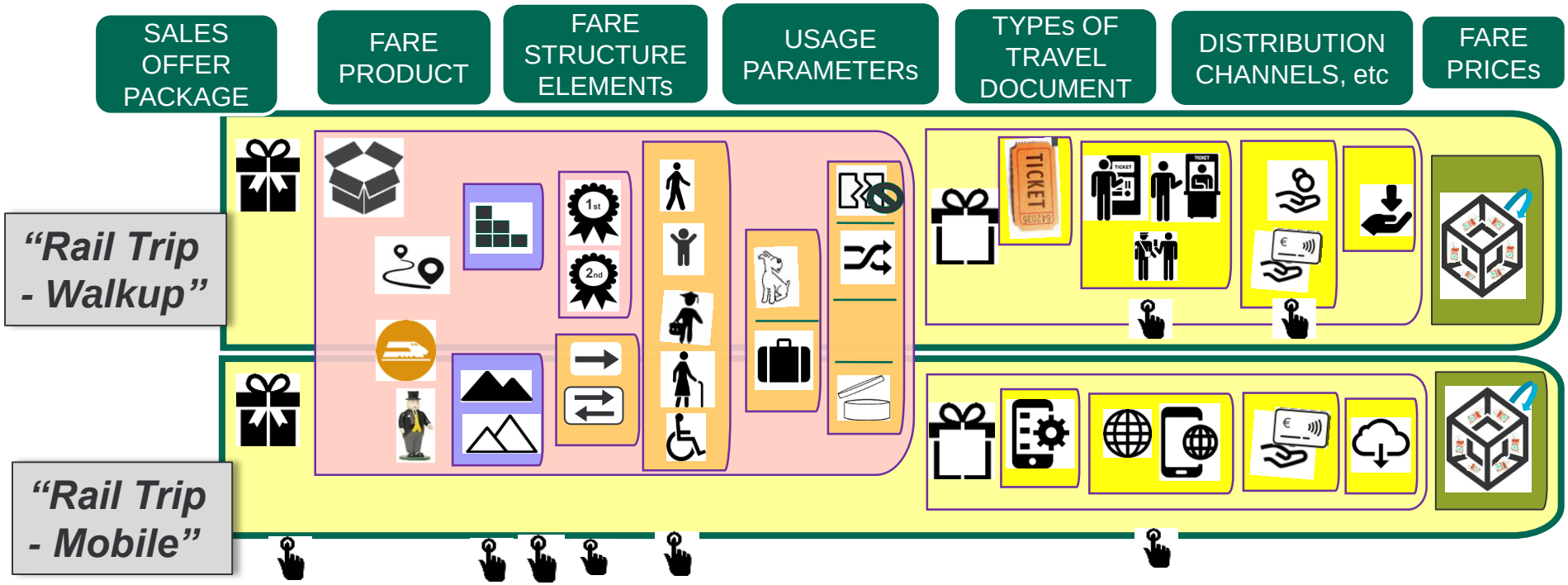
- **Available***: at stop, or on-board (Same price)*
- **Pay with:** *cash*
- **Travel Document:** *Printed ticket;*

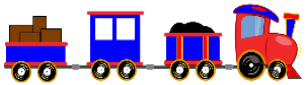
***Bus Trip Product;***

- **Tariff Structure:** *Named Zones,*
- **Access Rights** : *Day Pass, till end of Fare day (2am)*
- **Fare Demand Types***: Travel at anytime*
- **User Profiles:** *Adult, Child (different prices)*
- **Conditions:** *Can break journey; Can interchange; Transferable)*
- **Luggage Allowance:** *Pets, Prams free*

Department for Transport

# Q1. What is available to purchase? – Rail offer



A set of permissible options for rail tickets on the W-to-Z line

Department for Transport

# Q1. What is available to purchase? - Bus Offer

SALES OFFER PACKAGE | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | DISTRIBUTION CHANNELS, etc | FARE PRICEs

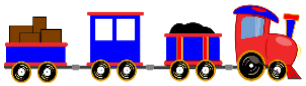
***"Bus Day Pass"***

A set of permissible options for bus tickets

Department for Transport

# Q2 What do I actually buy?

Parameters for electronic ticket data

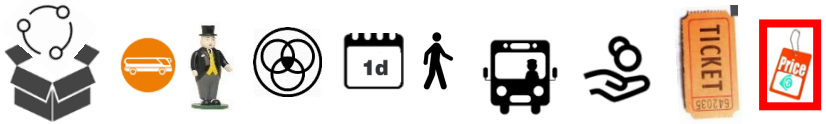


***Rail Trip Purchase;***

- ***Single Trip*** *from* ***X*** *to* ***Y****,*
- ***One Adult****,* ***1st*** *Class, (****Small animal*** *allowed free).*
- *Valid only on* ***Off peak*** *Trains (Leaving X after 9.30)*
- *As* ***Mobile App*** *ticket bought* ***on-line*** *with a* ***credit card***
- ***Price = 20 Euros***

***Bus Trip Purchase;***

- ***Day Pass*** *for* ***Zone 2****,*
- ***One Adult****, (****Small animal*** *allowed free)*
- *Valid till* ***end of fare day*** *(2am) on all buses from* ***Operator A***
- *As* ***Paper ticket*** *bought from* ***Driver*** *with* ***cash***
- ***Price = 3 Euros***

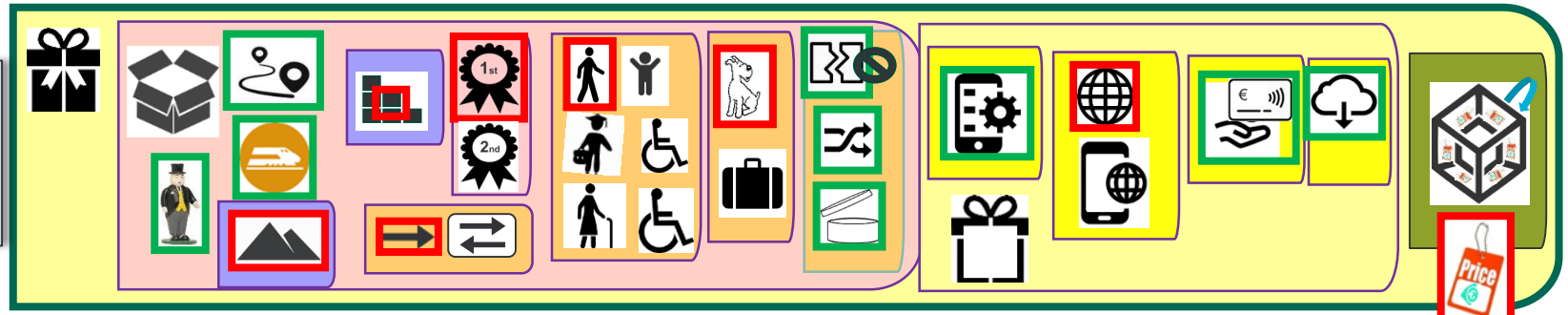


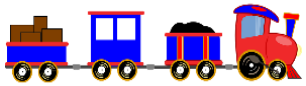
Department for Transport

# Q2. What did I actually buy?

| SALES OFFER PACKAGE | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | DISTRIBUTION CHANNELS, etc | FARE PRICEs |
|---|---|---|---|---|---|---|

***"Rail Trip online"***



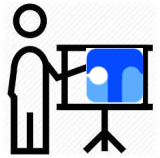
*"A mobile app train ticket for a rail trip Y to Z"*

***"Bus Day Pass"***

A bus day pass on Operator A's buses in Zone 2

Department for Transport

# Q3. What does the Rail price depend on?



SALES OFFER PACKAGE ELEMENTs

SALES OFFER PACKAGEs | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | DISTRIBUTION CHANNELs, etc | FARE PRICEs

*"Rail Trip - Walkup"*

*"Rail Trip - Mobile"*

*Prices Allowed combinations*

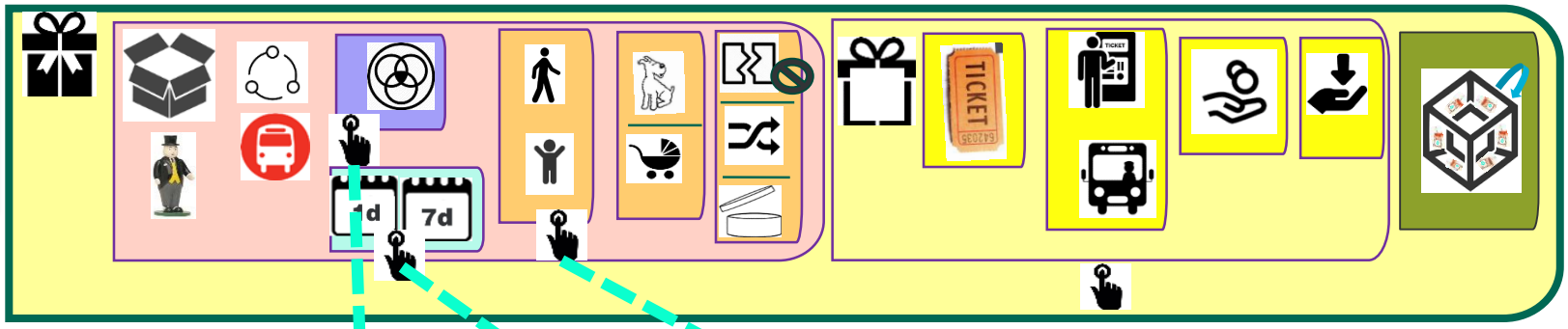
DISTANCE MATRIX ELEMENTs | FARE DEMAND TYPEs | ROUND TRIP | CLASSes OF USE | USER PROFILEs | SALES OFFER PACKAGEs | DISTRIB-UTION CHANNELs | PAYMENT METHODs

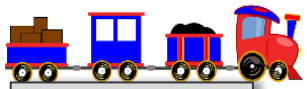
Department for Transport

# Q3. What does the Bus price depend on?

SALES OFFER PACKAGE | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | SALES CHANNELS, etc | FARE PRICEs

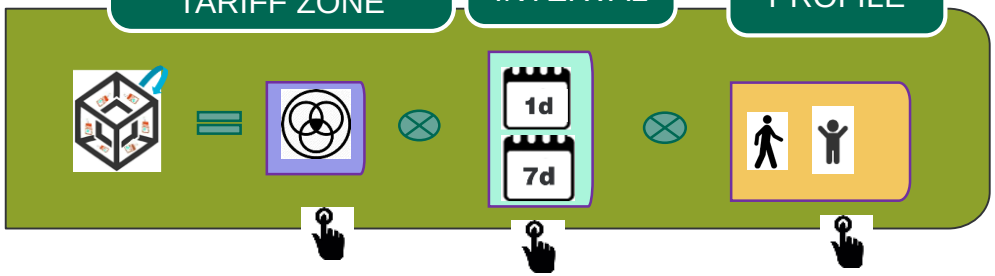
*"Bus Day Pass"*





*Prices - Allowed combinations*

FARE STRUCTURE ELEMENT / TARIFF ZONE | TIME INTERVAL | USER PROFILE




Price depends on

- Which zone chosen?
- Pass duration?
- User type?

Department for Transport

# Different ways we might market exactly the same product elements

1. **Separate Rail and Bus offers, no discount,** separate travel documents
   - { [❒ **Rail leg**], 🗎**ticket** ] } + { [ ❒**Bus leg**], 🗎ticket ] }
   - ❖ See example above
2. **Single "Plusbus" offer, discounted**, separate travel documents
   - { [ ❒**Rail leg,** 🗎**ticket** ] + [ ❒**Bus leg,** 🗎**ticket** ] }
   - ❖ See next example below *"A Single offer, Rail & Plusbus together"*
3. Single "Plusbus" offer, discounted, single travel document
   - { [ ❒**Rail leg ] + [❒Bus leg,** 🗎**ticket ]** }
4. **Separate purchase "Plusbus" as a later add on, discounted price**, separate travel documents
   - { [ ❒**Rail leg,** 🗎**ticket ] + [ ❒Bus leg,** 🗎**ticket** ] }
   - ❖ See example below "bundled products purchased separately"

Department for Transport

# Bundling two products as a single offer

***Rail Trip Product;***

- ***Tariff Structure:*** *P2P,*
- ***Access Rights****: Trip, Single or Return, 1st or 2nd Class*
- **Fare Demand Types***: Peak or | off Peak*
- ***User Profiles:*** *Adult, Child, Student; Senior, handicapped (different prices)*
- ***Conditions:*** *Cannot break journey; No interchange; Not Transferable)*
- ***Luggage Allowance:*** *Pets, 3 Suitcases free*

***Bus Trip Product;***

- ***Tariff Structure:*** *Named Zones,*
- ***Access Rights*** *: Day Pass, till end of Fare day (2am)*
- **Fare Demand Types***: Travel at anytime*
- ***User Profiles:*** *Adult, Child (different prices)*
- ***Conditions:*** *Can break journey; Can interchange; Transferable)*
- ***Luggage Allowance:*** *Pets, Prams free*

***Plusbus Offer;* Walk up**

- ***Available:*** *At stop (at discount), or on-board (no discount);*
- ***Pay with:*** *cash or card (at stop only).*
- ***Travel Document:*** *Printed ticket;*

***Plusbus Offer;* Online,**

- ***Available:*** *online (at extra discount)*
- ***Pay with:*** *debit card or credit card (extra fee) only*
- ***Travel Document:*** *Mobile app*

Department for Transport

# Bundling Products: A Single Offer with Rail & Plus Bus Pass together

SALES OFFER PACKAGE | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | SALES CHANNELS, etc | FARE PRICEs

***"Rail Trip with PlusBus - Walkup"***

1

***PlusBus for origin***

SALES OFFER PACKAGE ELEMENT

2

***PlusBus for destination***

SALES OFFER PACKAGE ELEMENT

3

Plusbus is are purchased together in with trip ticket

# Bundled products purchased separately

SALES OFFER PACKAGE | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | SALES CHANNELS, etc | FARE PRICEs

1

***"Rail Trip"***

ENTITLEMENT GIVEN

ENTITLEMENT REQUIRED

Must have a rail ticket to buy a PlusBus ticet
➔ENTITLEMENT states PRODUCT / Product dependencies

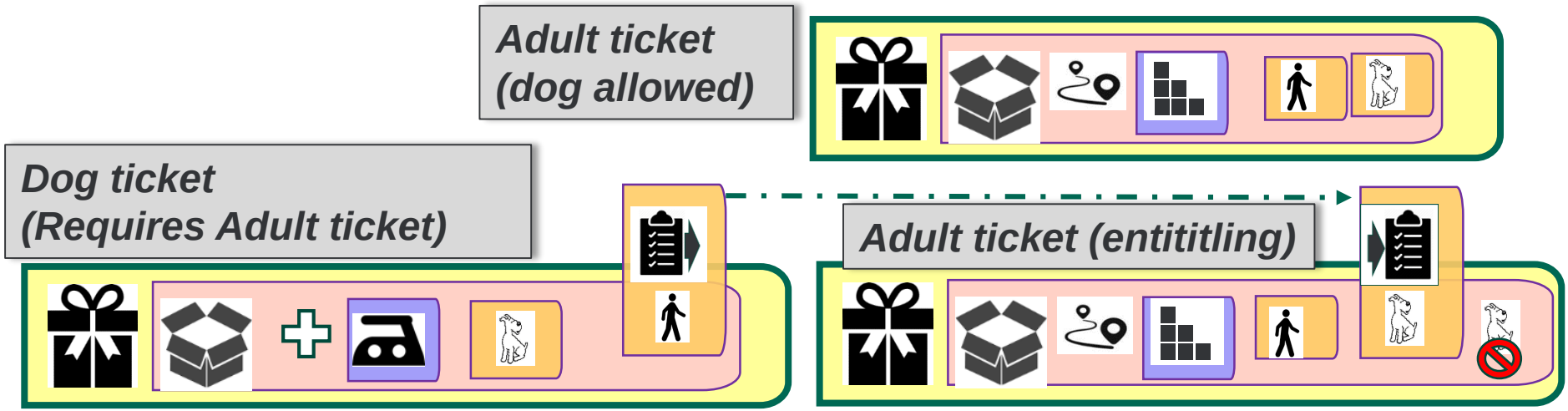
SALES OFFER PACKAGE

***"Bus Day Pass as separate Rail trip add on, "***

2

# What about the dog? Packaging as a Supplements product versus packaging as product parameters

1. Dog allowed as “baggage”
   - ⌘ {[ {[ ❒**Rail leg (◈dog allowed) }** 🗎**ticket** }
2. Dog requires separate ticket with its own travel document
   - ⌘ {[ **{[ ❒Person Rail leg}** 🗎**tic**ket } + {[ ❒**Rail Dog Supplement** 🗎**ticket** } }



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# Another common bundle: Seat Reservation Supplements Bundled and /or unbundled

1. Separate Rail Seat Reservation, separate travel & seat documents
   - **{ [ Rail leg, ticket } + { [ Rail Seat Reservation, ticket }**
2. Rail leg includes Seat reservation, separate travel & seat documents
   1. **{ [ Rail leg, ticket ] + [ Rail Seat Reservation, ticket] }**
3. Rail leg includes Seat reservation, single travel document
   - **{ [ Rail leg, ticket ] + [ Rail Seat Reservation, ticket] }**

Department for Transport

# Further ways we might market the same product elements

1. **“Railcard” Purchased right to buy another product at a discount Additional discount** separate travel documents
   a) ⋇{ [ ❒**Sale Discount Right],** 🗎**membership card ]** }
   b) Each purchase of ⋇{ [ ❒**Rail leg, (at reduced price],** 🗎**ticket ]** }
2. **“Frequent Flyer” Usage based rebate, either as rebate or discounted price**
   a) ⋇{ [ ❒**Sale Discount Right],** 🗎**account number]** }
   b) Each purchase of ⋇{ [ ❒**Rail leg, (also has value in mileage points],** 🗎**ticket ]** }

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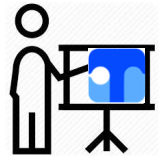
# Q5. What if there is a further discount ?



SALES OFFER PACKAGE ELEMENTs

SALES OFFER PACKAGE | FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | TYPEs OF TRAVEL DOCUMENT | SALES CHANNELs, etc | PAYMENT METHODs

*"Rail Trip - Walkup"*

*"Rail Trip - Mobile"*

*"Adult Rail Card"*

*Prices*

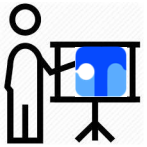
DISTANCE MATRIX ELEMENT | FARE DEMAND | CLASS OF USE | USER PROFILE | SALES OFFER PACKAGE | SALES CHANNEL | PAYMENT METHOD

Department for Transport

# Modelling Bus Fares - a component based analysis of some simple examples

- Single Trip, Point to Point Tariff Structure
  - Multiple User types
  - Derived prices
- Period Passes, Zonal Tariff Structure
  - Day, Season
  - Multi channel
- Multi-trip Carnet, Zonal Tariff Structure
  - Multiple User types
- Trip, Section Count Zonal Tariff Structure

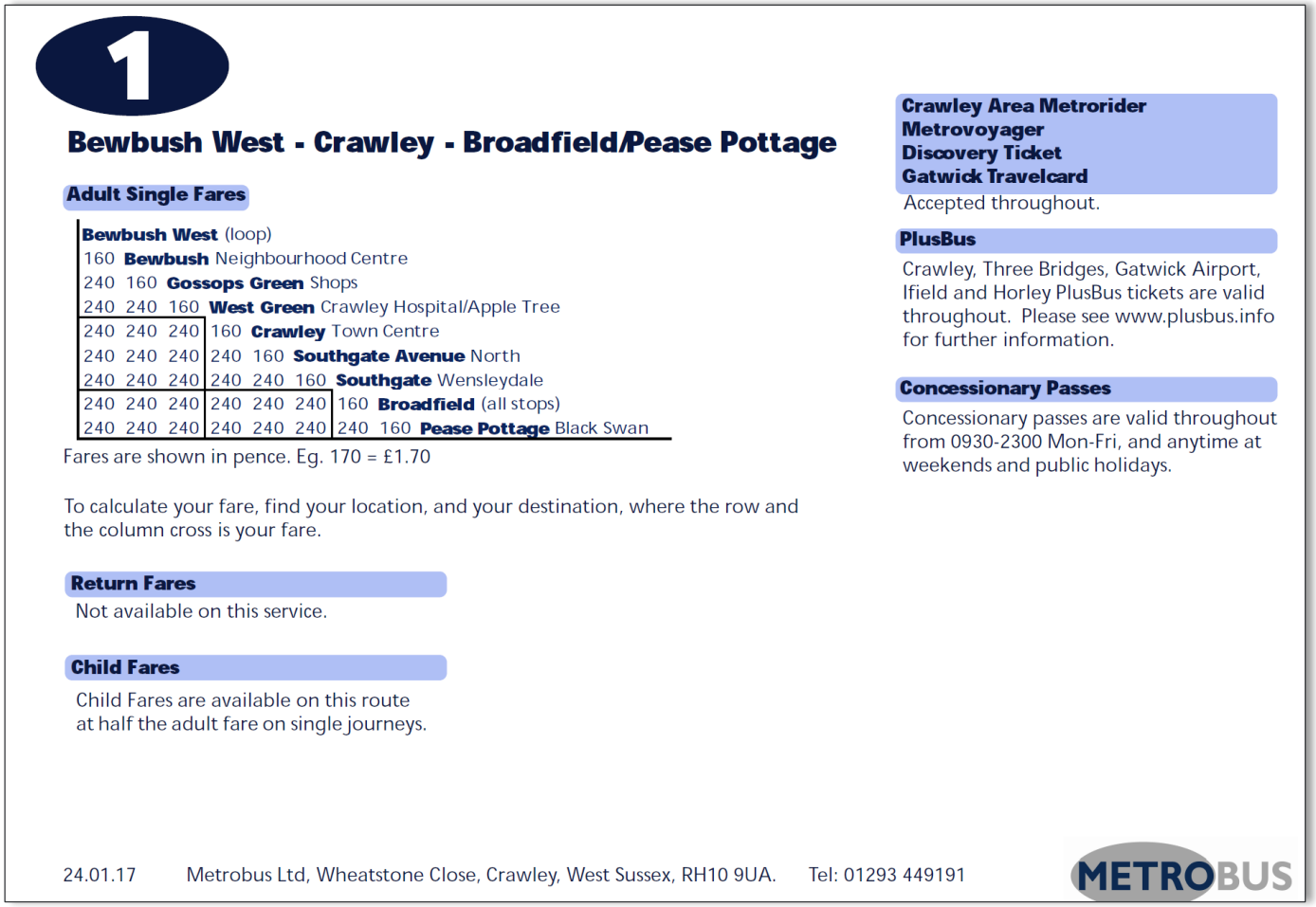
Department for Transport



# UK Bus Example: A Point to Point Fare

Department for Transport

# 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

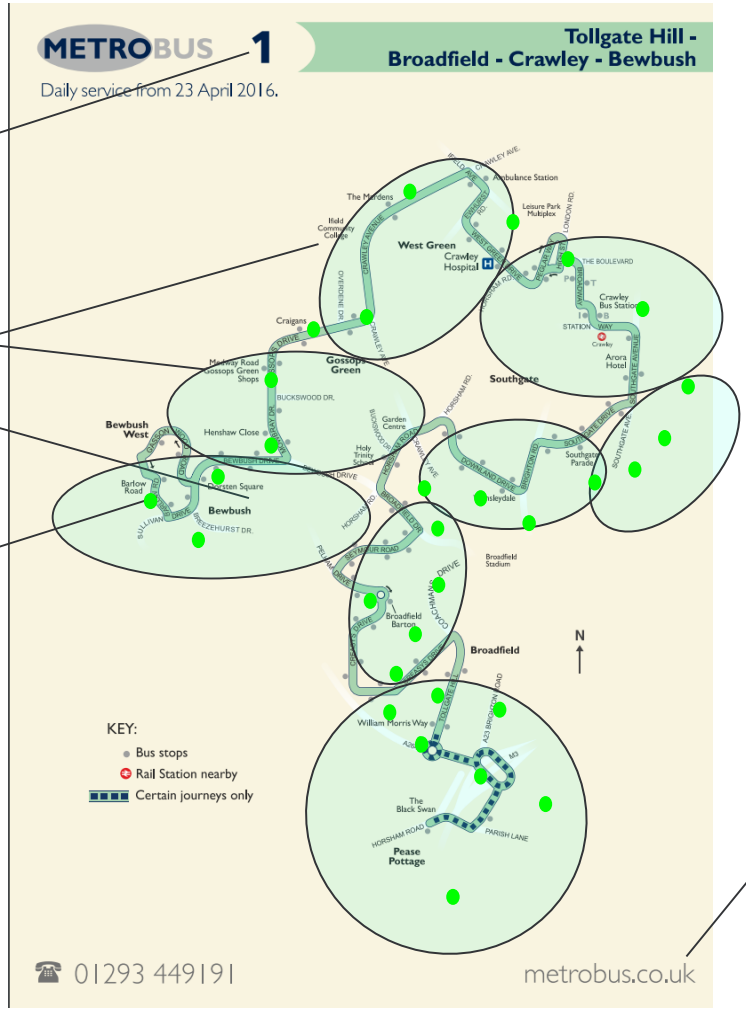
Department for Transport

# Metrobus 1 FARE ZONES

LINE

FARE ZONEs

SCHEDULED STOP POINTs




OPERATOR

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# Analysing the Metrobus Line 1 offer

- Access Rights
  - Zone To Zone :  Each zone covers several stops
  - Line: Line 1
  - Operator: Metrobus
- Products
  - Single product – a single Trip
  - User types: *Adult, Child (5-15) 50%,*
- Sales Offer packages
  - Travel Documents: *paper,*
- Pricing
  - O/D zone x User Profile
- Other products available – eg day pass, season pass, etc

# Metrobus 1 - Single ride, (cash)

Department for Transport

**TARIFF**

**FARE PRODUCT** (Single Trip)

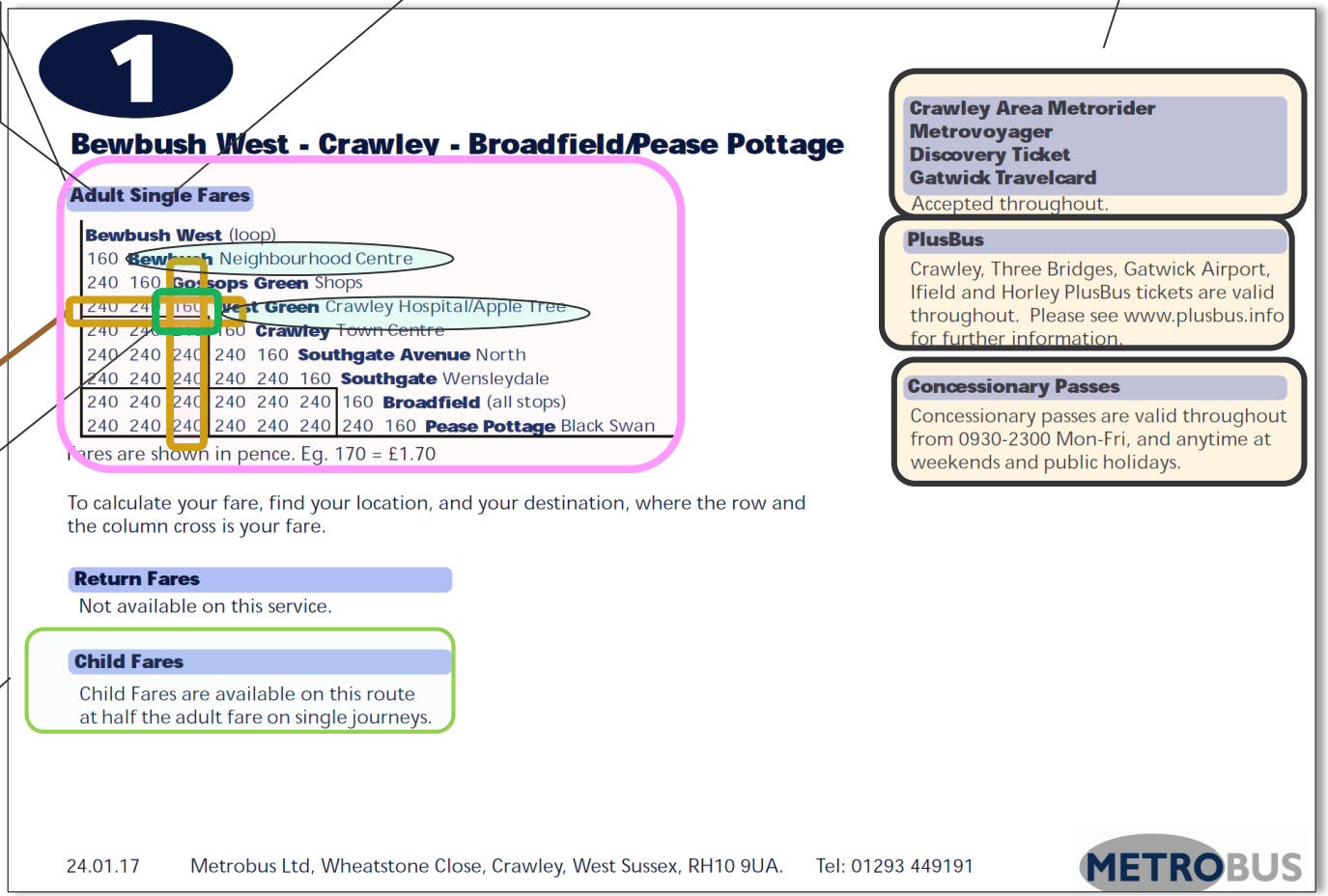
**FARE PRODUCTs** (Other day & Season passes)

**USER PROFILE** (Adult)

**DISTANCE MATRIX ELEMENTs**

**FARE PRICEs**

**USER PROFILE** (Child)



**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

# 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

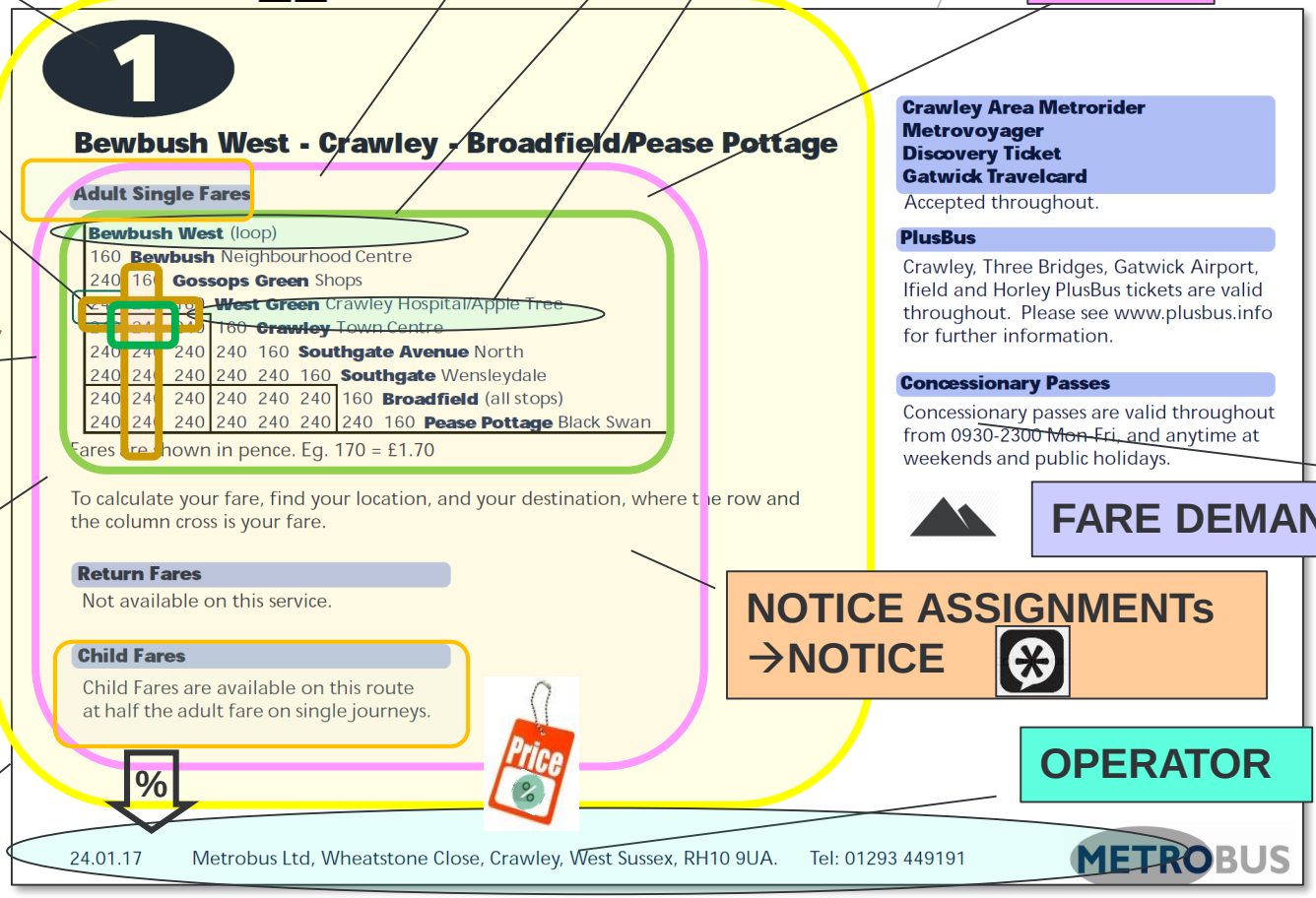
FARE PRICEs

FARE TABLE

PRICE UNIT

USER PROFILE

PRICE RULE




FARE DEMAND

NOTICE ASSIGNMENTs
→NOTICE

OPERATOR

# Example – Single Trip Product

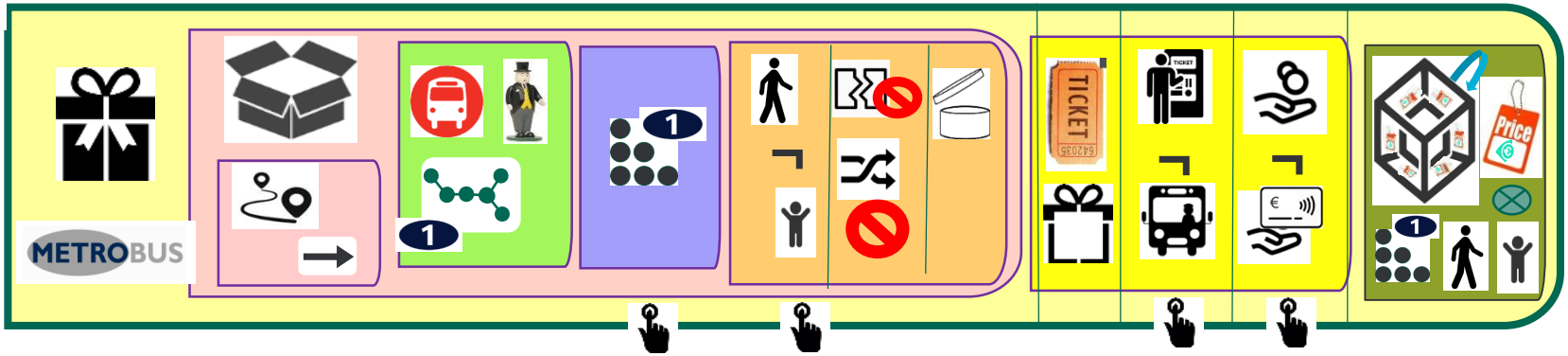
Department for Transport

| FARE PRODUCT | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | DISTRIBUTION ASSIGNMENT | FARE PRICEs |
|---|---|---|---|---|

METROBUS 1

SALES OFFER PACKAGE

"Cash Single"




***Offer; "Metrobus cash ticket"***

- **Tariff Structure:** *Zone to Zone;*
- **Product Access rights:** *single trip*; bus, Operator=*Metrobus, Line1*
- **User Profiles:** *Adult, Child,*
- **Conditions:** *Cannot break journey; Cannot interchange*; Refundable?
- **Travel Document:** *Printed "Cash ticket";*
- **Available:** at stop, or on-board (no discount);
- **Pay with:** *cash or card*
- **Prices :** ***Line1 x (n x n** Z2Z elements) x (Adult | Child)*
- **Brand** = *Metrobus*

1

***Travel Specification;***

- ***Which Zones?***
  - *Origin + Destination*
- ***Which User Profile?***
  - *(Adult | Child)*

***Purchase options***

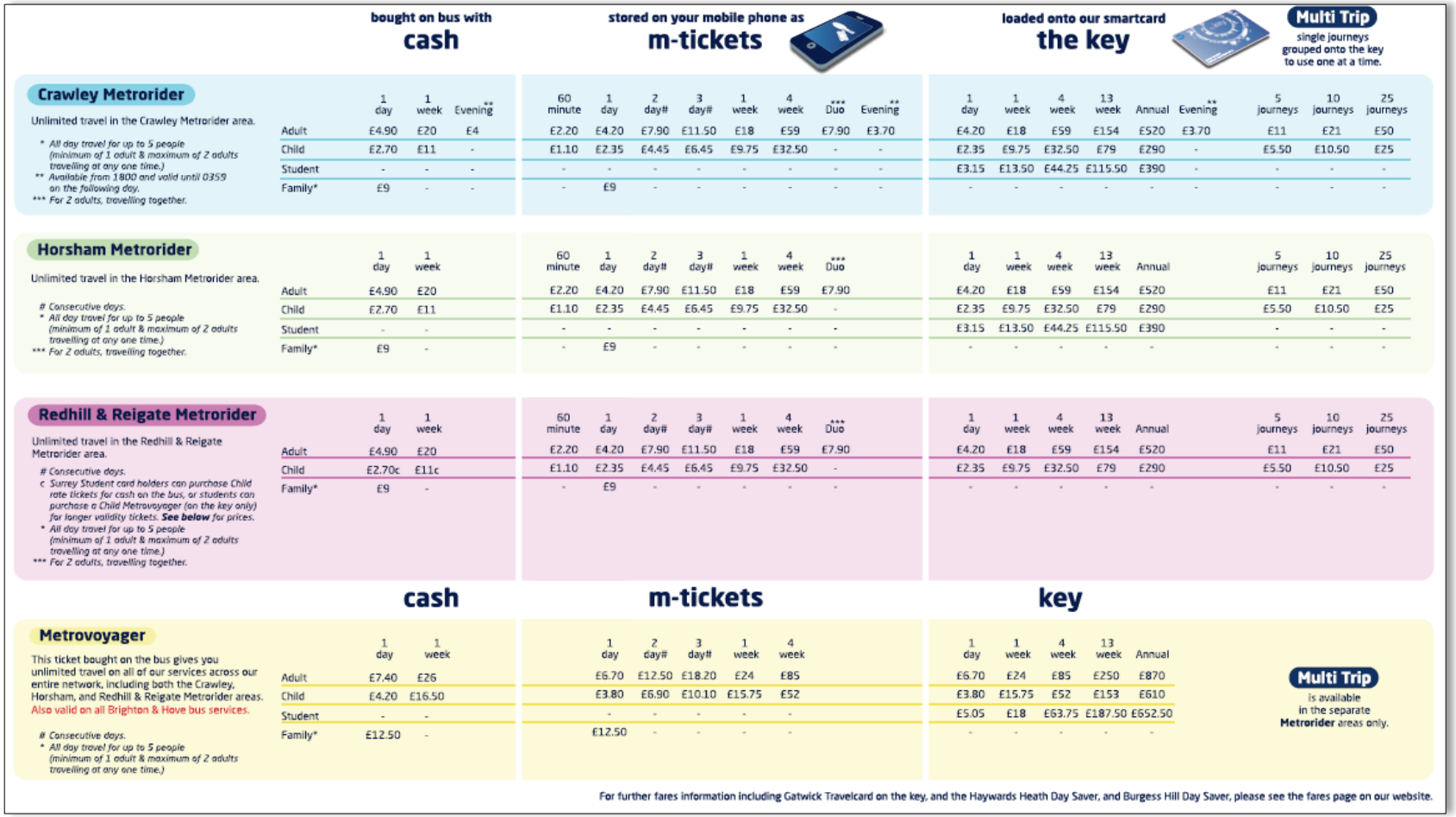
- ***Where?***
  - *At stop | on-board*
- ***Pay How?***
  - *Cash | Card*

Department for Transport

# UK Bus Example: Some Period Passes (Day & Season)

Department for Transport

# SEASON PASS - Metrorider



bought on bus with **cash** | stored on your mobile phone as **m-tickets** | loaded onto our smartcard **the key**

**Multi Trip** — single journeys grouped onto the key to use one at a time.

## Crawley Metrorider

Unlimited travel in the Crawley Metrorider area.

* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)
** Available from 1800 and valid until 0359 on the following day.
*** For 2 adults, travelling together.

| | cash | | | m-tickets | | | | | | | | key | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 day | 1 week | Evening** | 60 minute | 1 day | 2 day# | 3 day# | 1 week | 4 week | Duo*** | Evening** | 1 day | 1 week | 4 week | 13 week | Annual | Evening** | 5 journeys | 10 journeys | 25 journeys |
| Adult | £4.90 | £20 | £4 | £2.20 | £4.20 | £7.90 | £11.50 | £18 | £59 | £7.90 | £3.70 | £4.20 | £18 | £59 | £154 | £520 | £3.70 | £11 | £21 | £50 |
| Child | £2.70 | £11 | - | £1.10 | £2.35 | £4.45 | £6.45 | £9.75 | £32.50 | - | - | £2.35 | £9.75 | £32.50 | £79 | £290 | - | £5.50 | £10.50 | £25 |
| Student | - | - | - | - | - | - | - | - | - | - | - | £3.15 | £13.50 | £44.25 | £115.50 | £390 | - | - | - | - |
| Family* | £9 | - | - | - | £9 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Horsham Metrorider

Unlimited travel in the Horsham Metrorider area.

\# Consecutive days.
* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)
*** For 2 adults, travelling together.

| | cash | | m-tickets | | | | | | | key | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 day | 1 week | 60 minute | 1 day | 2 day# | 3 day# | 1 week | 4 week | Duo*** | 1 day | 1 week | 4 week | 13 week | Annual | 5 journeys | 10 journeys | 25 journeys |
| Adult | £4.90 | £20 | £2.20 | £4.20 | £7.90 | £11.50 | £18 | £59 | £7.90 | £4.20 | £18 | £59 | £154 | £520 | £11 | £21 | £50 |
| Child | £2.70 | £11 | £1.10 | £2.35 | £4.45 | £6.45 | £9.75 | £32.50 | - | £2.35 | £9.75 | £32.50 | £79 | £290 | £5.50 | £10.50 | £25 |
| Student | - | - | - | - | - | - | - | - | - | £3.15 | £13.50 | £44.25 | £115.50 | £390 | - | - | - |
| Family* | £9 | - | - | £9 | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Redhill & Reigate Metrorider

Unlimited travel in the Redhill & Reigate Metrorider area.

\# Consecutive days.
c Surrey Student card holders can purchase Child rate tickets for cash on the bus, or students can purchase a Child Metrovoyager (on the key only) for longer validity tickets. ***See below*** for prices.
* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)
*** For 2 adults, travelling together.

| | cash | | m-tickets | | | | | | | key | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 day | 1 week | 60 minute | 1 day | 2 day# | 3 day# | 1 week | 4 week | Duo*** | 1 day | 1 week | 4 week | 13 week | Annual | 5 journeys | 10 journeys | 25 journeys |
| Adult | £4.90 | £20 | £2.20 | £4.20 | £7.90 | £11.50 | £18 | £59 | £7.90 | £4.20 | £18 | £59 | £154 | £520 | £11 | £21 | £50 |
| Child | £2.70c | £11c | £1.10 | £2.35 | £4.45 | £6.45 | £9.75 | £32.50 | - | £2.35 | £9.75 | £32.50 | £79 | £290 | £5.50 | £10.50 | £25 |
| Family* | £9 | - | - | £9 | - | - | - | - | - | - | - | - | - | - | - | - | - |

## Metrovoyager

This ticket bought on the bus gives you unlimited travel on all of our services across our entire network, including both the Crawley, Horsham, and Redhill & Reigate Metrorider areas. Also valid on all Brighton & Hove bus services.

\# Consecutive days.
* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)

| | cash | | m-tickets | | | | | key | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 day | 1 week | 1 day | 2 day# | 3 day# | 1 week | 4 week | 1 day | 1 week | 4 week | 13 week | Annual | |
| Adult | £7.40 | £26 | £6.70 | £12.50 | £18.20 | £24 | £85 | £6.70 | £24 | £85 | £250 | £870 | |
| Child | £4.20 | £16.50 | £3.80 | £6.90 | £10.10 | £15.75 | £52 | £3.80 | £15.75 | £52 | £153 | £610 | |
| Student | - | - | - | - | - | - | - | £5.05 | £18 | £63.75 | £187.50 | £652.50 | |
| Family* | £12.50 | - | £12.50 | - | - | - | - | - | - | - | - | - | |

**Multi Trip** is available in the separate **Metrorider** areas only.

For further fares information including Gatwick Travelcard on the key, and the Haywards Heath Day Saver, and Burgess Hill Day Saver, please see the fares page on our website.

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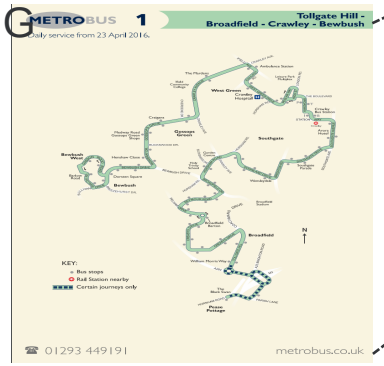
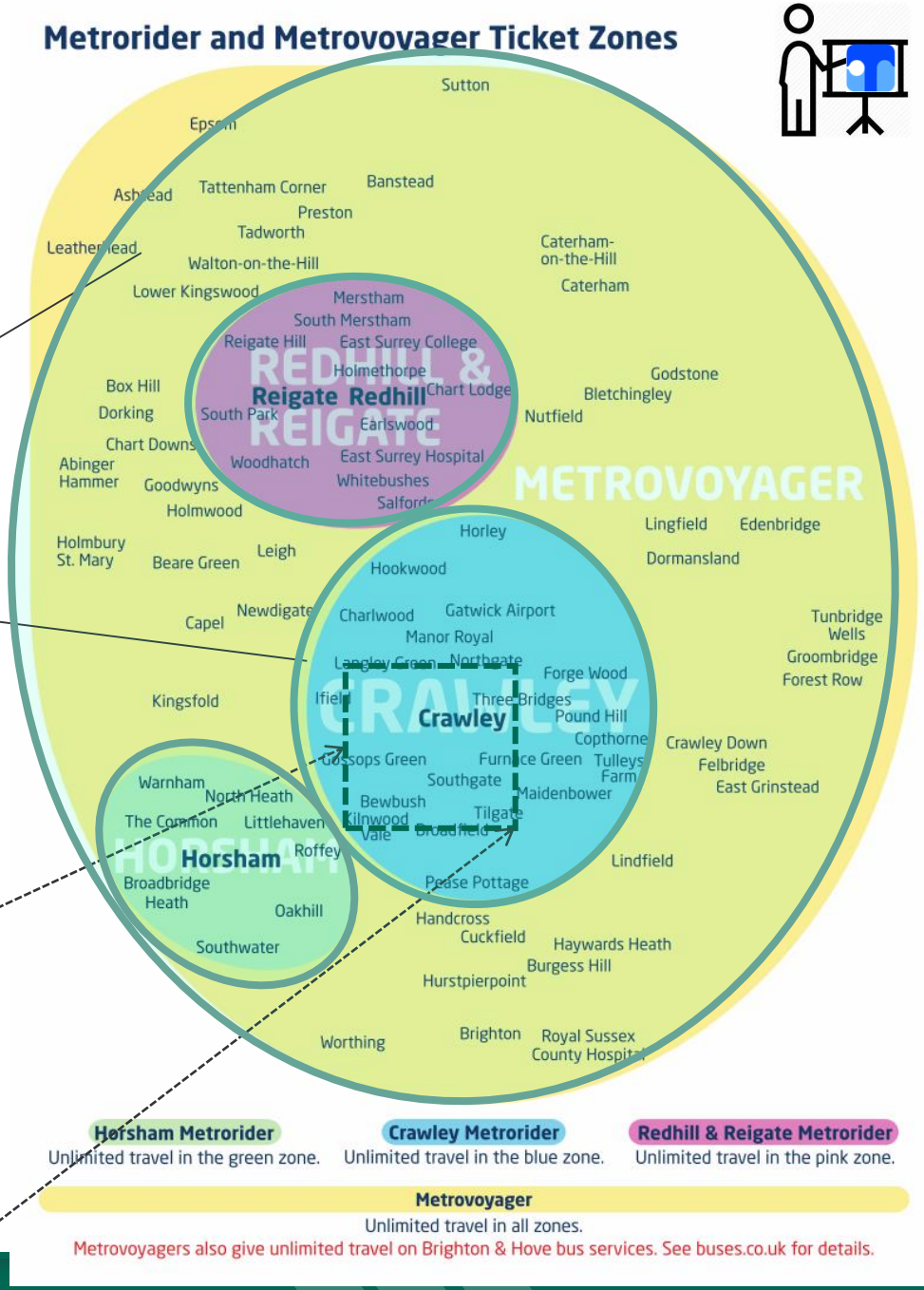
# Nested Fare Zones - Metrorider & Metrovoyager

**TOPOGRAPHICAL PLACEs**

**FARE ZONEs**

- ZONE topologies e.g
  - **NESTED**,
  - DISJOINT
  - HONEYCOMB
  - OVERLAPPING

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Department for Transport

# Season Pass (es)

**FARE PRODUCT**
**Season Pass**

**TYPEs OF TRAVEL DOCUMENTs**
**paper, app, smartcard**

**SALES PACKAGEs**
**"cash, m-ticket, the key"**

**TIME INTERVALs**
**(1day, 1 week, Evening, 1 month, Annual, etc)**

**FARE ZONEs**
**(Horsham, Crawley, Redhill, All)**

**FARE PRICEs**

bought on bus with **cash**

stored on your mobile phone as **m-tickets**

loaded onto our smartcard **the key**

**Multi Trip**
single journeys grouped onto the key

### Crawley Metrorider

Unlimited travel in the Crawley Metrorider area.

* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)
** Available from 1800 and valid until 0359 on the following day.
*** For 2 adults, travelling together.

| | 1 day | 1 week | ** | 60 minute | 1 day | 2 day# | 3 day# | 1 week | 4 week | *** Duo | ** | 1 day | 1 week | 4 week | 13 week | Annual | ** | 5 journeys | 10 journeys | 25 journeys |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Adult | £4.90 | £20 | £4 | £2.20 | £4.20 | £7.90 | £11.50 | £18 | £59 | £7.90 | £3.70 | £4.20 | £18 | £59 | £154 | £520 | £3.70 | £11 | £21 | £50 |
| Child | £2.70 | £11 | - | £1.10 | £2.35 | £4.45 | £6.45 | £9.75 | £32.50 | - | - | £2.35 | £9.75 | £32.50 | £79 | £290 | - | £5.50 | £10.50 | £25 |
| Student | - | - | - | - | - | - | - | - | - | - | - | £3.15 | £13.50 | £44.25 | £115.50 | £390 | - | - | - | - |
| Family* | £9 | - | - | - | £9 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

### Horsham Metrorider

Unlimited travel in the Horsham Metrorider area.

# Consecutive days.
* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)
*** For 2 adults, travelling together.

| | 1 day | 1 week | 60 minute | 1 day | 2 day# | 3 day# | 1 week | 4 week | *** Duo | 1 day | 1 week | 4 week | 13 week | Annual | 5 journeys | 10 journeys | 25 journeys |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Student | - | - | - | - | - | - | - | - | - | £3.15 | £13.50 | £44.25 | £115.50 | £390 | - | - | - |
| Family* | £9 | - | - | £9 | - | - | - | - | - | - | - | - | - | - | - | - | - |

### Redhill & Reigate Metrorider

Unlimited travel in the Redhill & Reigate Metrorider area.

# Consecutive days.
c Surrey Student card holders can purchase Child rate tickets for cash on the bus, or students can purchase a Child Metrovoyager (on the key only) for longer validity tickets. **See below** for prices.
* All day travel for up to 5 people (minimum of 1 adult & maximum of 2 adults travelling at any one time.)
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| | 1 day | 1 week | 60 minute | 1 day | 2 day# | 3 day# | 1 week | 4 week | *** Duo | 1 day | 1 week | 4 week | 13 week | Annual | 5 journeys | 10 journeys | 25 journeys |
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| Family* | £9 | - | - | £9 | - | - | - | - | - | - | - | - | - | - | - | - | - |

**cash** **m-tickets** **key**

### Metrovoyager

This ticket bought on the bus gives you unlimited travel on all of our services across our entire network, including both the Crawley, Horsham, and Redhill & Reigate Metrorider areas. Also valid on all Brighton & Hove bus services.

# Consecutive days.
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| | 1 day | 1 week | 1 day | 2 day# | 3 day# | 1 week | 4 week | 1 day | 1 week | 4 week | 13 week | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
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| Child | £4.20 | £16.50 | £3.80 | £6.90 | £10.10 | £15.75 | £52 | £3.80 | £15.75 | £52 | £153 | £610 |
| Student | - | - | - | - | - | - | - | £5.05 | £18 | £63.75 | £187.50 | £652.50 |
| Family* | £12.50 | - | £12.50 | - | - | - | - | - | - | - | - | - |

**Multi Trip**
is available in the separate **Metrorider** areas only.

For further fares information including Gatwick Travelcard on the key, and the Haywards Heath Day Saver, and Burgess Hill Day Saver, please see the fares page on our website.

Department for Transport

# Multitrip Carnet

**FARE PRODUCT (Multitrip)**

**TARIFF**

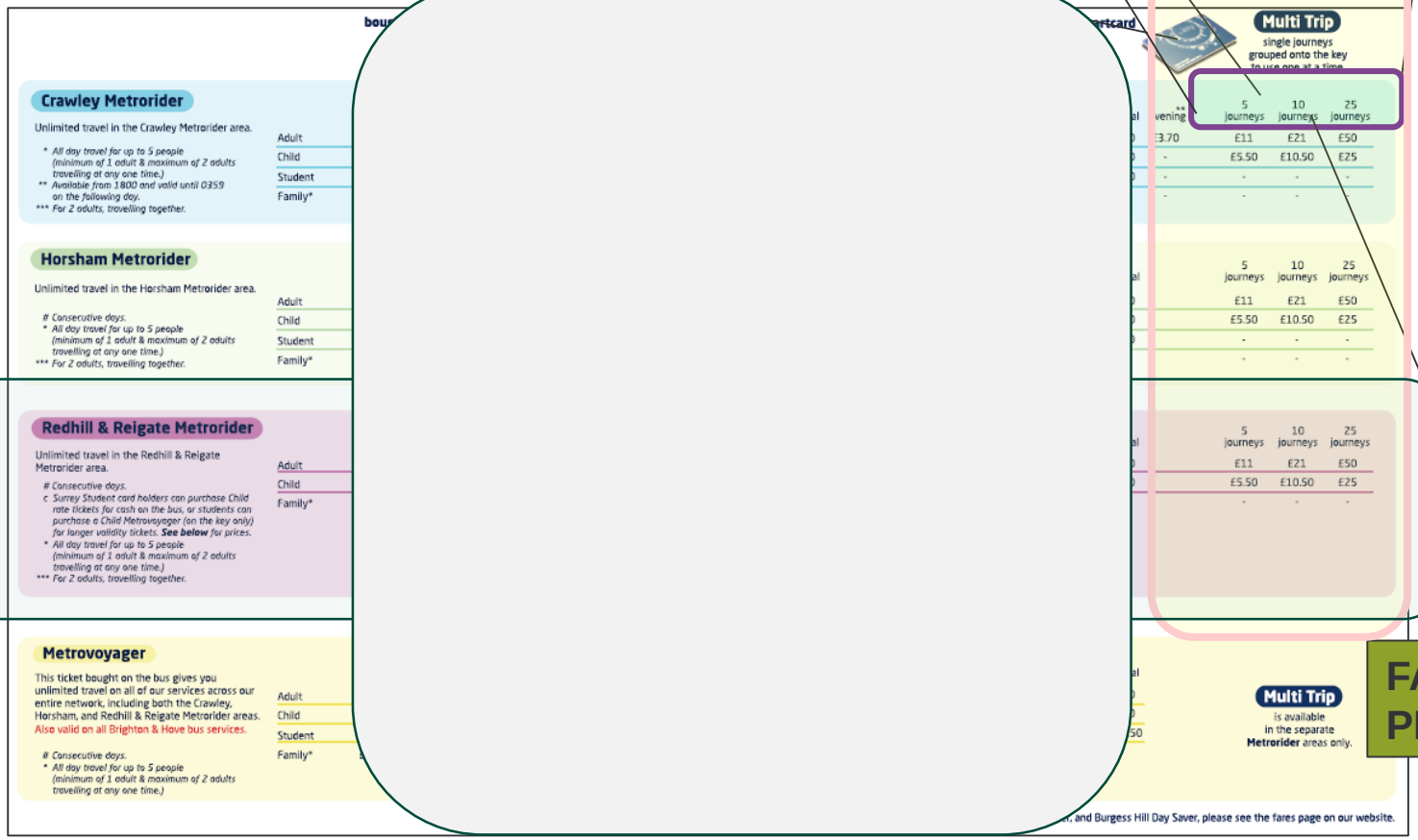
**SALES PACKAGEs "cash, m-ticket, the key"**

**TYPE OF TRAVEL DOCUMENT Smartchard**

**QUALITY FACTORs**

**FARE ZONEs**

**FARE PRICEs**

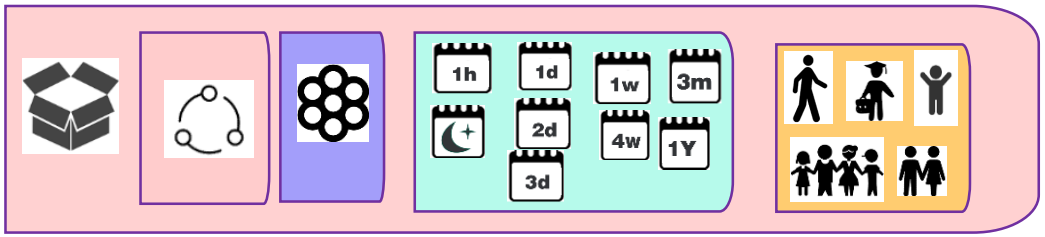


Department for Transport

# Analysing the Metrorider offer – Period Passes

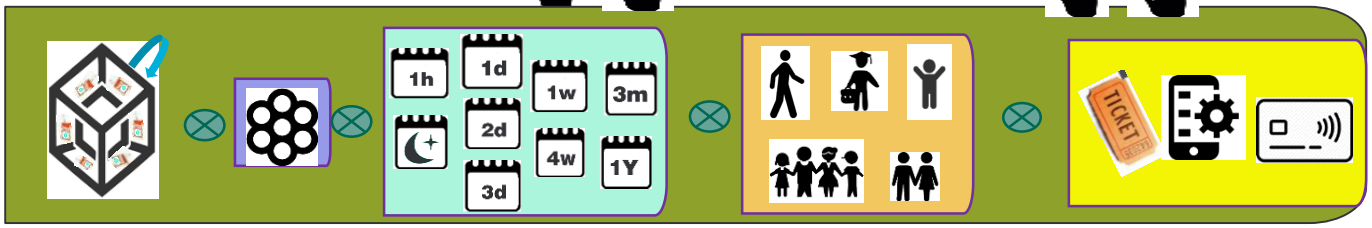
- Access Rights
  - Zones : Single (*Crawley, Horsham, Redhill)* or *All*
  - Durations: *Evening, 1,2,3 Day(s), 1,4 Week(s), Annual*
  - Operator: Metrobus
- Products
  - Single product – a period pass within a specified zone
  - User types: *Adult, Child, Student*
  - Group Tickets: *Family, Duo*
- Sales Offer packages
  - Travel Documents: *paper, app, smartcard*
  - 12 different combinations : 4 zone choices x 3 ticket choices (*paper, app, smartcard*)
  - Minor variations in available pass durations, User types etc between packages
- Pricing
  - Zone x Period x [User Profile|Group Ticket] x Sales Package (per Travel Document)

# Example - Period Passes



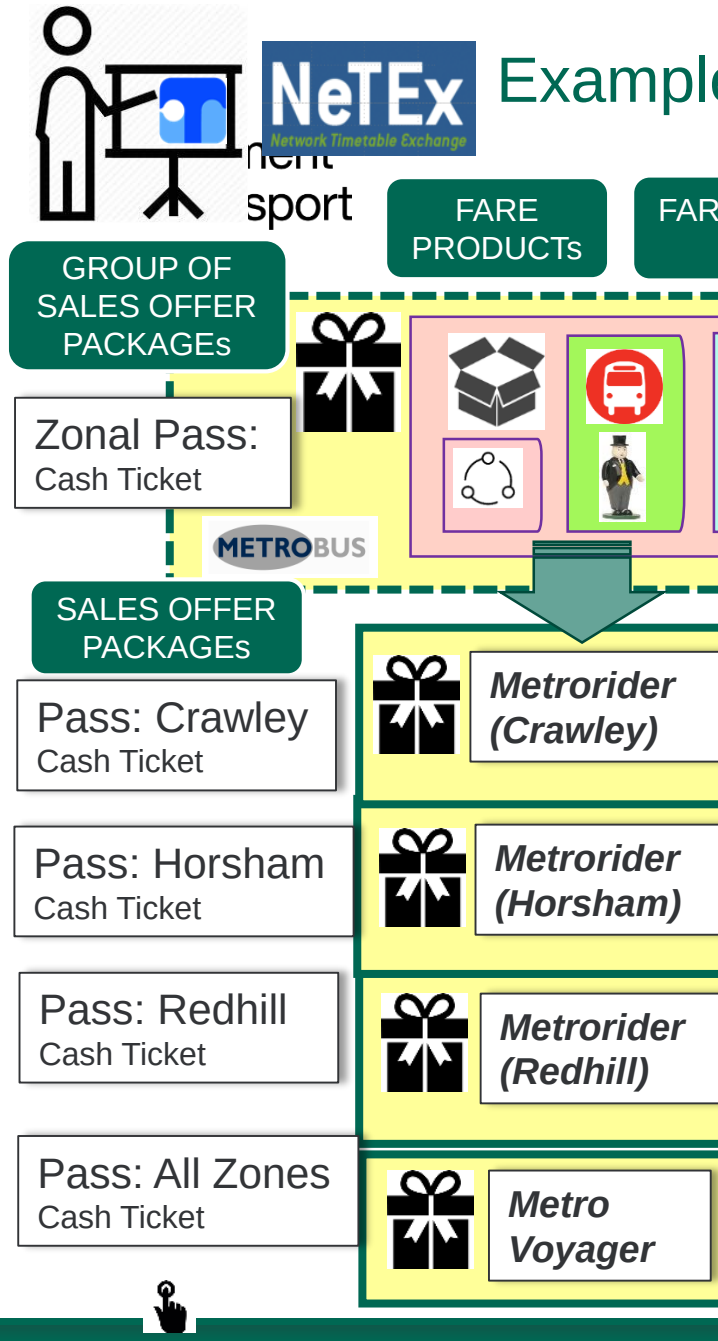

SALES OFFER PACKAGEs

| | Paper "Cash Ticket" | Mobile App (*m-ticket*) | Smartcard(*the-key*) |
|---|---|---|---|
| Crawley | | | |
| Horsham | | | |
| Redhill | | | |
| All Zones | | | |

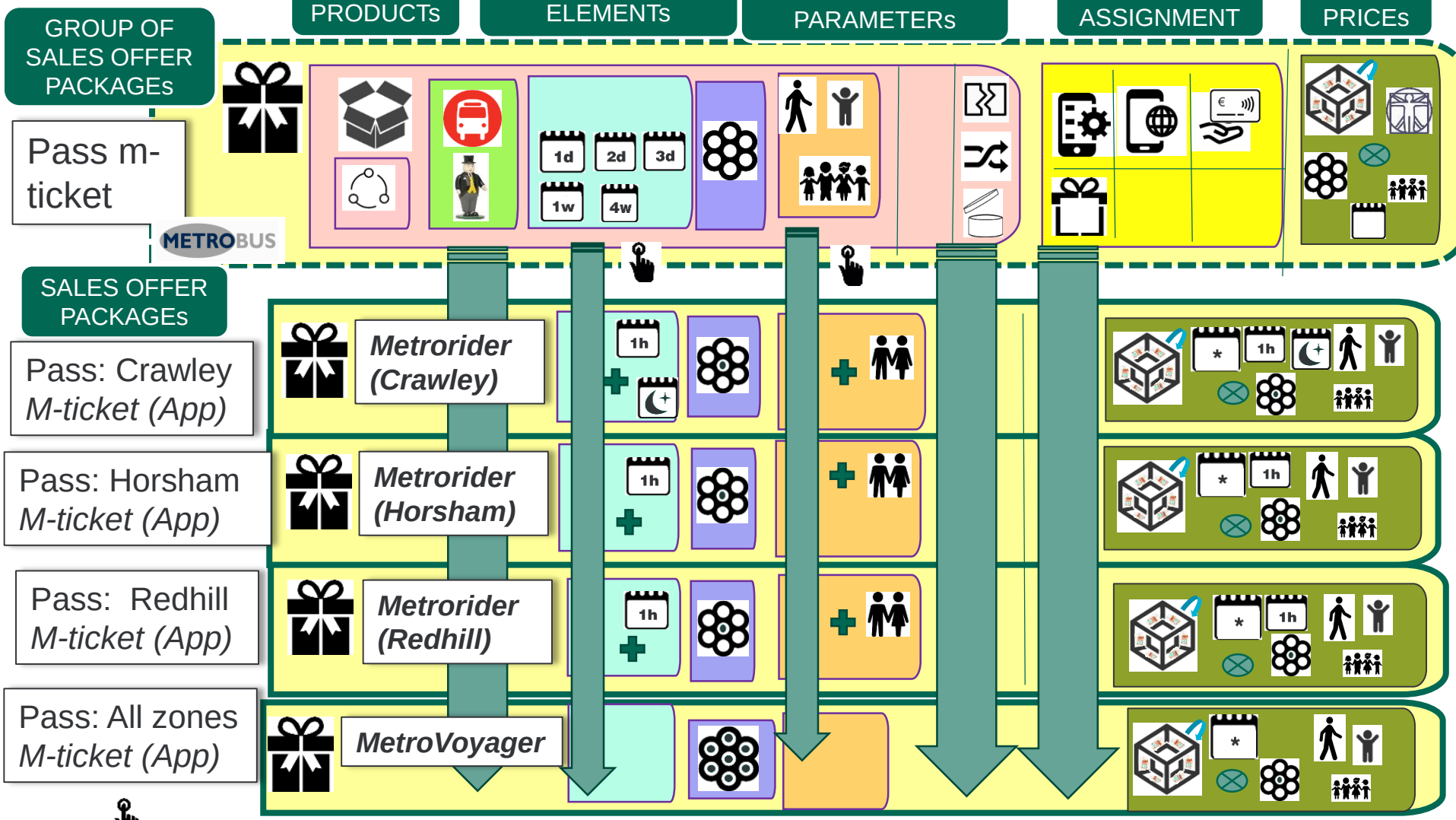



PRICE TABLE

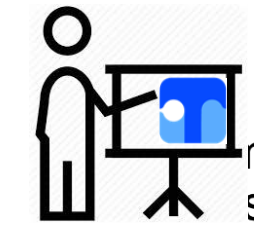
# Example – Period Pass Product: Cash Ticket



# Example – Period Pass Product: Mobile App



# Example –Period Pass Product - Smartcard



NeTEx Network Timetable Exchange

nent sport

| GROUP OF SALES OFFER PACKAGEs | FARE PRODUCTs | FARE STRUCTURE ELEMENTs | USAGE PARAMETERs | DISTRIBUTION ASSIGNMENT | FARE PRICEs |
|---|---|---|---|---|---|
| Pass Zonal<br>The-key (smartcard) | | | | | |
| **SALES OFFER PACKAGEs** | | | | | |
| Pass: Crawley<br>*The-key* (smartcard) | ***Metrorider (Crawley)*** | | | | |
| Pass: Horsham<br>*The-key* (smartcard) | ***Metrorider (Horsham)*** | | | | |
| Pass: Redhill<br>*The-key* (smartcard) | ***Metrorider (Redhill)*** | | | | |
| Pass: All zones<br>*The-key* (smartcard) | ***MetroVoyager*** | | | | |

Department for Transport

# Analysing the Metrorider offer – Carnets

- Access Rights
  - A single zone (*Crawley, Horsham, Redhill*)
- Products
  - Single product – a carnet for a specified number of trips
  - Available quantities: *5, 10, 25*
  - User types: *Adult, Child*
  - Use by date
  - Purchase Window: *Before 21:00 on previous day*
- Sales Offer packages
  - Travel Document: *smartcard only*
  - 3 different combinations : 3 zone choices
- Pricing
  - Zone x Number of Trips x [User Profile]

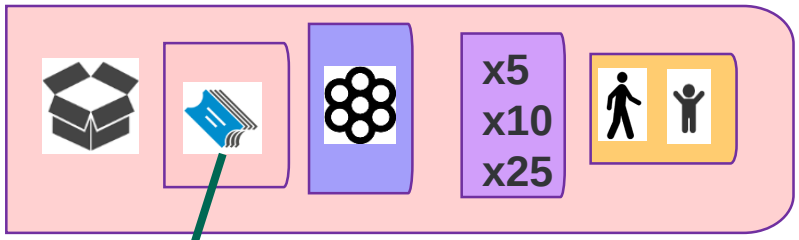
# Example – Multitrip (Carnet)

FARE PRODUCTs

SALES OFFER PACKAGEs

**Smartcard - Multitrip**

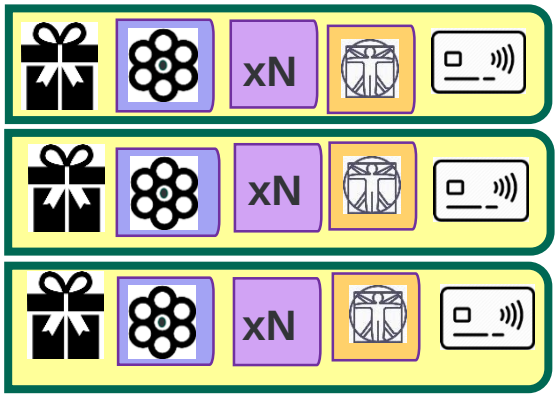
**Multitrip Product**




Crawley

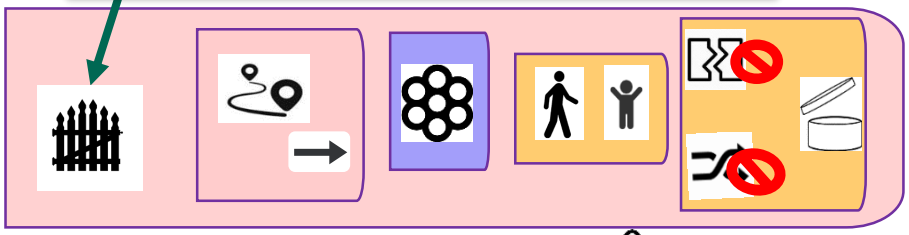
Horsham

Redhill



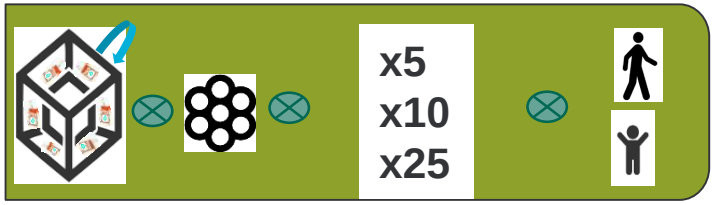

xN

**Single, trip 1-zone, Product**



VALIDABLE ELEMENT

**Price Combinations**



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# UK Bus Example: A Unit Section or “Stage” Fare

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# Stage /Section Count Fares

First

- Does not matter which section, just the number of sections.

## Single tickets

The cost of single tickets within the West of England will be based on the route distance you travel, with five single fares available:

**Up to three miles**

| | |
|---|---|
| Adult | from £2 |
| 16-21 year old/student | from £1.40 |
| Child aged 5-15 | from £1 |

**Three to six miles**

| | |
|---|---|
| Adult | from £3 |
| 16-21 year old/student | from £2.10 |
| Child aged 5-15 | from £1.50 |

**Six to nine miles**

| | |
|---|---|
| Adult | from £4 |
| 16-21 year old/student | from £2.80 |
| Child aged 5-15 | from £2 |

**Nine to twelve miles**

| | |
|---|---|
| Adult | from £5 |
| 16-21 year old/student | from £3.50 |
| Child aged 5-15 | from £2.50 |

**Over twelve miles**

| | |
|---|---|
| Adult | from £6 |
| 16-21 year old/student | from £4.20 |
| Child aged 5-15 | from £3 |

## How is your single fare calculated?

### Distance-based fares for the West of England

**In the West of England (excluding Bath Inner and Weston-super-Mare Town Zones – see pages 6 and 14) your single fare is worked out based on the route distance you are travelling.**

Distances are calculated using fare stage sections rather than individual bus stops, with each section being approximately one mile long*.

If you travel in 1-3 mile long sections it'll be £1.50, 4-6 mile long sections will be £2.50 and so on.

**Here is an example of one route and some of the fares along it:**

Emersons Green, Sainsbury's to Long Close would be £1.50 as you are travelling in three sections (numbers 1, 2 and 3, Long Close is classed as section 3 in this example as it's where you are getting off the bus).

Long Close to Narroways Road would be £2.50 as you are travelling in four sections (4, 5, 6, 7, Long Close is counted as section 4 in this example as it's your boarding point).

Blackberry Hospital to Downend, The Leap would be £2.50 as you are travelling in four sections (5, 4, 3, 2).

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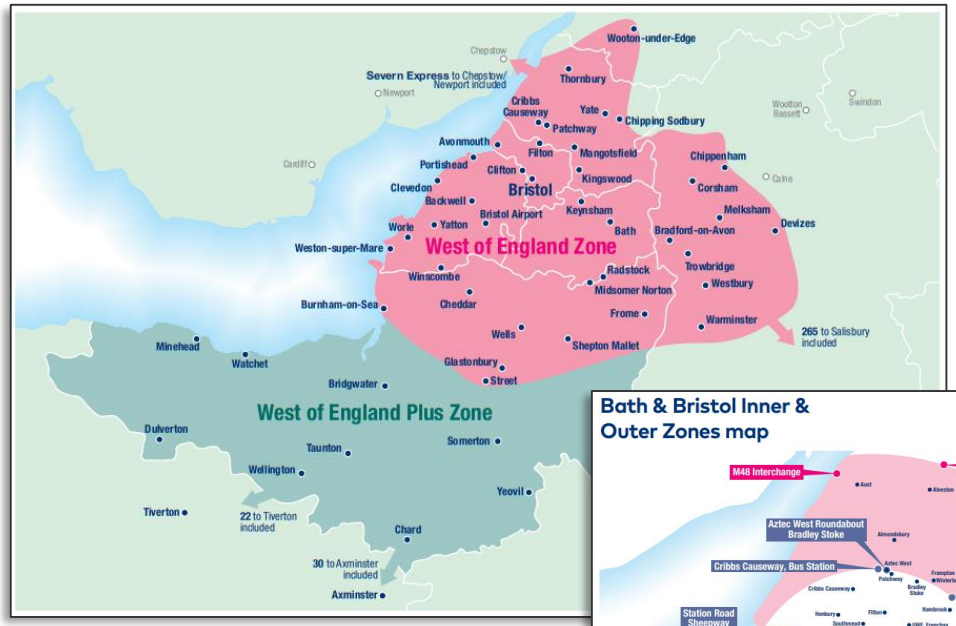
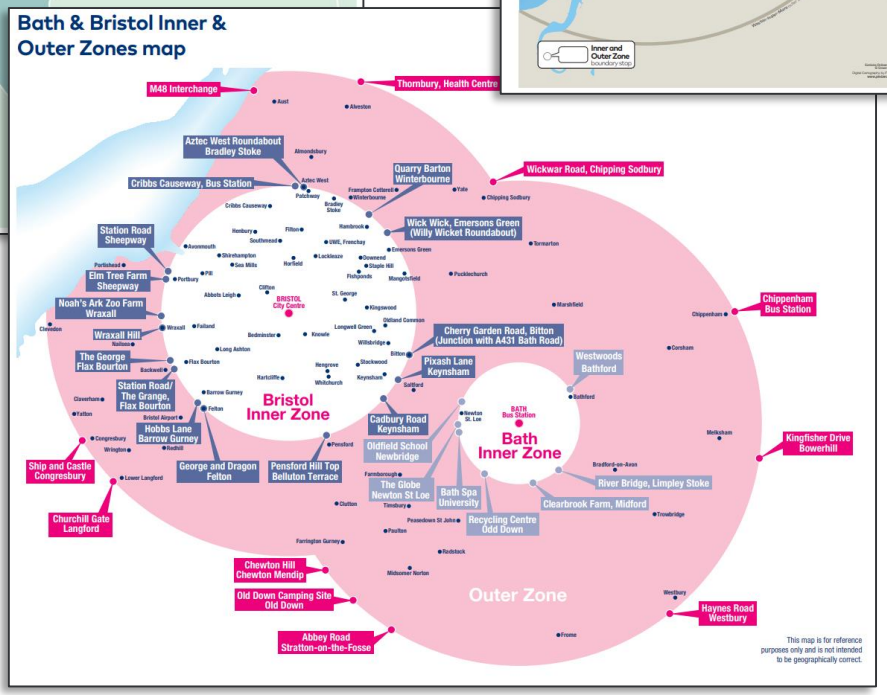
# Zone Maps






- **Stage fares**
  - West of England Zone
  - West of England Plus Zone
- **Zonal**
  - Bristol Inner Zone
  - Bath Inner Zone
  - Bath and Bristol outer zone
  - Weston-super-Mare Inner Zone

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# First West of England Zone Maps

- **Stage fares**
  - West of England Zone
- **Zonal**
  - Bristol Zone
  - Bath Zone
  - Bath
  - Weston-super-Mare Zone

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# Analysing the First Bristol offer – Section based trip tariff

- Access Rights
  - Sections : Defined by stages along route
  - Intervals : *1-3, 4-6, 7-9, 10+ Units (Notional miles)*
  - Operator: First
- Products
  - Single product – a single Trip
  - User types: *Adult, Child (5-15) 50%, Student (16-21) 30%*
- Sales Offer packages
  - Travel Documents: *paper, app (m-ticket)*
- Other products available – eg day pass, season pass

https://www.firstgroup.com/uploads/node_images/Fares%20Guide%20%28May18%29.pdf

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# Stage Fares

First

GEOGRAPHIC UNIT
*1-Section*

GEOGRAPHIC INTERVALS

| | |
|---|---|
| 1 2 3 | 01-03 = £1.50 |
| | 04-06 = £2.50 |
| | 07-09 = £4.50 |
| | 10+ = £5.50 |

FARE PRICEs

## How is your single fare calculated?

### Distance-based fares for the West of England

**In the West of England (excluding Bath Inner and Weston-super-Mare Town Zones – see pages 6 and 14) your single fare is worked out based on the route distance you are travelling.**

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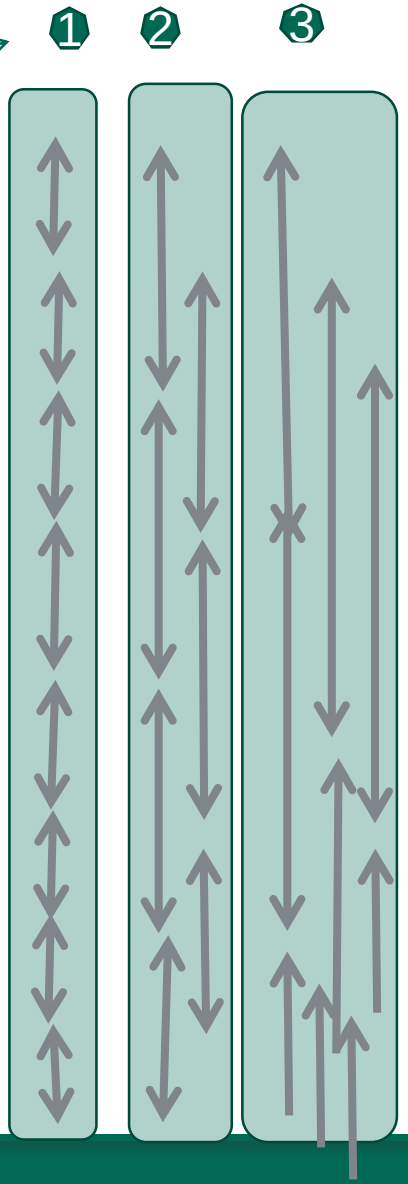
Long Close to Narroways Road would be £2.50 as you are travelling in four sections (4, 5, 6, 7, Long Close is counted as section 4 in this example as it's

Blackl d, The Leap would be £2.50 as you are travelling in four sections (5, 4, 3, 2).

Stage Points

FARE SECTIONs

SCHEDULED STOP POINTs

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# Routes for which multiple Tariffs are applicable?

# Products valid on Multiple Operators?

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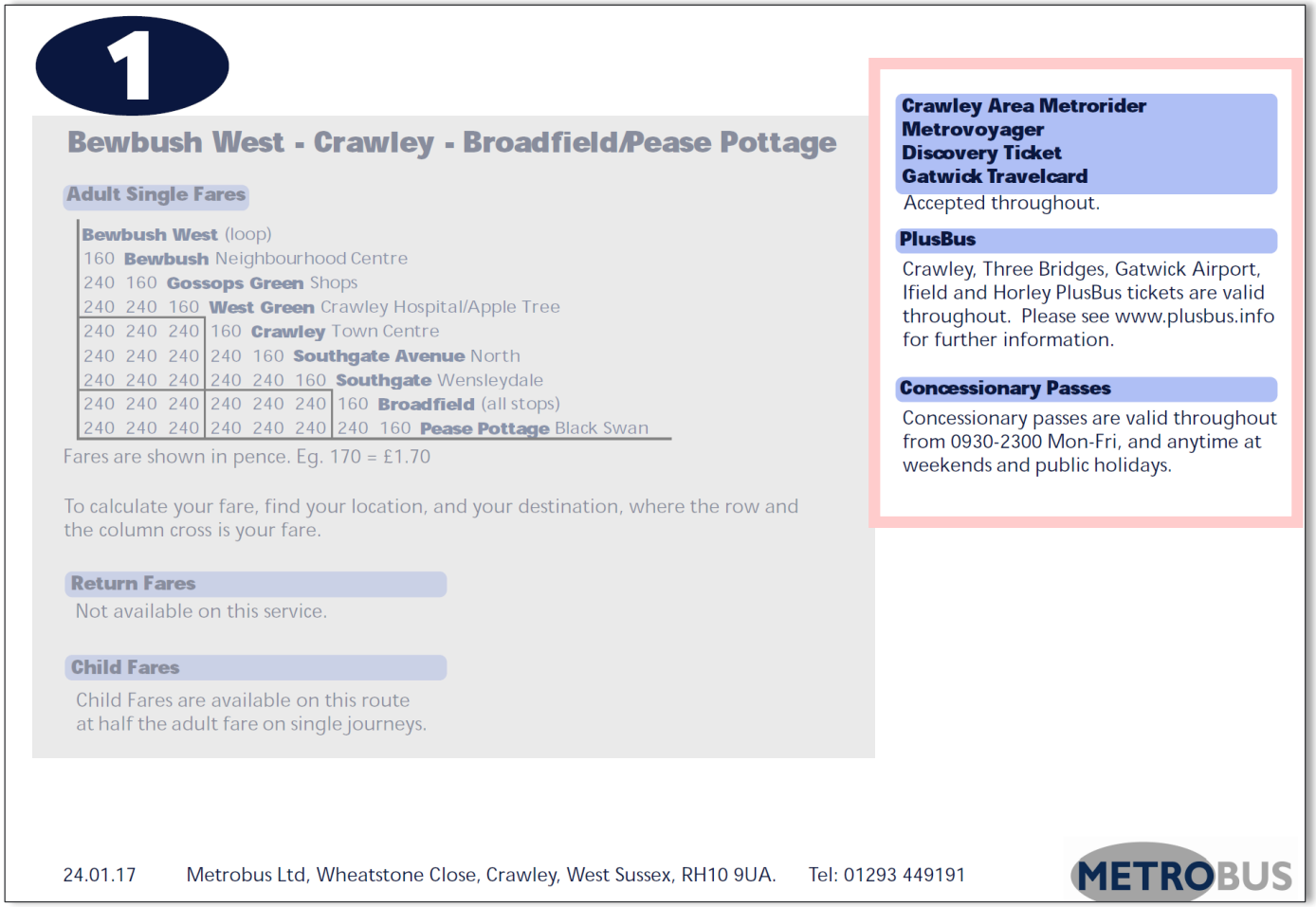
# Metrobus 1 - Other Tariffs



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

# Metrobus 1 - Other Tariffs

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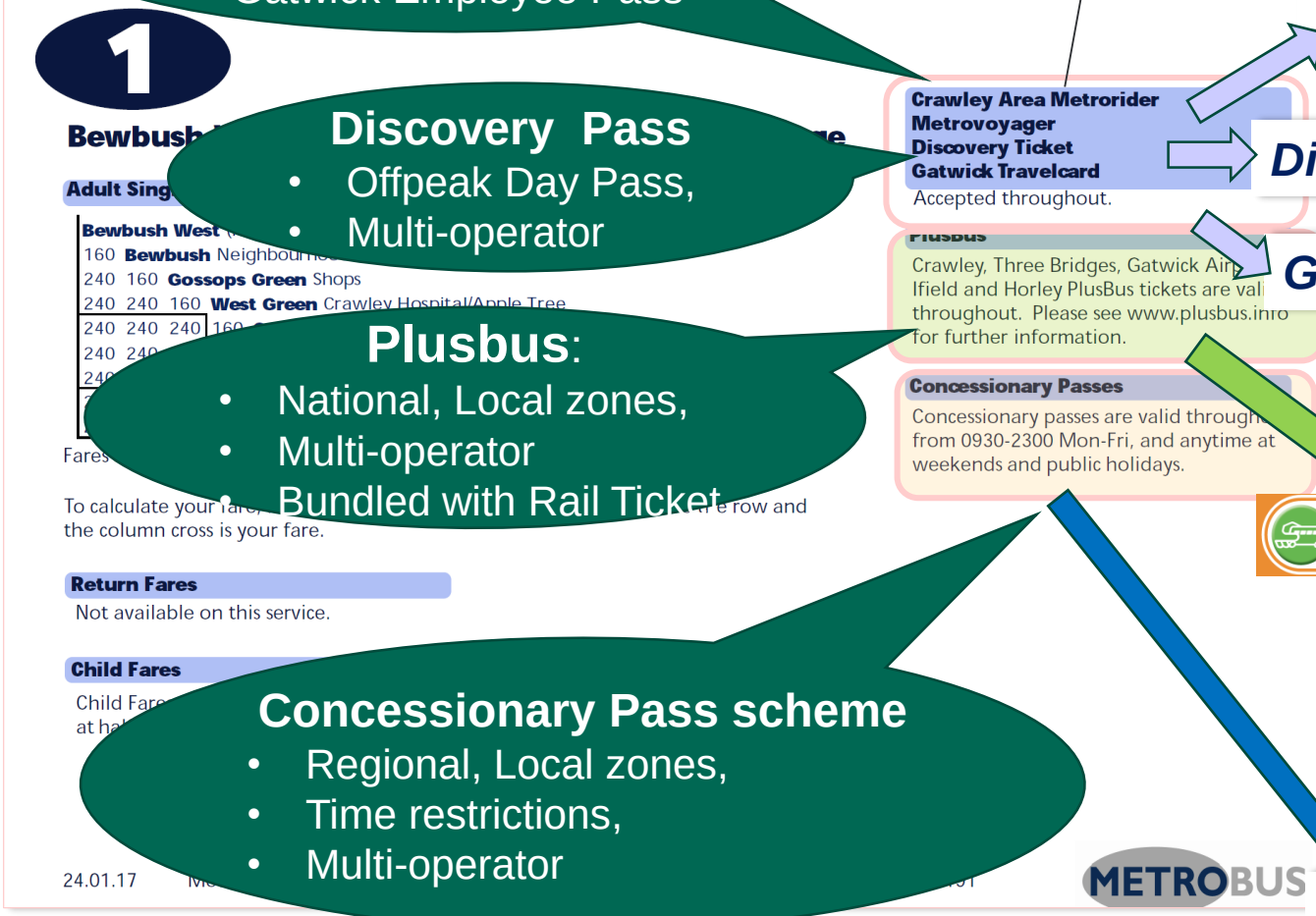
**Metrobus Products**
- Metrorider / Metrovoyager,
- Gatwick Employee Pass

**Discovery Pass**
- Offpeak Day Pass,
- Multi-operator

**Plusbus**:
- National, Local zones,
- Multi-operator
- Bundled with Rail Ticket

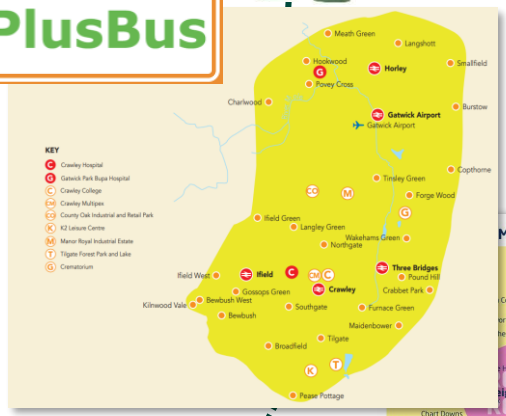
**Concessionary Pass scheme**
- Regional, Local zones,
- Time restrictions,
- Multi-operator

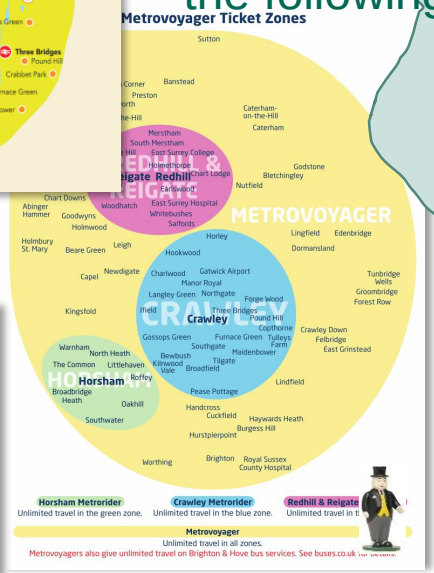
**FARE PRODUCTs**
**(Other day & Period passes)**

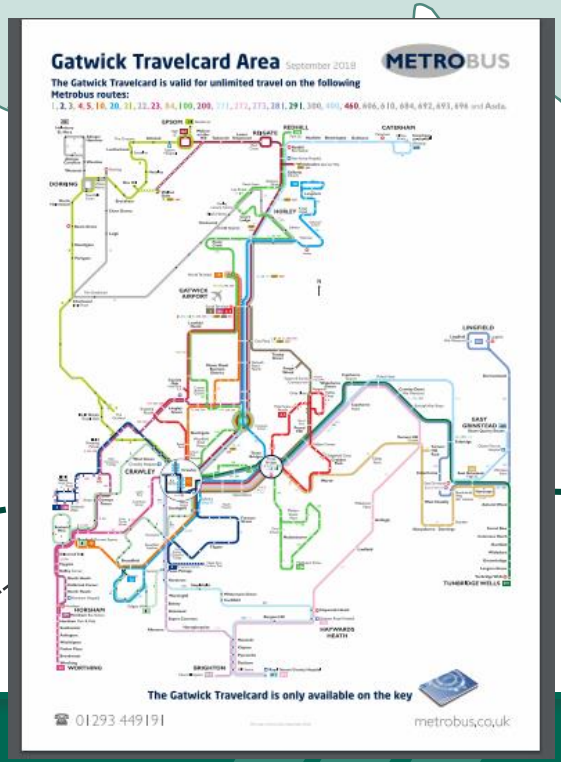


# Multiple Tariffs applicable

**Discovery Ticket**, a one day travel ticket, allowing you to travel unlimited in West Sussex, East Sussex, Surrey, Brighton & Hove, East Hampshire, Kent and Medwy on the following operated services:






Concessionary Pass Schema

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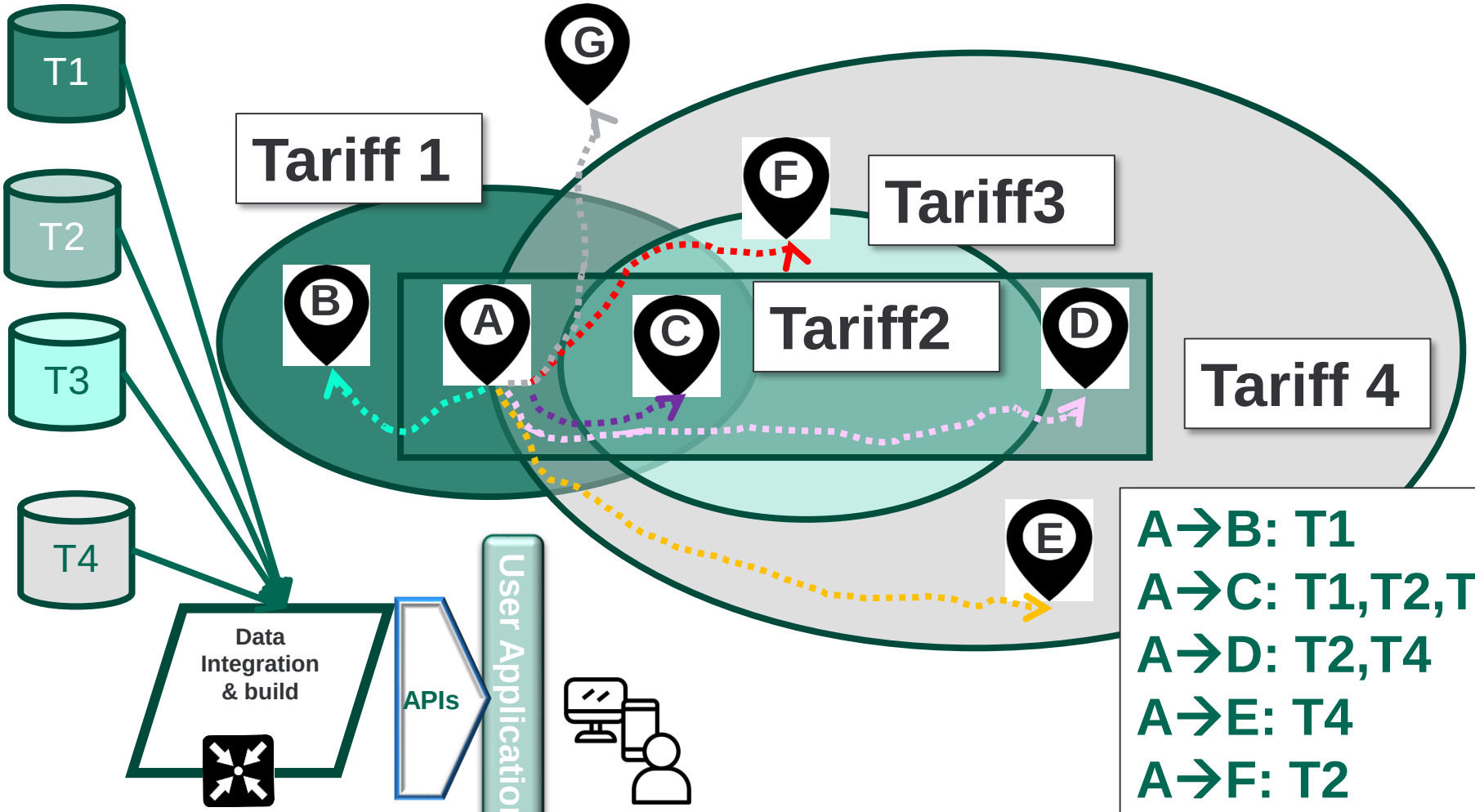
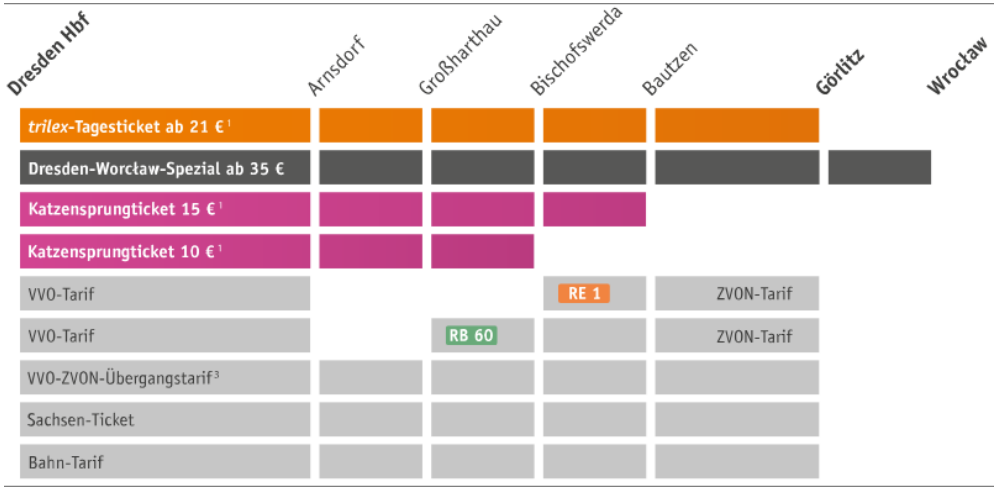
# Each tariff describes itself; it is the trip planner/ fare engine's task to find the applicable, best value fares for given trip



# Visualisation of Multiple Tariffs: Dresden - Wroclaw




*Trilex Tageskarte* tariff: is an off-peak flat rate **day pass** available for journeys crossing the region, and also to go to Liberec (CR). Group discounts are available.

*Dresden-Wroclaw-Spezial* is a special discounted **period return trip** fare valid on a cross-border route between Dresden (DE) and Wroclaw (PL). Group discounts are available.

*Katzensprung* tariff is an off-peak tariff offering **day passes** at two different rates for different sections; only within Saxony, only for the specified routes.

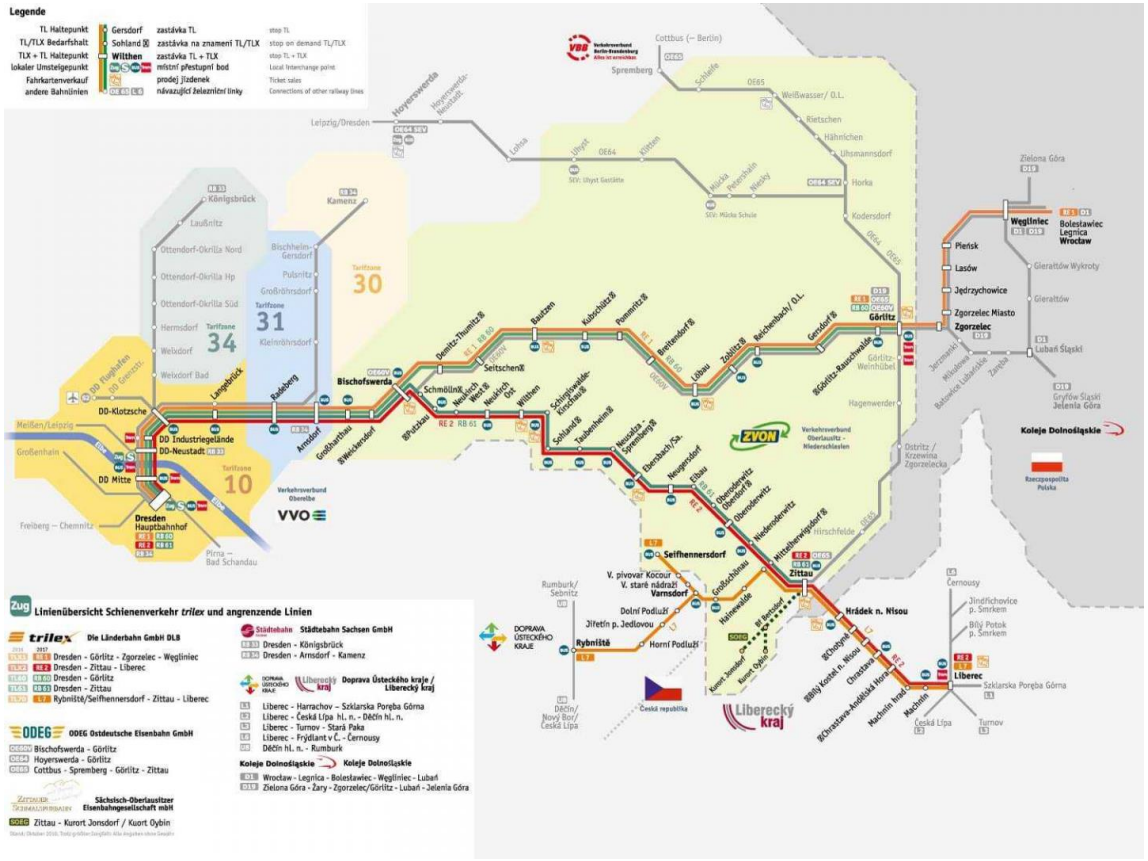
VVO (*Verkehrsverbund Oberelbe*), and ZVON (*Zweckverband Verkehrsverbund Oberlausitz-Niederschlesien*) tariffs are regional P2P tariffs only available on certain parts of the network. Regional expresses (E.g. RE 20, RB61) cost more than regular trains.

*Saxony* tariff is a regional off-peak day pass offered by Deutsch Bahn and usable as far as the border. Group discounts are available.

*Bahn tariffs* are standard P2P rail tariffs charged by national rail operators such as Deutsche Bahn and Polish Railways; available for all sections of the journey.

# Example #3 - Crossborder routes

- Multiple operators.
- Regional cross border tariffs.
- National and operator specific product sets.
- Point to point fares.
- Fare zones.
- Flat fares.
- Group discounts.
- Express trains
- Derived prices with rule steps showing price derivation.




- **Linie RE1, RB60:**
  - **Dresden** - Bischofswerda - Bautzen - Löbau - Görlitz (-**Wrocław**/Jelenia Góra)
- **Linie RE2, RB61:**
  - **Dresden** - Bischofswerda - Wilthen - Ebersbach - Zittau (-**Liberec**)

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# Modelling Prices

Pricing

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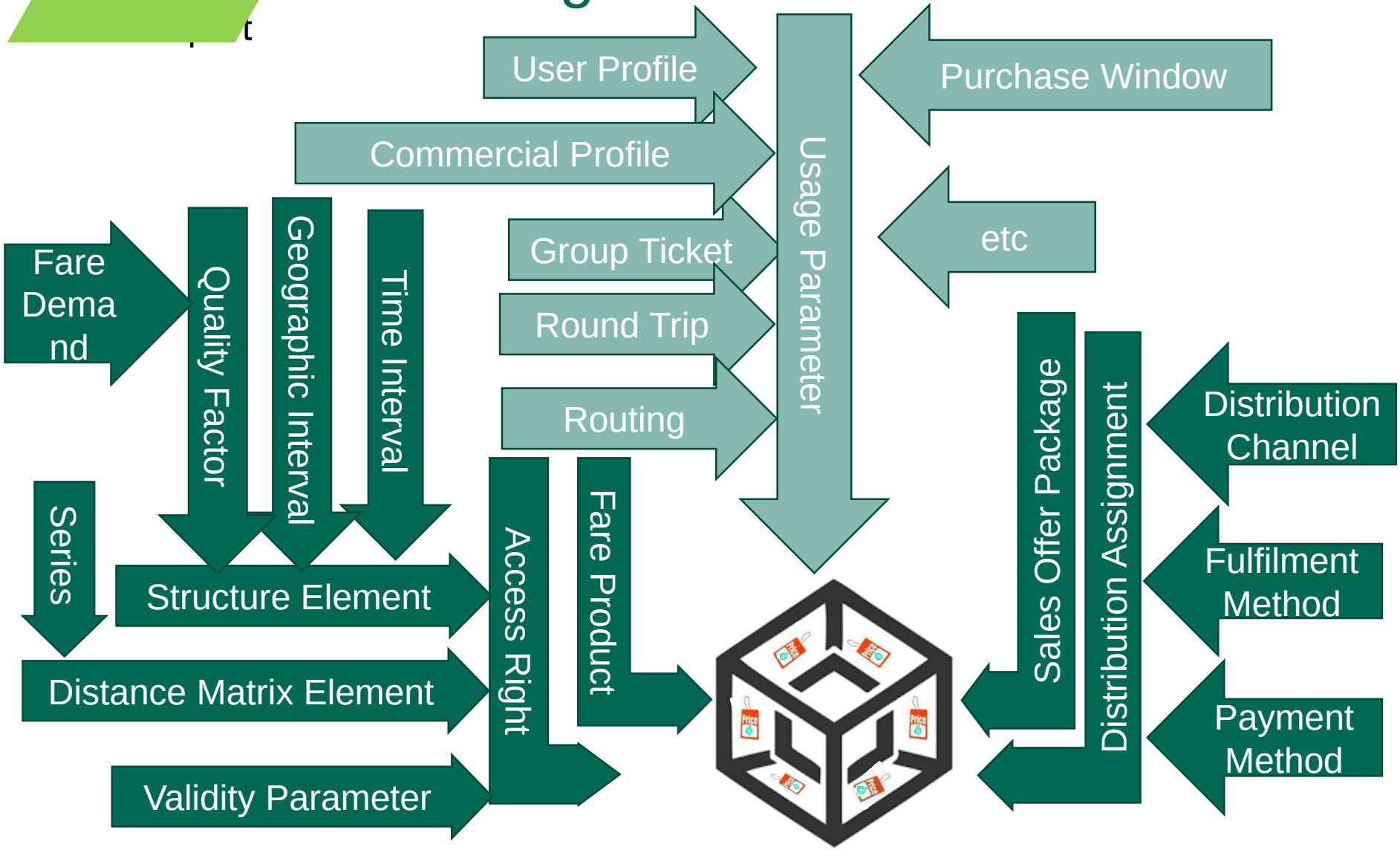
# Fare Prices

- Prices are separate from the tariff elements they price.
  - An element may have different prices with different validities.
  - Prices may apply to individual elements or combination of priceable elements

- Different type of prices
  - Static / Base Prices
  - Prices Derived from Base Prices
  - Dynamic Prices (pricing service)
    - Range bands for dynamic prices can be indicated by FARE QUOTA FACTORs

Pricing

# Pricing Dimensions



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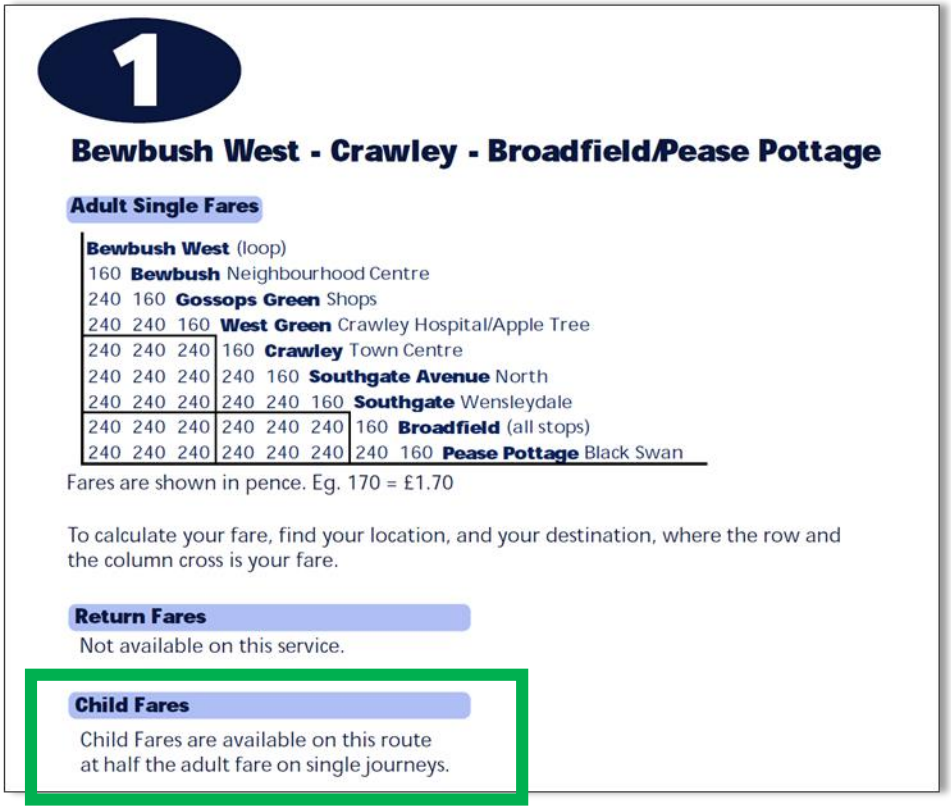
# Deribed Prices



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.

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

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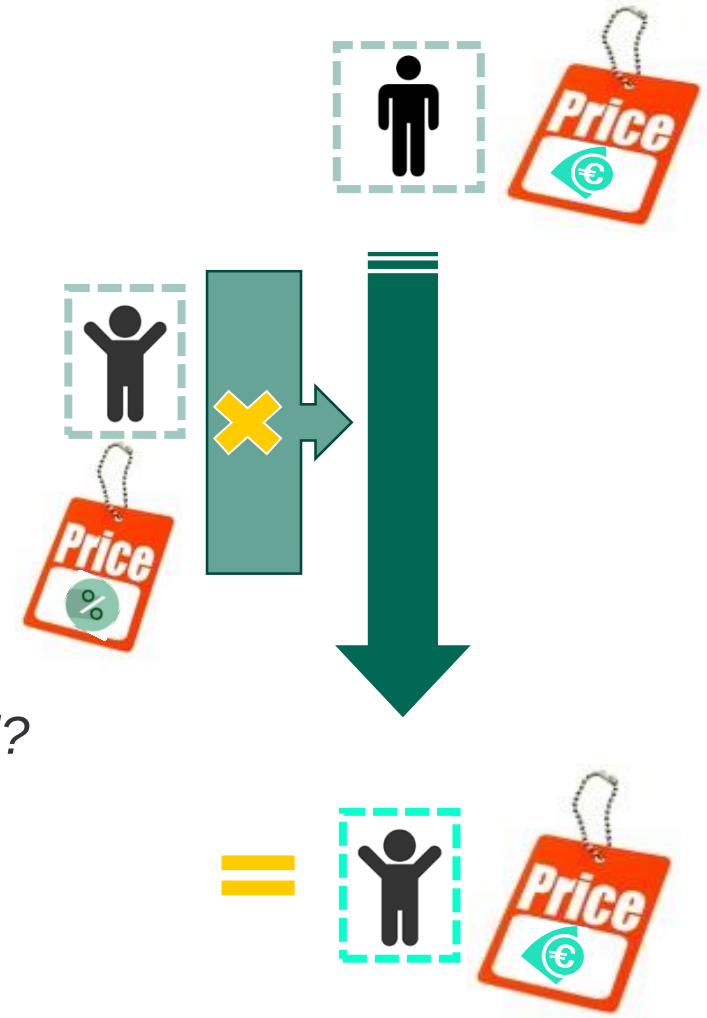
# Prices may be absolute or derived

- **Base Price**
  - E.g. *Adult =£1.50*
- **Pricing Rule**
  - Discounting
    - E.g. *Child = 50% of Adult*
  - *Limiting*
    - *Minimum price = 50p*
  - *Cumulative discounts allowed?*
- **Derived Price**
  - *E.g. Child = £0.75*



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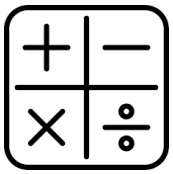
# Pricing Rules for deriving prices



- PRICING RULE
  - Any arbitrary named calculation
  - May be chained
- DISCOUNTING RULE
  - Price is a % or absolute discount or addition
- LIMITING DISCOUNTING RULE
  - Discount with absolute minima and maxima
- ROUNDING

Global parameters

  - Round to limit
  - Round in steps

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# Prices may be based on a price group

Is Metrobus1 really a unit zone count fare?

**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

**PRICE GROUP**

**A = £1.60 (= 1 stage?)**

**B = £2.40 (= 2 or more stages?)**

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

## Dublin Heuston - Cork Fare Grid

For a full list of ticket types and fares for our Dublin Heuston - Cork route, simply follow the guidelines below;

- Note the letter where your origin and destination stations intersect on the grid eg fare letter Cork to/from Portlaoise = N
- Using that letter check the Tickets and Fares Chart (below) to view the tickets and fares available for that station combination
- The fare grids are not screen reader friendly so anyone using a screen reader please contact us for any fares information you require

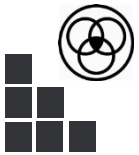
| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heuston | | | | | | | | | | | | | | | | | | |
| Sub* | Park West & Cherry Orchard | | | | | | | | | | | | | | | | | |
| Sub* | Sub* | Clondalkin/Fonthill | | | | | | | | | | | | | | | | |
| Sub* | Sub* | Sub* | Adamstown | | | | | | | | | | | | | | | |
| Sub* | Sub* | Sub* | Sub* | Hazelhatch/Celbridge | | | | | | | | | | | | | | |
| Sub* | Sub* | Sub* | Sub* | Sub* | Sallins/Naas | | | | | | | | | | | | | |
| D | C | C | B | B | A | Newbridge | | | | | | | | | | | | |
| E | D | D | C | C | B | A | Kildare | | | | | | | | | | | |
| F | E | E | D | D | B | B | A | Monasterevin | | | | | | | | | | |
| F | F | F | E | E | C | B | B | A | Portarlington | | | | | | | | | |
| G | G | G | F | F | E | D | C | B | A | Portlaoise | | | | | | | | |
| H | H | H | H | G | G | F | F | E | C | B | Ballybrophy | | | | | | | |
| K | K | J | J | J | H | G | G | F | F | D | B | Templemore | | | | | | |
| L | K | K | K | K | J | H | G | G | F | F | B | A | Thurles | | | | | |
| N | M | M | M | M | L | K | K | J | H | G | F | D | C | Limerick Jct | | | | |
| P | P | N | N | N | N | M | L | L | K | J | G | G | F | C | Limerick | | | |
| P | P | P | P | N | N | M | M | L | L | K | H | G | F | C | J | Charleville | | |
| R | R | R | R | R | P | N | N | N | M | L | K | H | H | H | K | B | Mallow | |
| T | T | T | S | S | S | R | R | P | P | N | M | L | K | H | K | F | C | Cork |

**Sub* indicates DART / Commuter fares apply**

- Prices vary according to; ticket type, origin and destination
- Adult Single: between €6.00 and €65.10
- Adult Day Return: between €10.90 and €84.00
- Child Single: between €3.00 and €31.00
- Child Day Return: between €5.00 and €31.00

For Sub* fares go to our DART and Short Hop Zone Fares calculator.

# Price data - Absolute



| OPERATOR | SALES PACKAGE | FARE PRODUCT | O/D | CLASS OF USE | USER PROFILE | CHANNEL | TRAVEL DOC TYPE | Price Amount |
|---|---|---|---|---|---|---|---|---|
| BR | Trip+AtCounter | Trip | X→Y | 1st | Adult | Counter | Paper | £20.00 |
| BR | Trip+AtCounter | Trip | X→Y | 1st | Child | Counter | Paper | £10.00 |
| BR | Trip+AtCounter | Trip | X→Y | 2nd | Adult | Counter | Paper | £15.00 |
| BR | Trip+AtCounter | Trip | X→Y | 2nd | Child | Counter | Paper | £7.50 |
| BR | Trip+MobileApp | Trip | X→Y | 1st | Adult | Mobile | MobileApp | £18.00 |
| BR | Trip+MobileApp | Trip | X→Y | 1st | Child | Mobile | MobileApp | £9.00 |
| BR | Trip+MobileApp | Trip | X→Y | 2nd | Adult | Mobile | MobileApp | £14.00 |
| BR | Trip+MobileApp | Trip | X→Y | 2nd | Child | Mobile | MobileApp | £7.00 |
| | *etc* | | | | | | | |

Separate price given for each possible combination

# Price data – Some Derived

| OPERATOR | SALES PACKAGE | FARE PRODUCT | O/D | CLASS OF USE | USER PROFILE | CHANNEL | TRAVEL DOC TYPE | Amount Or Rule |
|---|---|---|---|---|---|---|---|---|
| BR | Trip+AtCounter | Trip | X→Y | 1st | Adult | Counter | Paper | £20.00 |
| BR | Trip+AtCounter | Trip | X→Y | 1st | Child | Counter | Paper | →%Adult |
| BR | Trip+AtCounter | Trip | X→Y | 2nd | Adult | Counter | Paper | £15.00 |
| BR | Trip+AtCounter | Trip | X→Y | 2nd | Child | Counter | Paper | →%Adult |
| BR | Trip+MobileApp | Trip | X→Y | 1st | Adult | Mobile | MobileApp | £18.00 |
| BR | Trip+MobileApp | Trip | X→Y | 1st | Child | Mobile | MobileApp | →%Adult |
| BR | Trip+MobileApp | Trip | X→Y | 2nd | Adult | Mobile | MobileApp | £14.00 |
| BR | Trip+MobileApp | Trip | X→Y | 2nd | Child | Mobile | MobileApp | →%Adult |
| | *etc* | | | | | | | |

Some prices are based on others

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# Summary

# Describing Fares with NeTEx

**Pricing**

Prices attached to elements
Pricing rules
*Adult flexible single costs £30*
*Child = 50% Adult price*

Fulfilment & Payment
Control & Validation
Billing &Clearing

**Network**
- stops, tariff zones, line, operator
- *Zone 1 contains 8 stops….,Line 1 runs…*

**Fare policy / tariff structure:**
- space-, time-based…access rights
- *P2p fare, Stage fare, Flat fare*

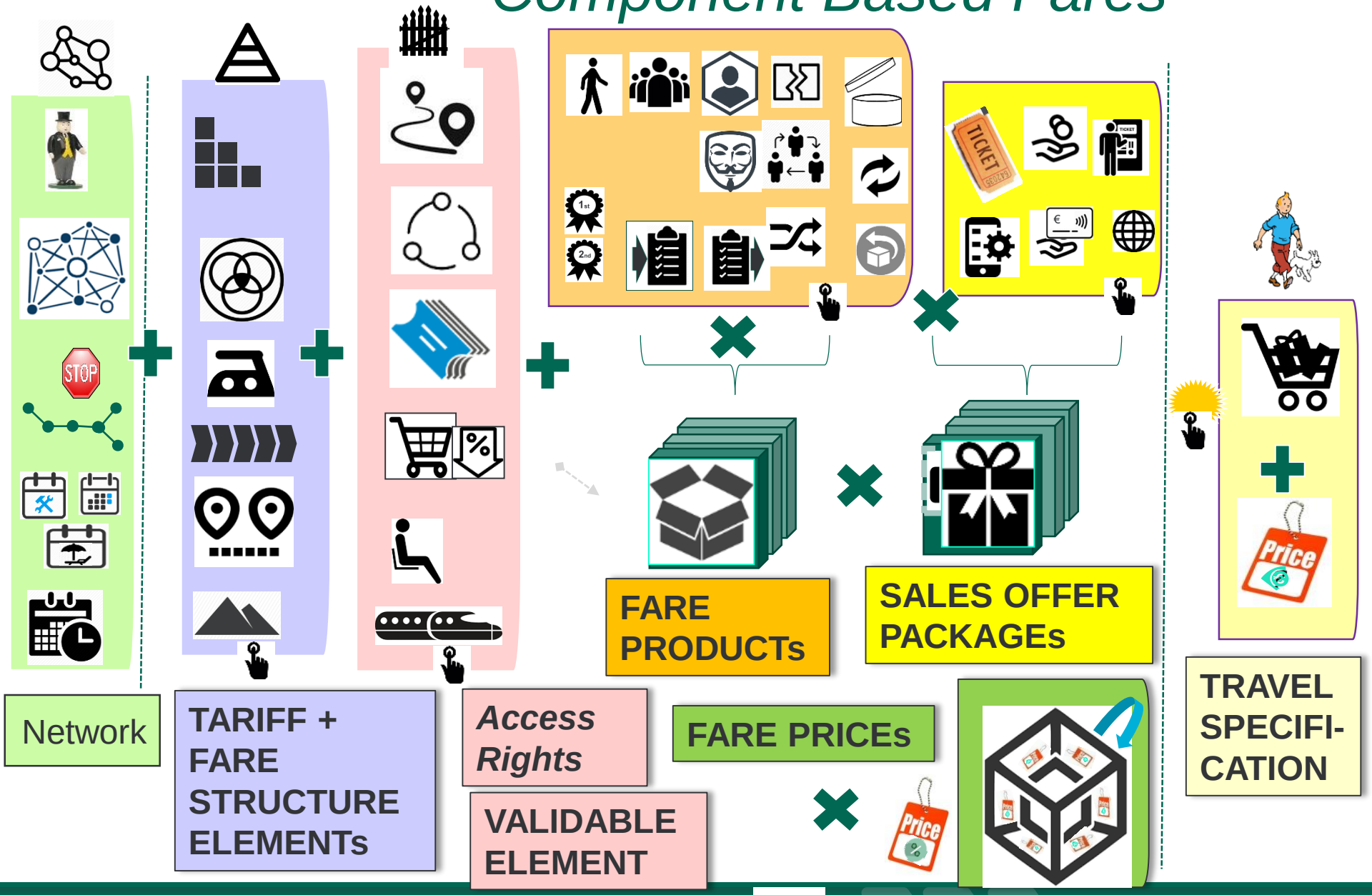
**Rights to access & consume services:**
- scope and order of use
- validity and usage rules
- *bus trip stop X to stop Y, metro trip 3 zones*

**Marketable combinations of access rights**
- validity & usage limiting parameters
- & charging moments
- *off peak metro trip 3 zones followed by bus trip 2 zones ,no interchange, Child reduction*

**Sales Offer Description:**
- media & travel document types
- distribution channels & contracts
- *Paper ticket at ATM, carnet of 10, smartcard*

**Travel Specification**
- Specific set of choices to purchase
- *Adult single A to B on a smartcard*

# Component Based Fares



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# Some principles for Scoping UK bus tariffs

traveline

1. Every price dimension found in UK bus fares needs a corresponding model element
2. There is no single universal way to package fare offers
   - Yet any type of product / offer can be built from a common set of components
3. You can exchange the data elements and parameters, but not how they are used
   - E.g. pricing parameters (discounts, rounding)
   - E.g. Combining conditions on tariffs, products and sales offers
4. Each product should just define its own tariff
   - It is the trip planner / fare engine's task to find all available tariffs

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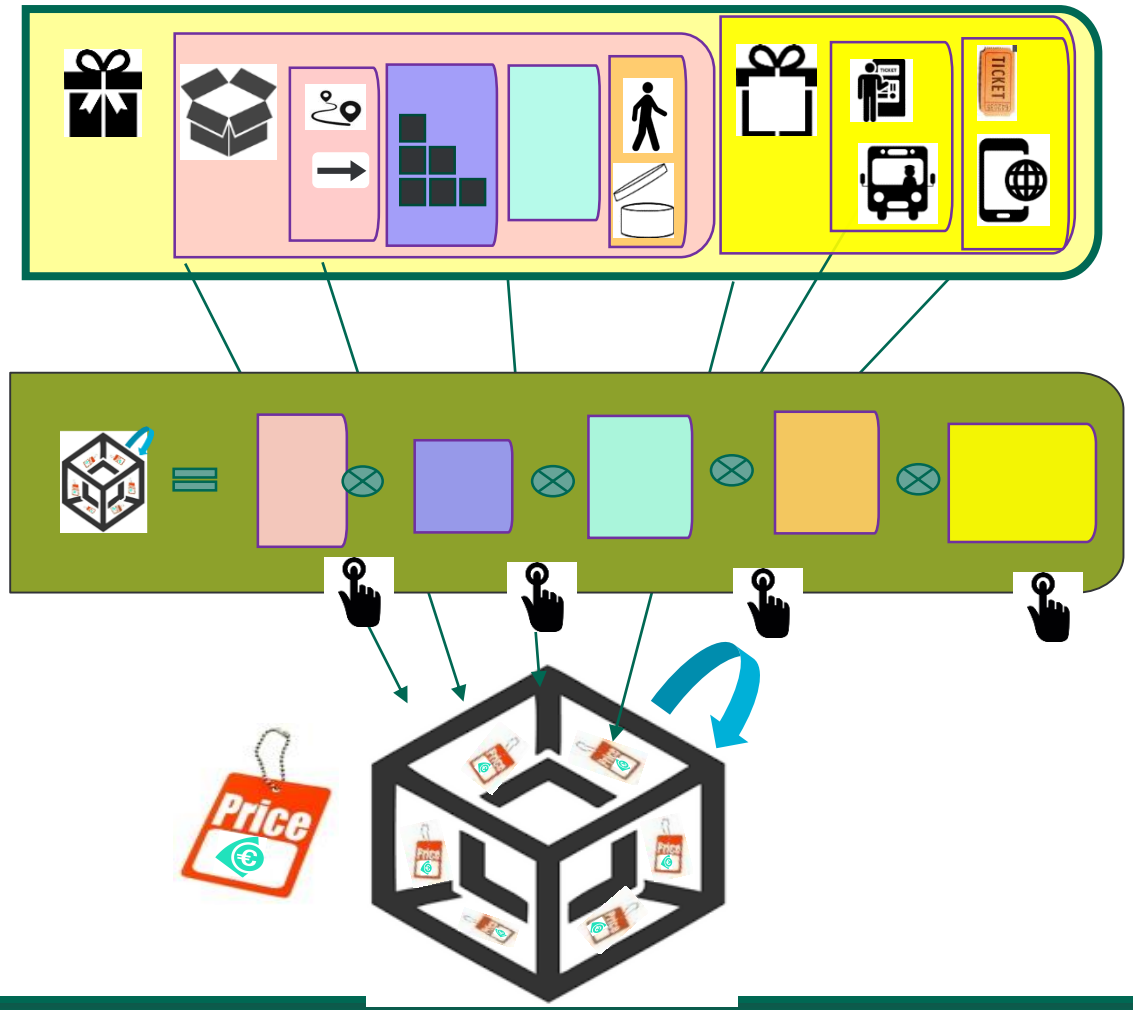
# Price dimensions




- Anything which is a price dimension for a UK Bus Fare needs to be represented by a model element in the profile
  - E.g. O/Ds, zones, user types, channels, media types, etc
- Anything else is optional –
  - E.g. rules for ages of a use type such as child or senior
  - E.g. Locations to buy tickets
- Scope depends on specific tariff structures to be supported

# Stage Fares

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First

GEOGRAPHIC UNIT
*1-Section*

GEOGRAPHIC INTERVALS

| | |
|---|---|
| 01-03 | = £1.50 |
| 04-06 | = £2.50 |
| 07-09 | = £4.50 |
| 10+ | = £5.50 |

FARE PRICEs

## How is your single fare calculated?

### Distance-based fares for the West of England

**In the West of England (excluding Bath Inner and Weston-super-Mare Town Zones – see pages 6 and 14) your single fare is worked out based on the route distance you are travelling.**

Distances are calculated using fare stage sections rather than individual bus stops, with each section being approximately one mile long*.

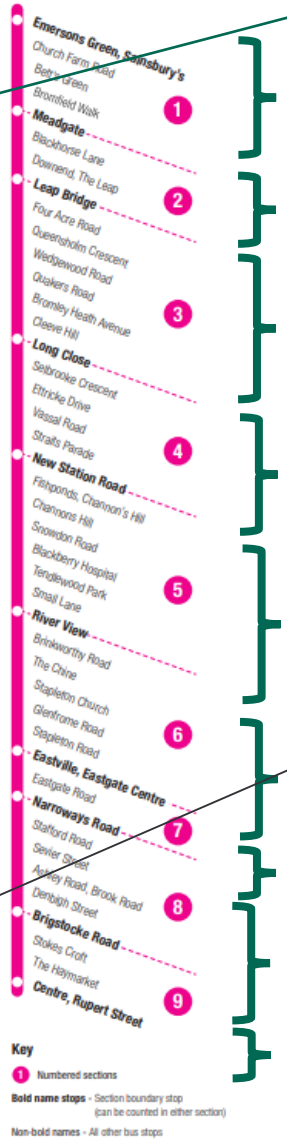
If you travel in 1-3 mile long sections it'll be £1.50, 4-6 mile long sections will be £2.50 and so on.

**Here is an example of one route and some of the fares along it:**

Emersons Green, Sainsbury's to Long Close would be £1.50 as you are travelling in three sections (numbers 1, 2 and 3, Long Close is classed as section 3 in this example as it's where you are getting off the bus).

Long Close to Narroways Road would be £2.50 as you are travelling in four sections (5, 4, 3, 2).

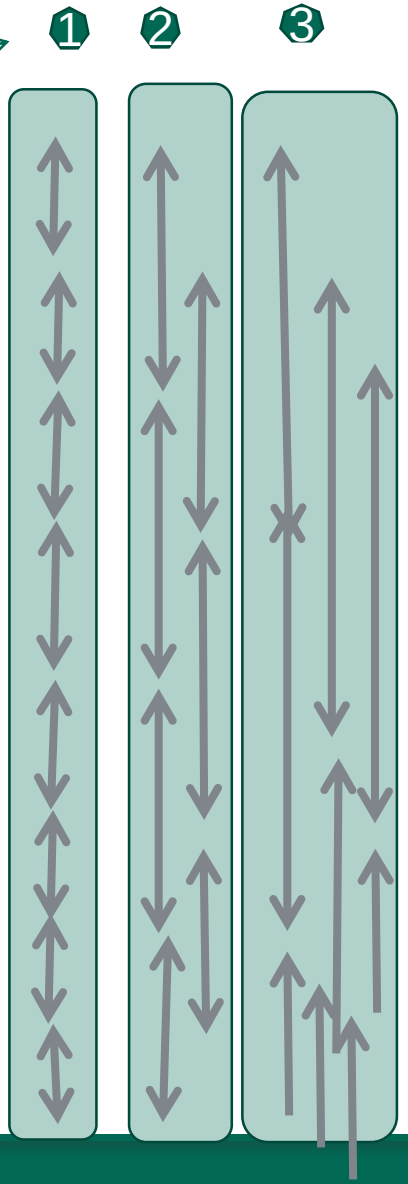
Blackberry Hospital to Downend, The Leap would be £2.50 as you are travelling in four sections (5, 4, 3, 2).




SCHEDULED STOP POINTs

Stage Points

FARE SECTIONs

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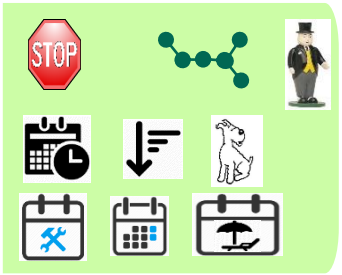
# Benefits of Transmodel / NeTEx Approach to Fares



- **Powerful Component based representation**
  - Allows many different tariff combinations to be described with the same set of atomic components
  - Allows complex conditions to be expressed
  - Allows necessary packaging of products into different offers
  - Gives highly reusable implementations
- **Joined up conceptual model - Reuses existing Network & Timetable elements**
  - Network (Stops, tariff zones, modes, operators, etc)
  - Timetable elements, servicesetc
  - Temporal conditions and day types, validities
- **Robust, Flexible, Extensible Technology**
  - XML allows selective use, validation integrity checking etc
  - UML provides tool supported system documentation
  - Conceptual model for Account Based Ticketing and future developments

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# Some Drawbacks to a Component based Approach

- **Skills Investment needed to understand Concepts & Components**
  - Tariff structures, Access rights
  - Uses of different parameters
  - Product and Sales Offer packaging
- **Component based semantics require attention to assembly and compounding behaviour**
  - Exchange of data does not guarantee exchange of behaviour!