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

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National foreword

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European foreword

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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