



BSI Standards Publication

Intelligent transport systems - Public transport - Open API for distributed journey planning

National foreword

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English Version

Intelligent transport systems - Public transport - Open API for distributed journey planning

Intelligente Verkehrssysteme - Öffentlicher Verkehr -
Offene API für verteilte Reiseplanung

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European foreword

This document (CEN/TS 17118:2017) has been prepared by Technical Committee CEN/TC 278 “Intelligent transport systems”, the secretariat of which is held by NEN.

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0 Introduction

0.1 General

The availability of accurate and timely information about public transport (PT) services has been an increasing expectation over the past decade or more and systems have been developed to assist in the compilation and delivery of such information making best use of the rapid advances in information technology (IT) capabilities. Multi-modal information systems typically have started with an urban or regional focus to meet the information needs of those making relatively local journeys – whilst information requirements for longer-distance journeys have been delivered primarily by mono-modal information systems from the rail and airline industries.

However there have been some pioneering systems over the past 10 years that have extended these models, notably

- EU-Spirit in Northern Europe
- JourneyWeb in Great Britain
- DELFI in Germany

These three systems employed different architectures that collated data from multiple sources in order to be able to offer information about longer-distance journeys that involved travel in the area of more than one regional information system in a single transaction. This technique of bringing information together from two or more information systems when necessary is referred to as "distributed journey planning".

The ability to extend such systems to wider applications has been greatly enhanced through the way in which public transport data is now increasingly standardised by following the principles set out in the "Public Transport Reference Data Model" (Transmodel) EN standard, and its related implementation Standards and specifications.

0.2 An Open API for distributed journey planning (OJP)

A review of the three long-established Distributed Journey Planning systems that have been working in Europe over the past 10 years (EU-Spirit, JourneyWeb and DELFI) found that, whilst the architecture of each of these systems was different, the nature of the enquiries sent between the systems, and the content of the responses sent in return, were essentially the same. This suggested that it would be possible to define a single Open Journey Planning API to support all distributed journey planning systems.

The Open Journey Planning API (OJP) will therefore allow a system to engineer just one interface that it can make available widely (to authorised users or openly as they so choose) rather than having to engineer separate APIs for each bipartite exchange arrangement that may be required with other systems.

However existing journey planning systems (and probably some that will be developed in the future) may require their own specific APIs for use with their closest partner systems, where the volume of enquiries is such that efficiency considerations demand a tightly specified API for such clients. The intention of the Open API is to provide an opportunity for just one universal channel to exchange information to lower-volume users – once created then there is little reason not to allow as many users of this API as may wish to use it.

0.3 The public transport information tensions

The greatest use of public transport (in terms of the number of passenger journeys) happens in urban areas where frequent and regular services cater for the needs of relatively short-distance journeys.

Usage then declines as journey distances get longer – with inter-regional and international journeys comprising the smallest number of public transport journeys.

However the need for information about PT services is least in areas with frequent and regular services, where passengers quickly get to know about the services they rely on for most of their journeys – and therefore their need to check information systems is relatively infrequent. Longer distance journeys, however, are made less often and for a variety of reasons there is a much greater need to obtain information for such journeys before setting off. So the need for information is greatest for the very journeys that are made least often. It is difficult to make a business case to provide information systems geared specifically to the needs of the longer-distance travellers, therefore. Instead it becomes important to find ways of meeting the information needs of those passengers by using information collated and delivered primarily for the much larger group of those making short-distance journeys.

The distributed journey planning systems mentioned above were a measured response to these tensions, allowing data to be shared across multiple systems in different ways to ensure that someone wanting to plan a journey anywhere in (for instance) Germany could go to their own regional journey planner which collected relevant information from other regional planners in order to satisfy a particular enquiry. In Great Britain Transport Direct provided a national journey planning service collating data from the 11 regional traveline journey planners. And in the Baltic area EU-Spirit collated information from several sources to allow international planning between several European states. In Slovenia a proposal to extend the national journey planning system to a multi-national distributed system was included in the SIJPRIS service, although to date it has not yet been implemented.

Over time technology and techniques have allowed these particular systems to drive greater efficiencies as regional systems have been able to merge into ones covering larger areas. This has reduced the complexity of the distributed journey planning process within the areas covered by these systems. The moves to open data have also enabled larger "consolidated" datasets to be used in journey planners (notably Google Transit, or Traveline's national journey planner in Great Britain) – but these are systems offering much less rich information than that from the more local or regional systems, and the data on them is often less timely than is possible on the local and regional systems.

Taking all these factors into account there remain advantages in the distributed journey planning model notwithstanding the trends towards travel information systems that are designed to cover ever larger areas. Key points would appear to be that distributed systems are sharing the most up to date information from the local authorised source in a way that cannot be achieved with systems that collate data for much larger areas. This is particularly important in areas where local public transport market is deregulated (as has been the case in most of Great Britain since 1986) where bus services can change on any date of an operator's choosing rather than there being only one or two service change dates each year from which any changes of services are known well in advance (as is the case in many other parts of Europe).

In the foreseeable future distributed journey planning will continue to provide an effective mechanism for extending the geographical scope of any journey planner with a minimum of effort – so long as there is a single standardised API as proposed in this Technical Specification which will ensure that only one API would need to be engineered to allow standard questions to be asked of other systems, and to allow answers to standard questions from other systems to be sent in response.

For the enquirer there is one other important advantage of distributed journey planning – and that is that the questions can be asked, and answers read, within a layout that the user is familiar with – and in their own natural language.

0.4 Distributed journey planning architecture beyond scope

0.4.1 General

Distributed Journey Planning depends not just on there being an available API for the exchange of data. It also requires the system responding to an end-user's enquiry to be able to work out what enquiry to

send to one or more other information systems, and how to merge the responses with data from its own repositories in order to create one or more seamless journey plans for the enquirer. There are several different approaches to the "architecture" for distributed journey planning – and these are beyond the scope of this Technical Specification. The following paragraphs, however, outline some of the key considerations that any implementation of distributed journey planning will need to take into account.

0.4.2 The distributed journey planning approach

One of the key considerations for building a distributed journey planning system is to define what supporting data (metadata) is required and where it is to be held. At its simplest the process of making an enquiry typically has several stages :

- a) An enquirer goes to his **home system** and composes an enquiry expressing the location of the start and end points in their own terms or as permitted by the user interface
- b) The enquirer's **home system** seeks to match the enquirer's locations to locations understood by the journey planner, and then converting them into terms (perhaps geographic coordinates) that can be understood by the home and other distributed journey planning engines
- c) The **home system** establishes what questions it needs to ask and from what journey planning systems (both its own and those of one or more distributed partners) it needs to ask for information that it does not already have in its own databases
- d) The **home system** then collates the information received in response to the questions asked of the different systems to create a seamless and efficient journey plan which it can then deliver to the enquirer.

In some systems the **home system** does not itself undertake the distributed journey planning. Instead the **home system** passes that task to a separate distributing journey planning system which completes the process and returns the answers to the **home system**.

For the enquirer it is important to make the process as simple and efficient as possible – so the process of matching locations with system gazetteers can be a critical one. Ideally the enquirer should be able to specify a location as a station or stop name, a topographic place, a street address, a postcode (if this covers a meaningful small area), and possibly Points of Interest. Such data for locations within the geographical scope of the **home system** is likely to be held already – but if the location is outside that geographical scope where does the equivalent data come from? – and how does the home system know that it needs to find data for a distant location?

0.4.3 Distributed or centralised approaches

So one of the key considerations for building a distributed journey planning system is to define what supporting data (metadata) is required and where it is to be held. Somehow the home system needs to be able to recognise that a requested origin or destination is not in its own geographical area – and once it has done that it also needs to recognise which system(s) will be able to provide journey planning answers for that location. One way of managing this would be for a network of distributed journey planning systems to share a central repository of gazetteers (indexes of geographical entities – localities, addresses, stops & stations, etc) to resolve these questions (and probably to go on to make the necessary enquiries of the relevant journey planning systems) before handing back the information to the originating home system. This would be a centralised model for handling journey enquiries that required the distributed service. Alternatively each participating system could hold gazetteer data for all the participating systems' areas – and the enquiry process could then work on a peer-to-peer decentralised basis. To get an efficient approach it is necessary to consider all required support data – not only the gazetteers, but also how access to the timetable data for long-distance PT services (notably trains, coaches, ferries and flights) can be achieved in a way that allows it to be used in the creation of the effective journey plans.

0.4.4 The basis for the Open API

Recent work in Germany's IP-KOM research project has brought together the lessons learned from various information systems (including EU-Spirit, JourneyWeb and DELFI) and developed the TRIAS schema to support future information systems in Germany. Because this work has brought together the experience of the three long-standing distributed journey planning models, it was decided that it should form the basis of the proposed standard Open API for distributed journey planning. This Technical Specification is based, therefore, on the TRIAS schema developed in Germany with appropriate extensions to meet the full requirements for Distributed Journey Planning.

A number of existing European Standards and Technical Specifications will underpin the work – notably Transmodel (Public Transport Reference Data Model), IFOPT (Identification of Fixed Objects in Public Transport), SIRI (Service Interface for Realtime Information) and NeTEx (Network and Timetable Exchange). The experiences from EU-Spirit, JourneyWeb and DELFI systems will feed into the work, along with references to relevant national implementation standards that have supported Distributed Journey Planning to date. The Open API will depend on the consistency of data from all sources that comes from the implementation of the existing European Standards for public transport information.

0.4.5 Other possible uses for the Open API

Whilst the Open API is intended primarily to support distributed journey planning, experience of such APIs to date has shown that they can also be used for other purposes. For instance they can be used for communication between personal journey planning apps and a journey planning service (without any distributed journey planning requirement). Or they can be used to enable a park-and-ride planner to combine car journey planning with public transport journey planning, connecting the two modes at the park-and-ride car parks. Or they can support the use of taxis as a mode to access public transport in areas where conventional public transport does not exist or is very sparse. A standard Open API will provide many opportunities to use and re-use public transport and associated data in the delivery of innovative information services.

0.5 The European ITS Directive

The forthcoming Delegated Regulation of the ITS Directive with regard to the provision of EU-wide multimodal travel information services will provide the necessary requirements to make EU-wide multimodal travel information services accurate and available across borders. It establishes the specifications necessary to ensure the accessibility, exchange and update of travel and traffic data and distributed journey planning for the provision of multimodal information services in the European Union. The Delegated Regulation recommends the use of the Open API standard in relation to the requirements specified in Article 7 'Linking Travel information Services'.

1 Scope

This Technical Specification defines a schema for establishing an Open API for Distributed Journey Planning that can be implemented by any local, regional or national journey planning system in order to exchange journey planning information with any other participating local, regional or national journey planning system.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 15531-2:2015, *Public transport — Service interface for real-time information relating to public transport operations — Part 2: Communications*

CEN/TS 15531-5, *Public transport — Service interface for real-time information relating to public transport operations — Part 5: Functional service interfaces situation exchange: Situation Exchange*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE This section explains how specific terms are used in the OJP Schema and, where relevant, notes their ancestry from, semantic correspondence with, and any differences from, the use of terminology in other public transport standards. Terminology used in the German TRIAS schema, on which the OJP Schema is based, has been converted as far as possible to the standard terminology used in Transmodel, SIRI, NeTeX or IFOPT.

So where relevant there is a commentary to show that the definition of a term is identical to that used in Transmodel v6 (shown as *[TMv6]*) or Transmodel v5.1 *[TMv5.1]*, or NeTeX *[NeTeX]* or SIRI v2 *[SIRI]* or a commentary how the term differs from that in Transmodel v5.1 or v6, NeTeX or SIRI v2. Terms used in TMv6 or other referenced standards are shown in CAPITALS. Some of the references to NeTeX come from informative rather than normative sections, but are underpinned by the Transmodel v5.1 normative standard.

The dictionary definitions of words in everyday use, such as Journey and Trip, are not sufficiently precise to be used in the specification of an information system – and therefore these (and other) words have very specific definitions (as shown below) when used in the technical sections of this document (sections 3 onwards). A Journey Planning System can have many outputs – in the context of this Technical Specification the focus is on its Trip Planning functionality.

3.1 Terms used in OJP schema

3.1.1

AbsoluteBearing

absolute compass bearing in degrees

3.1.2

AccessFeatureType

[corresponds to AccessFeatureType of PATH LINK in TMv6]

type of physical feature of PATH LINK

3.1.3

Address

[TMv6]

descriptive data associated with a PLACE that can be used to describe the unique geographical context of a PLACE for the purposes of identifying it. May be refined as either a ROAD ADDRESS, a POSTAL ADDRESS or both

3.1.4

Altitude

altitude in metres above sea level

3.1.5

Attribute

generic attribute (with associated text) that can be associated with many facilities, PT service restrictions, etc.

3.1.6

BookingArrangement

[generalisation of BOOKING ARRANGEMENTS in TMv6]

arrangement for booking any TRIPLE(s)

3.1.7

CalcTime

calculation time in milliseconds

3.1.8

CallAtNearStop

indication of the walk distance and time to a nearby stop where relevant

3.1.9

CallAtStop

[same as CALL in SIRI]

meeting of a VEHICLE JOURNEY with a specific SCHEDULED STOP POINT

3.1.10

CertificateId

form of identification that can be used as a Message Integrity Property (public key cryptography)

3.1.11

Connection

physical (spatial) possibility for a passenger to change from one public transport vehicle to another to continue a trip, defined by two SCHEDULED STOP POINTs. Different times may be necessary to cover the link between these points, depending on the kind of passenger

3.1.12

ContinuousLeg

[a specialised type of RIDE in TMv5.1 and NeTex]

leg of a TRIP that is not bound to a timetable

3.1.13

ContinuousModes

modes that run at any time without a timetable

3.1.14**ContinuousService***[specialisation of SERVICE JOURNEY in TMv6]*

vehicle movement on a continuous, non-timetabled service

3.1.15**DataFrameRef***[corresponds to VERSION FRAME of data in TMv6]*

identifier of the set of data being used by an information system, which allows a comparison to be made with the versions of data being used by overlapping systems. Corresponds to VERSION FRAME Id

3.1.16**DatedJourney***[corresponds to DATED VEHICLE JOURNEY in TMv6]*

passenger carrying VEHICLE JOURNEY for one specified DAY TYPE for which the pattern of working is in principle defined by a SERVICE JOURNEY PATTERN. DatedJourney details include its operating days

3.1.17**Delivery**

process of delivering messages

3.1.18**DirectionCode***[related to DIRECTION in TMv6]*

identifier of a GROUP of DIRECTIONS of the ROUTEs belonging to the same LINE created for the purpose of filtering and organising timetables

3.1.19**Distance**

physical measurement of the distance between two specific points in metres

3.1.20**EntitlementProduct***[specialisation of a SERVICE ACCESS RIGHT in NeTEx that may be materialised as a TRAVEL DOCUMENT]*

precondition to access a service or to purchase a FARE PRODUCT issued by an organisation that may not be a PT operator (eg: military card, concessionary card, etc)

3.1.21**Equipment***[TMv6]*

item of equipment installed either fixed (PLACE EQUIPMENT) or on-board vehicles (VEHICLE EQUIPMENT). A service (LOCAL SERVICE such as LEFT LUGGAGE, TICKETING SERVICE) is considered as immaterial equipment as well. TYPE OF EQUIPMENT is a classification of EQUIPMENT

3.1.22**ErrorMessage**

message structure that indicates the error state, which could be "OK" if nothing went wrong

3.1.23**ExchangePoints***[specialisation of CONNECTION END in TMv6]*

points at which partial solutions from two different journey planning systems may establish a connection

3.1.24

Facility

[TMv6]

named amenity available to the public at a SITE or on a SERVICE. A FACILITY has no further properties other than a name. An EQUIPMENT or LOCAL SERVICE is used to describe the further properties provided as part of particular FACILITY

3.1.25

Fare

[corresponds to FARE PRODUCT in TMv5.1 and NeTEx]

different FARE PRODUCTS that may be available with related information

3.1.26

FareAuthority

[view of the aggregation of ORGANISATION and RESPONSIBILITY ROLE in TMv6]

ORGANISATION which has the RESPONSIBILITY ROLE for the definition of FARE PRODUCTS

3.1.27

FareParam

[corresponds to the FARE parameter model in TMv5.1 and NeTEx]

parameters which are used to determine the price to be paid for a FARE PRODUCT by a specific passenger

3.1.28

FarePassenger

[specialisation of USER PROFILE in TMv5.1 and NeTEx]

attributes of a passenger that influence the price to be paid by that passenger for a FARE PRODUCT

3.1.29

FareProductBooking

[aggregation of DISTRIBUTION CHANNEL and BOOKING ARRANGEMENT in NeTEx]

information to support the process of booking a FARE PRODUCT

3.1.30

FareProductPrice

[corresponds to FARE PRODUCT PRICE in TMv5.1 and NeTEx]

price at which a FARE PRODUCT can be purchased

3.1.31

FareProductValidity

[TMv5.1 and NeTEx]

conditions of use for a particular FAREPRODUCT

3.1.32

GeoArea

[specialisation of ZONE in TMv6]

LINK SEQUENCE (one-dimensional) forming the boundary of a ZONE

3.1.33

GeoCircle

definition of a circular GeoArea

3.1.34**GeoPositions***[generalisation of LOCATION in TMv6]*

Longitude, Latitude in WGS84 (and Altitude if required)

3.1.35**GeoRectangle**

definition of a rectangular GeoArea

3.1.36**GeoRestrictions**

Application of geographical restrictions to a search

3.1.37**GuidanceAdvice**

various types of guidance advice given to travellers

3.1.38**IndividualModes**

modes which an individual powers themselves (such as walk, cycle)

3.1.39**IndividualTransportOptions**

enumeration of the types and capabilities of Individual Modes

3.1.40**InitialLocationInput**

input of a GeoPosition for a starting point

3.1.41**InternationalText***[specialised view of ALTERNATIVE NAME in TMv6]*

alternative identified text to be used in specified languages

3.1.42**Journey***[specialisation of JOURNEY in TMv6]*

corresponds to a NORMAL DATED VEHICLE JOURNEY or to a DATED VEHICLE JOURNEY but may be extrapolated from a VEHICLE JOURNEY

3.1.43**Latitude**

latitude in degrees from equator

3.1.44**LegAlight**

situation at a stop or station at which the passenger alights from a TRIPLEG including time-related information

3.1.45**LegAttribute**

facilities available on a specified (part of a) TRIPLEG

3.1.46

LegBoard

situation at a stop or station at which the passenger boards a TRIPLEG including time-related information

3.1.47

LegIntermediate

situation at a stop or station that lies between the LegBoard and LegAlight stop or station including time-related information

3.1.48

LegTrack

LINK PROJECTION of a TRIPLEG onto the topography of the route being followed

3.1.49

Length

distance in metres between two points normally along a defined route

3.1.50

Line

[TMv6]

group of ROUTEs which is generally known to the public by a similar name or number

3.1.51

LineDirection

[corresponds to DIRECTION in TMv6]

GROUP of DIRECTIONS of the ROUTEs belonging to the same LINE created for the purpose of filtering and organising timetables

3.1.52

LineIdentity

[TMv6]

number, letter or name that identifies a particular LINE

3.1.53

LinkProjection

[TMv6]

oriented correspondence from one LINK of a source layer, onto an entity in a target layer: e.g. LINK SEQUENCE, COMPLEX FEATURE, within a defined TYPE OF PROJECTION

3.1.54

Location

spatially-related input (such as name, postcode, coordinate, etc) given by an enquirer and used by the LocationInformation service

3.1.55

LocationInformationService

service establishing the existence in an information system of a location of various types as seen by an enquirer

3.1.56

LocationText

text used by an enquirer of an information system to indicate an origin, destination or other location

3.1.57**Longitude**

longitude in degrees from Greenwich

3.1.58**MessageIntegrityProperties**

properties that allow checks for message integrity

3.1.59**Mode**

[specialisation of MODE in TMv6]

extended range of VEHICLE MODEs, aggregating them with some SUBMODEs

3.1.60**MultiPointTrip**

[special concept relevant to distributed journey planning]

Trip that is defined by multiple alternative Origins and/or Destinations

3.1.61**MultiTripFare**

[specialisation of FARE PRODUCT in TMv5.1 and NeTEx]

one or more FARE PRODUCTS covering multiple TRIPs or TRIPLEGs

3.1.62**NoChangeAt**

no-change-at restrictions for a TRIP, i.e. SCHEDULED STOP POINTs or STOP PLACEs at which no TRANSFER is allowed within a TRIP

3.1.63**NotVia**

not-via restrictions for a TRIP, i.e. SCHEDULED STOP POINTs or STOP PLACEs that the TRIP is not allowed to pass through

3.1.64**NumberOfResults**

parameter to control the number of TRIP results before/after a point in time. May NOT be used when departure time at origin AND arrival time at destination are set

3.1.65**Occupancy**

[corresponds to OCCUPANCY in SIRI]

passenger load status of a VEHICLE

3.1.66**OJPService**

IT service within the OJP schema

3.1.67**OJPSubscription**

subscription arrangement for a participant in a Distributed Journey Planning system

3.1.68**OpenPercent**

percent value as integer, no upper limit

3.1.69

OperatingDay

[TMv6]

day of public transport operation of which the characteristics are defined in a specific SERVICE CALENDAR and which may last more than 24 hours

3.1.70

Operator

[TMv6]

company providing public transport services

3.171

OptimisationMethod

types of algorithm that can be used for planning a TRIP (fastest, least walking, etc)

3.1.72

OsmTag

tag used in the Open Street Map system

3.1.73

Owner

[specialisation of an ORGANISATION in TMv6]

ORGANISATION with ownership as the RESPONSIBILITY ROLE

3.1.74

Participant

[corresponds to PARTICIPANT in SIRI]

IT system that is participating in a communication with other participant(s)

3.1.75

PassengerCategory

[specialised simplified view of USER PROFILE in TMv5.1 and NeTEx]

classification of passengers by age or other factors that may determine the fare they will need to pay

3.1.76

PathGuidance

[extended view of a NAVIGATION PATH in TMv6 to include the textual navigation instructions]

description of a piece of a TRIP. May include geographic information, turn instructions and accessibility information

3.1.77

PathGuidanceSection

one or more path guidance sections that build the TRIPLEG

3.1.78

PathLink

[specialised view of a PATH LINK in TMv6]

link within a PLACE or between two PLACES (that is STOP PLACES, ACCESS SPACES or QUAYS, BOARDING POSITIONS, POINTS OF INTEREST etc or PATH JUNCTIONS) that represents a step in a possible route for pedestrians, cyclists or other out-of-vehicle passengers within or between a PLACE

3.1.79

Percent

percent value as integer, limited to max value 100

3.1.80**PhoneNumber**

[specific attribute of CONTACT DETAILS in TMv6]

phone number for a specified organisation, department or purpose

3.1.81**Place**

[TMv6]

geographic PLACE of any type which may be specified as the origin or destination of a trip

3.1.82**PlaceContext**

[view of PLACE in TMv6]

PLACE and access to it by individual transport

3.1.83**PlaceData**

types of PLACE-related data that can be used as filters

3.1.84**PlaceInformation**

Information about a specific PLACE

3.1.85**PlaceType**

[corresponds to TYPE OF PLACE in TMv6]

classification of basic types of PLACE

3.1.86**PlaceUsage**

use of a PLACE as an origin, destination or via

3.1.87**PointOfInterest**

[corresponds to POINT OF INTEREST in TMv6 with related information]

type of PLACE to or through which passengers may wish to navigate as part of their TRIP and which is modelled in detail by journey planners

3.1.88**PointOfInterestCategory**

[view of POINT OF INTEREST CLASSIFICATION in TMv6]

categorisation of POINTs OF INTEREST in respect of the activities undertaken at them

3.1.89**Priority**

priority values ranging from 1 (highest) to 5 (lowest)

3.1.90**PrivateCode**

code within scope of a private referential system

3.1.91

PrivateMode

[category of MODE in TMv6]

MODEs offered by private individuals

3.1.92

PrivateService

specific service operated by a Private Mode

3.1.93

ProgressBetweenStops

[similar to SIRI]

type for progress between stops

3.1.94

PtMode

[from SIRI]

mode of public transport service, corresponds to VEHICLE MODE and SUBMODE

3.1.95

PtSubmode

[corresponds to SUBMODE in TMv6]

submode of a public transport mode

3.1.96

RouteDescription

[attribute of ROUTE in TMv6]

descriptive text for a ROUTE, eg: "Airport via City Centre"

3.1.97

Service

depending on context the word service can refer to a PT service (being an overall package of one or more public transport routes, timetables and travel facilities offered); or an IT service; or a journey planning, information or other functional service; or an immaterial facility such as Left Luggage. The context is often clear when it is used with another term (as in PT service, special service, service link, service pattern, etc)

3.1.98

ServiceDelivery

[IT service, taken from SIRI]

response from producer to consumer to deliver payload data. Either answers a direct ServiceRequest or asynchronously satisfies a subscription. May be sent directly in one step, or fetched in response to a DataSupplyRequest

3.1.99

ServiceFacility

[view of a SERVICE FACILITY SET in TMv6]

(a view of) SERVICE FACILITY SET (a set of FACILITIES available for a specific VEHICLE TYPE (e.g. carriage equipped with low floor) possibly only for a service (or for a SERVICE JOURNEY or a JOURNEY)

3.1.100

ServiceRequest

[an IT service, taken from SIRI]

request for the immediate delivery of data. Answered with a ServiceDelivery (or a DataReadyRequest)

3.1.101**ServiceResponse***[an IT service, taken from SIRI]*

response message containing a payload and various attributes of its own

3.1.102**ServiceStatus**

parameters which describe the current status of a DATED VEHICLE JOURNEY

3.1.103**ServiceViaPoint***[specialisation of VIA in TMv6]*

STOP PLACE or SCHEDULED STOP POINT as a VIA for a particular SERVICE PATTERN. Specialisation of a VIA

3.1.104**SharingModel**

sharing service loan and return scheme

3.1.105**SharingService**

transport service that provides shared vehicles

3.1.106**Signature**

data for transmission of message signatures (public key cryptography), used to prove Message Integrity

3.1.107**SituationFullRef**

reference to situation message. Message details might be found in response context or through other communication channels

3.1.108**Situations***[as SIRI]*

container for the structured description of situations in public transport or on the road (individual transport)

3.1.109**Speed**

relative speed in percent. If given slows the standard speed (below 100) or increases it (above 100)

3.1.110**StaticFare***[specialisation of a FARE PRODUCT in TMv5.1 and NeTEx]*

list of FARE PRODUCTS under the responsibility of a FARE AUTHORITY, independent of any specific trip result

3.1.111**Status**

whether the request was processed successfully or not. Default is "true"

3.1.112

StopAttributes

[properties of a SCHEDULED STOP POINT or STOP PLACE in TMv6]

selection of attributes of ACCESSIBILITY LIMITATION related to a SCHEDULED STOP POINT extended by attributes referring to some PLACE EQUIPMENT

3.1.113

StopCallStatus

[see SIRI CALL]

current status of each stop along the route of a PT Service

3.1.114

StopEvent

[see SIRI CALL]

departure or arrival event or both

3.1.115

StopEventContent

[see SIRI CALL]

parameters which define the extent of information to be returned in a Stop Event result

3.1.116

StopEventData

[see SIRI CALL]

parameters which establish various filtering criteria for Stop Event results

3.1.117

StopEventParam

[see SIRI CALL]

parameters which define what is to be included in a Stop Event result

3.1.118

StopEventPolicy

[see SIRI CALL]

parameters which define the number, Time Window and types of Stop Event to be included

3.1.119

StopFacility

[corresponds to a SITE FACILITY SET in TMv6]

FACILITY that applies to a stop

3.1.120

StopFare

stop-related FARE PRODUCT information

3.1.121

StopPlace

[extended view of STOP PLACE in TMv6]

STOP PLACE extended by ACCESSIBILITY LIMITATION properties and of the associated equipment, comprising one or more locations where vehicles may stop and where passengers may board or leave vehicles or prepare their trip, and which will usually have one or more wellknown names

3.1.122**StopPoint**

[extended view of SCHEDULED STOP POINT in TMv6]

SCHEDULED STOP POINT extended by ACCESSIBILITY LIMITATION attributes and with identifier and name where passengers can board or alight from vehicles

3.1.123**SubMode**

[TMv6]

variant of a MODE, as for instance international or domestic rail (rail being the MODE)

3.1.124**Subscription**

[see SIRI]

arrangement which allows a specific organisation to access an information system - usually taking the form of security parameters which may or may not need to be paid for

3.1.125**SubscriptionRequest**

[see SIRI]

request from a subscriber to a producer for a subscription to a particular IT service. Answered with a SubscriptionResponse

3.1.126**TariffZone**

[corresponds to TARIFF ZONE in TMv5.1 and NeTEx]

ZONE used to define a zonal fare structure in a zone-counting or zone-matrix system

3.1.127**TerminateSubscription**

[see SIRI]

request to end a subscription to a particular IT service

3.1.128**Ticket**

[corresponds to a FARE PRODUCT in TMv5.1 and NeTEx]

FARE PRODUCT which may be materialised as a TRAVEL DOCUMENT and which gives the passenger an entitlement to travel on one or more specific TRIPLEGs subject to specified conditions

3.1.129**TimedLeg**

[corresponds to a RIDE in TMv6 (with related information)]

passenger TRIPLEG with timetabled schedule

3.1.130**TimeWindow**

window of opportunity that the traveller has to perform a specific TRIPLEG

3.1.131**TopographicPlace**

[TMv6]

type of PLACE providing the topographical context when searching for or presenting travel information, for example as the origin or destination of a trip. It may be of any size (e.g. County, City, Town, Village) and of different specificity (e.g. Greater London, London, West End, Westminster, St James's)

3.1.132

TrackSection

LINK PROJECTION on the infrastructure network of the TRIPLEG together with time information

3.1.133

Transfer

travel between two POINTs located sufficiently near to each other that they represent for a passenger a possibility to reach one of the POINTs when starting at the other in a timescale which is realistic when undertaking a TRIP, eg: ACCESS or CONNECTION

3.1.134

TransferDuration

[attribute of a CONNECTION (not INTERCHANGE) in TMv6]

calculated duration in a response taking into account the request parameters.; TransferDuration plus waiting time is the minimum interval between arrival and departure time

3.1.135

TransferLeg

[specialisation of NAVIGATION PATH in TMv6]

description of a TRIPLEG which links other TRIPLEGs where a TRANSFER between different LOCATIONs is required

3.1.136

TransferModes

MODEs dedicated to perform TRANSFERs

3.1.137

Transition

transition types for interchanges

3.1.138

Trip

[extended view of TRIP PATTERN in TMv5.1 (to include time-related information)]

whole journey from passenger origin to passenger destination in one or more TRIPLEGs

3.1.139

TripContent

parameters that control the level of detail of the TRIP results

3.1.140

TripData

data to be included/excluded from search, eg: modes, operators, etc

3.1.141

TripFare

Fare for a specified TRIP

3.1.142

TripFareProduct

[specialisation of FARE PRODUCT in TMv5.1 and NeTEx]

FAREPRODUCT covering a part or the whole of a TRIP from boarding the first public transport vehicle to alighting from the last public transport vehicle (corresponds to a package of PREASSIGNED FARE PRODUCTs)

3.1.143**TripInfoService**

short for Trip Information Service. OJP Service that provides details on a single VEHICLE JOURNEY that may be used by a passenger TRIP

3.1.144**TripLeg**

[generalisation of RIDE in TMv5.1 covering more MODEs]

single stage of a TRIP that is made without change of MODE or VEHICLE JOURNEY (ie: between each TRANSFER)

3.1.145**TripLocation**

location of a passenger currently travelling in a VEHICLE

3.1.146**TripMobility**

parameters the user can set to restrict the mobility options, particularly for interchanging

3.1.147**TripParam**

parameters which define the content expected in a TRIP plan

3.1.148**TripPolicy**

parameters which control the TRIP search behaviour

3.1.149**TripSummary**

summary of the details of a TRIP

3.1.150**TripVia**

VIA restrictions for a TRIP

3.1.151**TurnAction**

range of alternative turns that can be described

3.1.152**TypeOfFareClass**

classes of travel available on a particular PT service which will affect the price to be paid

3.1.153**ValidDayBitType**

sequence of bits (values 0 or 1) coded as a text string and representing days

3.1.154**VatRate**

relevant Value Added Tax rate

3.1.155

Vehicle

[a specialisation of VEHICLE in TMv6 to include privately operated vehicles as well as public transport ones]

specific type of vehicle used for carrying passengers

3.1.156

VehiclePosition

geographical and logical position of a vehicle

3.1.157

VehicleProgress

progress of a vehicle relative to timetable service pattern

3.1.158

Version

[TMv6]

group of operational data instances which share the same VALIDITY CONDITIONS. A version belongs to a unique VERSION FRAME and is characterised by a unique TYPE OF VERSION

3.1.159

WebLink

URL of a web resource with label

3.1.160

Weekday

[derived from DAY OF WEEK and PROPERTY OF DAY in TMv6]

enumeration of individual the seven DAYS OF WEEK, along with public holidays

3.1.161

WeekdayTimePeriod

[specialisation of TIME BAND in TMv6]

aggregation of TIME BAND, DAY OF WEEK and PROPERTY OF DAY

3.1.162

Zone

[TMv6]

two-dimensional PLACE within the service area of a public transport operator (administrative zone, TARIFF ZONE, ACCESS ZONE, etc.)

3.2 Terms in OJP Schema

The following are extensions that can be associated with other Dictionary entries

3.2.1

Base

basic or default requirement

3.2.2

Code

shorthand reference for a particular item of data

3.2.3**Enumeration**

set of values that can be associated with the term

3.2.4**Filter**

parameter that controls the level of detail of a particular type of information

3.2.5**FilterGroup**

collection of parameters that control the level of detail of a particular type of information

3.2.6**FilterStructure**

structure of a set of filter parameter(s)

3.2.7**Group**

group of elements related to a particular topic

3.2.8**Input**

requirement for specific type of information to be supplied for the system to work

3.2.9**InputStructure**

structure of the way an INPUT is to be expressed

3.2.10**Ref**

code that refers to something specific, normally of a specified type (such as VEHICLE JOURNEY, STOP POINT, DAY TYPE, etc)

3.2.11**RefGroup**

group of REFs related to a specific topic

3.2.12**ReferenceStructure**

structure of the way that a REF code is expressed in a particular context

3.2.13**RefStructure**

same as "Reference Structure"

3.2.14**Request**

structured message requesting specific information

3.2.15**RequestStructure**

structure of a Request for a particular type of information

3.2.16

Response

structured message providing specific information that has been requested

3.2.17

ResponseStructure

structure of a Response for a particular type of information

3.2.18

Result

partial or complete outcome from a data search or calculation including status information

3.2.19

ResultStructure

structure of a Result from an enquiry

4 Symbols and abbreviations

API	Application Programming Interface
DJP	Distributed Journey Planning
DS	Distributing System
EHS	Enquirer's Home System
EU	European Union
HTTP	HyperText Transfer Protocol
IFOPT	Identification of Fixed Objects in Public Transport
IP-KOM	Internet-Protokoll basierte K ommunikationsdienste (IP-based communications services)
ISO	International Standards Organisation
IT	Information Technology
NeTEx	Network and Timetable Exchange
OJP	Open Journey Planner
Open API	An API which is published for widespread implementation
POI	Point of Interest
PT	Public Transport
REST	Representational State Transfer
RS	Responding System
SIRI	Service Interface for Real-time Information
SOAP	Simple Object Access Protocol
TM	Transmodel
TPEG	Transport Protocol Experts Group
TRIAS	Travellers' Realtime Information and Advisory Standard
UML	Unified Modelling Language
URI	Uniform Resource Identifier

URL	Universal Resource Locator
VDV	Verband Deutscher Verkehrsunternehmen (D)
WGS	World Geodetic Standard
WSDL	Web Services Description Language
XML	eXtensible Mark-up Language
XSD	XML Schema Document

5 Use cases

5.1 General

The following use cases describe the requirements for the standardised OJP schema that is being proposed for Distributed Journey Planning (DJP). It covers both key tasks that are essential for the core functions in a DJP system and some additional tasks that might usefully complement such systems. It is suggested that all implementations should cover the essential tasks – and each should also describe in a discovery mechanism those other functions which that particular implementation is able to handle.

The following descriptions assume a relatively simple and straightforward example of Distributed Journey Planning in which there are four key "actors" or "roles" in the process :

- 1) **enquirer** – the person asking for information
- 2) the enquirer's **home system** – the journey planning system to which the enquirer is connected
- 3) a **distributing system** - the system that distributes journey planning enquiries to other systems
- 4) **responding system(s)** – the system(s) that respond to questions from the distributing system.

An enquirer requests a trip from a journey planning system which is referred to as the enquirer's **home system** – and the home system then has to recognise that the enquiry requires information from other systems. It therefore passes the enquiry to a **distributing system** (which may be integrated with the home system or physically separate) which makes enquiries of one or more **responding system(s)** from which it will glean additional information in order to put together a comprehensive trip plan to meet the enquirer's request. Once the **distributing system** has the required comprehensive trip plan it returns this to the home system, which in turn presents the results to the enquirer.

The **home system** will have a user interface through which it receives enquiries from enquirers, and through which it responds to those enquirers. It may have its own journey planning capability for a specific geographical territory (which could also cover only certain modes of transport) – or it may only have sufficient intelligence to know that it needs to draw information from other journey planning systems by passing the enquiry to the distributing system.

The **distributing system** will need to know from which journey planning systems it needs to draw all relevant information to meet the requirements of each enquiry it receives, and it needs to be able to communicate with the relevant responding systems – which it would do using an API.

To describe the geographical context of a distributed journey planning system there are three key concepts

- 1) the **local region** – the territory for which the journey planner itself can plan trips without information from other systems
- 2) the **adjacent regions** – the regions which are adjacent to the local region and have their own "local" journey planning systems

- 3) **remote regions** – the regions which have their own "local" journey planning systems but which are not adjacent to the local region

There are five typical distributed journey planning scenarios (in addition to the non-distributed scenario of a local point to a local point), each of which may require handling in a different way depending on the architecture of the distributed journey planning system:

- 1) local point to remote point.
- 2) local point to adjacent region point.
- 3) remote point to remote point (same region).
- 4) remote point to remote point (different regions)
- 5) remote point to remote point (different but adjacent regions)

A point in the above descriptions refers to any location which can be translated into geographical coordinates – this might be, for example, the centre of a topographic place (city, town, village), the centre of a postcode, or a specific address or point of interest. Or it can also refer to a public transport stop which might be translated into either its unambiguous Reference (code) or its geographical coordinates.

In some distributed journey planning systems there may be one or more additional types of responding system, particularly where there is a separate journey planner providing information for long-distance travel (such as a rail and/or coach journey planner, or ones covering flights and/or ferries, or ones covering car journey planning as an access option to and from public transport). Such additional planners may have a larger territorial area than the regional planners that cover local transport.

As noted earlier, this Technical Specification is concerned with the communication protocols necessary to pass enquiries and responses between participating DJP systems. It is not concerned with the architecture or logic of the journey planning engine that sits in any distributing system, through which the user's enquiry is broken down into appropriate components. Each component is then forwarded to a relevant local journey planning system with DJP capabilities (a **responding system**) in order to collect information about each component of the requested trip plan.

5.2 Key tasks for Distributed Journey Planning

5.2.1 Planning a component of a trip

An enquirer wishes to plan a trip and places the enquiry with a journey planning system that has DJP capabilities (the enquirer's **home system**). Part of the requested trip lies in an area covered by a different journey planning system which also has DJP capabilities. The initiating **home system** (the one which received the end-user's enquiry) passes the journey planning details to a **distributing system** which creates a journey planning request to pass to the **responding system** for the component of a trip in the responding system's territory. The request comprises one or more origin points, one or more destination points, a preferred departure or arrival time at each of either all of the origin or all of the destination points, and any preference that the enquirer may have stipulated for modes (and sub-modes) of transport to be included in or excluded from the trip plan, along with any specific accessibility / mobility requirements. Maximum walk distances and estimated walk speeds should be included, with a separate connection walk speed that may be different. It may also include a via (or not via) point, or a point at which a transfer may or may not take place, and it could specify preferred operator(s) of PT services, or specific PT services. It could include the journey planning algorithm that is preferred (such as fastest, least walking or least connections). And it could ask for the response to just give the essential details, or it could ask for all stops to be shown, with scheduled times or currently projected times from a real-time system. If cycling is offered as an option to reach the start of a public

transport trip (or to complete the trip) then this would need to be requested and parameters would specify maximum cycle distance and expected cycling speed. Finally the number of trip options to be returned needs to be specified – in terms of a number of trip options, or a time period to be covered by the trip options offered, and whether trips are required from each requested origin or just any one or more of them, and likewise to each requested destination or only to any one or more of them.

5.2.2 Discovering relevant stops

In order to specify a DJP request it will be necessary for the **distributing system** to determine the set of stops from one of which the requested component of the trip has to start – and likewise the set of stops at one of which it has to end. This set of stops are those to or from which the **distributing system** is able from its own resources (or from responses to other component enquiries) to plan the requested overall trip. There may be a need, therefore, to establish the identity of potential connection stops on the border between journey planning systems. This would require an exchange of questions and answers, delivering the name of the stop, its coordinates and the code by which it is recognised by the relevant **responding systems**.

5.2.3 Obtaining information about accessibility and services for those with special needs

Travellers with mobility, sensory or other disabilities may have special needs when using public transport. The user making an enquiry will need to be able to describe their own needs in a simple and codified way that can be interpreted intelligently by journey planners, so that solutions offered best meet the needs of the enquirer. The schema for DJP systems therefore has to be able to convey the specific needs of such travellers, whilst the responses have to be able to carry the information necessary to describe the accessibility or other features of the PT services being proposed in the trip plan in sufficient detail that the traveller can be confident of what will be offered when making the trip. For this to be matched to available information about accessibility restrictions it would be necessary to return information about the leg path – so that information about access paths and connection paths is linked to the physical restrictions that apply to them (ramps, escalators, lifts, stairs, etc).

5.2.4 Seeking route information that can be displayed on maps

A trip plan will comprise several distinct components. At a minimum it will normally involve an access leg to get to the public transport system, a public transport leg and a final access leg to get from the public transport system to the required destination of the passenger's trip. Whilst the passenger should be able to rely on the public transport vehicle taking them from the boarding point to the alighting point, many passengers for one reason or another like to follow their route on a map. But the requirement for a map is much greater for the access legs at each end of a trip – and for any transfers necessary in the course of the trip. To that end it should be possible to request sufficient details of the track (sequenced map coordinates) of the trip to be made such that it can be plotted over a topographic map of the trip at various scales or zoom levels, sufficient to see detail where it is most needed but also to be able to see the whole trip in context.

5.3 Other possible tasks for a Distributed Journey Planning system

5.3.1 Requesting a stop timetable

Whilst a traveller may wish to plan a specific trip, it may equally be useful to be able to see a list of all departures from a specific stop within a specified time window – a "stop timetable". A request for such a timetable might specify not only the stop but possibly an individual platform within such a stop.

5.3.2 Requesting times for all intermediate stops in a trip

Whilst a trip may be specified by simply its boarding and alighting stops and times, it is also possible to ask for trips to be described with details of all stops between the boarding and alighting points and the times at which these stops are expected to be reached. This would help a passenger follow the progress of their trip along the route.

5.3.3 Requesting expected events at a particular stop

With an increasing number of operations having real-time monitoring and prediction systems the departure times of vehicle journeys can be obtained not only in the form of a timetable, but also in the form of predicted departure times calculated in real time. So whilst this information is not available when pre-planning a trip a long time in advance, it becomes available close to the scheduled departure times (and becomes increasingly accurate as the scheduled time gets ever closer). A "stop event" request and response should deliver the best information known at the current time for departures from a stop in the next short while – perhaps 30 min or an hour. Whilst this information may be available locally, the DJP system provides an opportunity for such information to be available in the user's native language and in a style of presentation with which they are familiar if they make the request through the initiating system rather than seeking the information from a local information system.

5.3.4 Requesting information about the fares and ticket options for a particular trip

One of the most challenging aspects of public transport information is that related to fares and tickets, with significant differences in the way in which fares are determined, in the nature of the types of ticket that are available, and the way in which tickets can be purchased. As journey planning systems increasingly provide at least basic information about fares and tickets so a DJP system should be able to interrogate such systems and convey the relevant information to enquirers. The first priority for detailed information would be to give the price for a specific planned trip on the assumption that it is paid for with single trip tickets. However such information places public transport at a disadvantage as many public transport systems have much cheaper ticket options for return tickets, multi-trip tickets, multi-person tickets, etc. So a second priority would be to provide more general information about ticketing systems in a specific geographical area. In addition there may be a requirement to provide hyperlinks to on-line retailers of relevant tickets.

5.3.5 Other possible questions

Whilst the Open API will cover all normal forms of journey planning request, it is recognised that some journey planning systems may wish to ask for supplementary information if it is available. Examples of such requests might be to seek a "rain safe" trip (one which minimises exposure to the weather), or to ask for an estimate of energy usage for each leg of a trip. Such requests could be added to the schema on a bi-partite basis between systems that can exchange such additional information, without undermining the generality of the Open API specification.

6 System Architectures, Metadata and Data

6.1 General

This technical specification does not seek to specify how a distributed journey planning system should work – the specification is agnostic on this question as experience has shown that each of the methods used to date has required a very similar question-and-answer protocol, which in essence is what the API provides. However the experience of the three main distributed systems to date (and that being developed in France) offers some indications of the alternatives that can be considered – and further details of the three historic systems (EU-Spirit, DELFI and JourneyWeb) and the emerging French system (APII-SIM) are given in Annex B.

6.2 General considerations

The core of Distributed Journey Planning lies in the fact that several journey planning systems have to contribute to fulfil a complex (or very long-distance) journey planning task. This task is split into smaller sub-tasks by the **distributing system**. The sub-tasks are then sent to **responding systems** that take care of them.

This approach has some working assumptions:

- 1) The **distributing system** is able to split the original task into sensible sub-tasks.
- 2) The **distributing system** knows from which **responding systems** reasonable solutions for a sub-task can be expected.
- 3) The **distributing system** knows the exchange points (and their identifiers) that will link the parts of the overall trip (the solutions of each **responding system** for a sub-task). In most cases this will comprise the stop identifiers of relevant stations, airports, ferry ports or coach hubs.

Points 1 and 2 above emphasise the necessity of knowing the coverage of each **responding system** in terms of area and transport services. Splitting a long-distance (maybe cross-continent) trip request into pieces involves identifying parts of the overall trip that can be covered by **responding systems** that have incorporated timetable data for certain areas or transport services. This knowledge about responding systems' capabilities can be kept in static files or in an online register (see 8.11).

Probably the most crucial difference in the architectures that have been used for distributed systems to date has been the way in which relevant data is held, and where the various stages of computation take place.

For a participating system there are two questions to be asked for each enquiry

- Can this enquiry be responded to using only information already in this system? If so, then distributed planning is not required.
- If a distributed journey plan is required, which other journey planning systems can provide the components that might make up the journey plan solution.

If a distributed journey plan is required then the architecture of the distributed system will determine how the calculation is made. Some of the questions and options are :

- Is it possible for the **home system** to include long-distance public transport information to the exchange points in all other regions? – if so the journey planning calculations are simpler and the risk of sub-optimal solutions being offered is minimised
- To what extent can each of the participating systems include data for PT services which traverse its own region's immediate regional boundary? This would help to ensure that such trips can be planned on a single system (rather than distributed) – avoiding the undoubtedly difficult situation where services repeatedly cross the boundary between adjacent journey planning systems
- Can the distributed journey be planned on the Enquirer's **home system**, which itself draws information from one or more other systems to cover the long-distance leg (if not held in the user's home system) and the distant local leg of the trip solution (peer-to-peer arrangement)?
- Is a distributed enquiry passed to a central **distributing system** which then draws information from both the user's home system and from other relevant **responding systems** before passing the solutions back to the home system? The central **distributing system** might itself host a multi-modal journey planner covering the long-distance PT services required to join the respective exchange points in each participating region (centralised arrangement).
- A central system might start by planning the core long-distance element of the trip first, and then add the feeder legs into and from that long-distance trip ... or it might try to plan the trip sequentially from origin to destination

- What is the most efficient sequence of planning the trip? If long-distance data is held within the user's home and distant **responding systems**, then it is likely that one end of the trip has fewer potential exchange points than the other – so allowing the end with the larger number of exchange points to plan its own local leg of the trip and the long-distance leg. This is less complex and therefore more efficient than the other way around.
- Whatever planning method is used both forward and backward planning will be necessary to ensure that the solutions are optimised, by ensuring that the best trips are offered
- No matter how the journey planning systems are separated in terms of geographical or PT service scope, there is always an option to co-locate different systems (or copies of different systems) if this would provide advantages in terms of speed of inter-communication between the distributed system partners, as they could be linked across a very high-speed Local Area Network. This then maintains the separate management of each local journey planning system whilst avoiding the latency involved in communication between servers over the internet.

6.3 Metadata requirements

The journey planning methods noted above imply a need to have an understanding of the overall network of public transport services, as well as the geographic scope of each participating journey planner (the **responding systems**). This requires several sets of metadata which might include :

- Gazetteers which allow the journey planning systems to determine the journey planning system areas in which the origin and destination respectively are situated
- Lists of potential exchange points that might be passed through in any distributed journey plan – typically these represent locations on the long-distance public transport network at which the long-distance legs of trips might start or finish ... so the interface between the "trunk" legs and the "local" legs at each end of the overall trip.

Identifying the exchange points (and their identifiers) that can be used for joining the parts of the overall trip delivered by each of the **responding systems** could be done in one of the two following ways:

- by static files that list the exchange points for each responding system (or each pair of responding systems)
- by an online-request for exchange points that can be sent to each responding system.

6.4 Core data requirements

Experience has shown that journey planners generally need to be able to identify a location for the start and end of a trip from a user's input of

- Any stop, station or other public transport terminal
- A topographic place (city, suburb, town, village or hamlet)
- A wide range of different types of points of interest
- A named street
- The postal street addresses of an individual property
- A postcode (particularly relevant where these are very precise, as in the UK where a postcode typically covers no more than about 50 addresses on a specified street)

- A point on a map.

There are two options how to lookup these types of locations (see Figure 1). The enquirer's **home system** could collect all topographic place data from all **responding systems** (if no such central topographic place database already exists) and harmonise them into a local copy of a system-wide topographic place gazetteer. This typically involves an off-line process of collecting the data and making all entries unique. The other option is to look up relevant matches from the **responding systems** at the time the user request is received. This latter option does not need an off-line pre-processing step, but makes dealing with the request at run-time much more complex. In any case it is crucial that the journey planning requests are sent to the **responding systems** with object identifiers for the origin and destination location (and all exchange points) that the **responding systems** are able to interpret correctly.

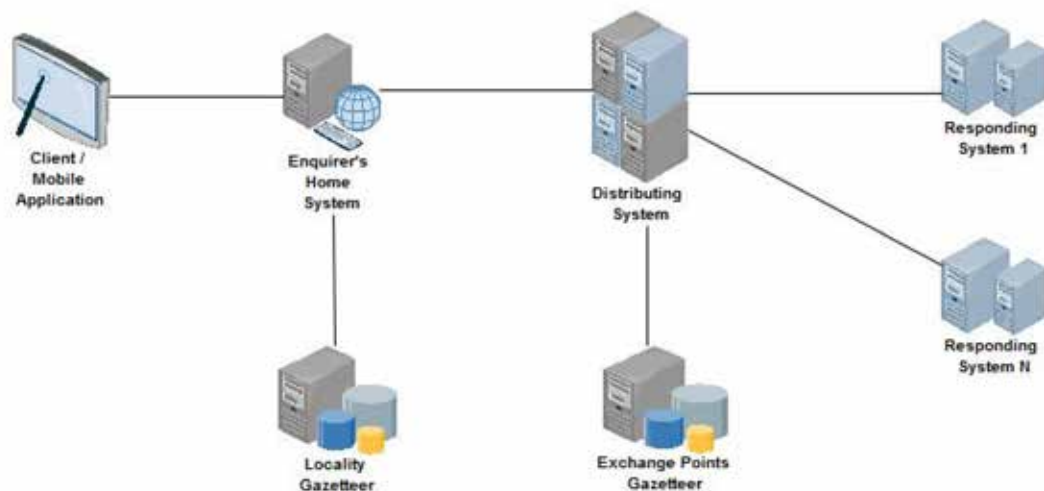


Figure 1 — System Architecture of a Distributed Journey Planning environment

If a system-wide Topographic place Gazetteer does not exist, the Enquirer's home system has to retrieve distant localities (and their object identifiers) from the responding systems (via the distributing system) at run-time.

For all these types of locations to be usable each needs to be associated with a precise geo-location in the form of coordinates following a recognised standard (including those which can be converted to a different standard coordinate system if necessary). For locations which are "areas" (such as cities, towns, villages or large points of interest such as a hospital or a park) then it is normal that an arbitrary central point is taken as a proxy for the overall location, although it may also be possible to represent large points of interest by a set of points (in effect "entrances" to the relevant area) each of which could be used as an alternative location for the POI.

The journey planner will also need a topographic map which allows the routing of trips to follow appropriate roads, alongside the ability to plan walk legs along all available pedestrian routes, and the ability to present the origin, destination, interchanges and stops, and routes. In some locations it may be necessary to prevent the use of certain paths or roads by a routing engine (eg: not allowing pedestrians to walk along motorways or through road tunnels). If the journey planning engine finds interchange opportunities by proximity rather than by such opportunities being identified in the stops data, then mechanisms may be needed to add barriers to prevent interchanges connecting stops that have no physical connections (eg: on two sides of a river which has no bridge).

The schedules of all public transport services need to be available – and should be encoded to a unique representation of each physical stopping point (matching the gazetteer entry location for such points).

Consistent rules are required to ensure that adequate time is allowed for connections between PT services – taking into account the time that may be required for ticket purchase, and movement between the respective stopping points, as well as taking account of potential routine perturbation of operations (for instance allowing up to, say, 3 minutes for the possible late running of a service from which a connection is to be made to an otherwise on time onward leg of the trip). For airports and ferry ports the connection times also need to allow for security and baggage handling arrangements – and for these there are differences between those travelling with or without luggage and between those who like to have generous time allowances at such locations, and those who are happy with tightly timed connections.

Data ideally should include accessibility information associated with vehicle journeys, physical stops and transfer locations, such that the planner can advise whether trips can be made by wheelchair users, or those with mobility problems that may require lifts rather than stairs or escalators.

Booking information should be included for PT services which require booking in advance (either because they have reserved seats, such as a long-distance coach service, or because they are demand-responsive services). In general this would be expected to be a hyperlink to a third-party site on which reservations can be made.

Arrangements for accessing fare information may also be included. Requirements for this differ widely from country to country, and between different types of PT service. Where information can be found on-line or where ticket purchase is possible on-line then a hyperlink to such sources or services should be included.

In France (and maybe elsewhere) an option for car-pooling is envisaged, where a car driver offers to provide transport to one or more passengers to share his or her car.

7 Open API for Distributed Journey Planning – OJP Services

7.1 Departure Monitor

7.1.1 Purpose

The departure monitor service shows the departures from a certain stop / station. Real-time information systems can also integrate the available forecast data and the information about interruptions. The OJP API is oriented towards end-users of the information, and can look backwards as well as predicting forwards in time. This is in contrast to SIRI, which is oriented towards communication between information systems and focuses only on observations and predictions of vehicle positions in current time,

The arrival monitor variant informs of the arrival times of the various modes of transport at a stop / station.

If, for instance, a coordinate has been chosen as the point of departure instead of a stop / station, the departures (arrivals) at the stops / stations within a specified radius are shown (perhaps with information about the distance to the stop).

The departure monitor service can also be used to provide the data for the operation of a digital passenger information monitor.

7.1.2 Interactions

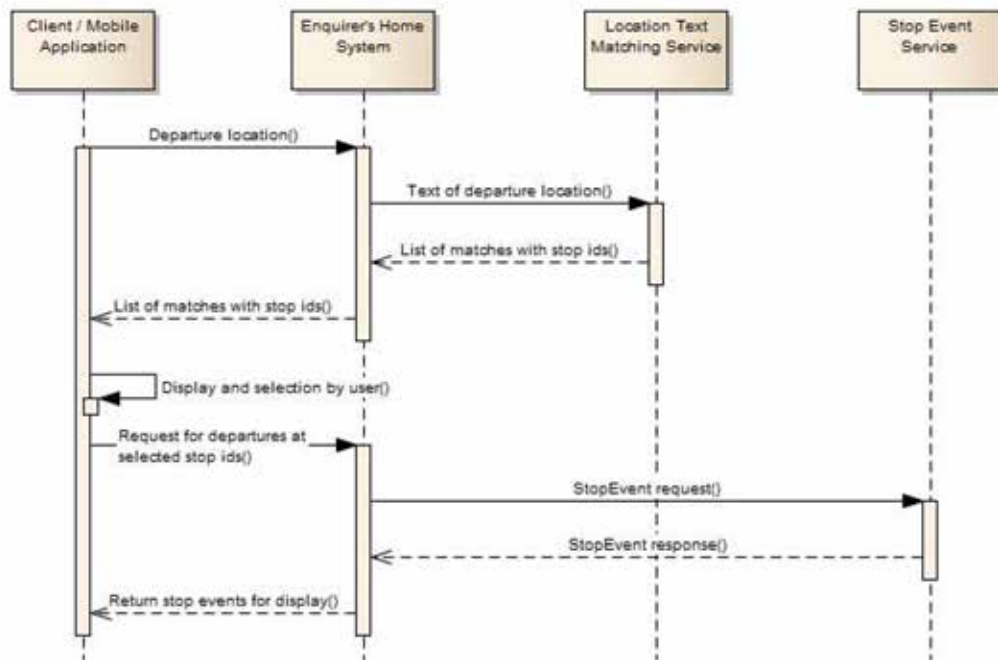


Figure 2 — Sequence diagram for a departure monitor

7.1.3 Concerned Components

Service provider: Responding System

Service requester: Home System

7.1.4 Function 1: Departure Monitor

Input data

- Departure location (as coordinate, stop / station, stop area, address, POI)
- Date and time
- Departure or arrival variant (or both)
- User options:
 - need for low-floor vehicles, wheelchair transport
 - transport mode filter
 - line filter
 - direction filter
 - possibility of transporting bicycles
 - fare restrictions (e.g. no lines with supplementary fare)
- Technical parameters, like number of desired events, time slot

- Degree of desired additional information (with mode of transport before and after the stop / station etc.)
- Use of forecast and interruption data (including SIRI SX or SM messages, or information about time restrictions for a stop point)

Output data

- Departure / arrival events, including
 - journey ID
 - departure stop / station
 - target time and forecast or information about journey interruption
 - line number
 - mode of transport
 - direction
 - stops / stations and forecast arrival and departure times up to the approaching stop / station
 - stops / stations and forecast arrival and departure times after the latest stop / station
 - transport company
 - references
 - URL of booking systems

7.2 Fare Information

7.2.1 Purpose

Distinction is made between two kinds of fare information, i.e. static and trip-related fare information. The static information includes e.g. lists of fare offers, assignments of tariff zones to stops / stations and URLs to further fare information. Trip-related information includes e.g. the various fares valid for a certain trip (or a section of a trip) on a certain day. The fare offer for a trip can comprise the cash fare (fare for a single trip, fare for multiple trips, fare for children etc.) and the time-related fare (fare for a day, a week, a month or a year, fare for students for a semester).

7.2.2 Interactions

Two flows are imaginable for the trip-related fare information, which are seen in the below figures.