Towards a web of transport information

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Abstract
This article presents an approach for interoperability of travel information services based on two layers: a directory of transport information services, and open web services. The approach would enable end-users to navigate in the transport information, much as they navigate between transport modes in the real world.

We present corresponding prototype implementations under development in France, that aim at standardising Public Transport information web services, and referencing them in a national directory of multimodal transport information services.

Keywords: multimodal travel information, standards, information services directory, web services, open data

1. Introduction

For more than ten years, Public Transport and more generally Travel information is on the web. Public Transport and Multimodal Information web sites continue to be improved at a rapid pace, benefitting from new technologies such as mobile, contactless media, geo-information, social networks, real-time... However, they are still ‘information silos’ and there is yet no open and uniform way for third parties to access and reuse the information, as recognised by the 2010 ITS Directive which states “making EU-wide multimodal travel information services accurate and available across borders to ITS users” as one of the priorities.

This is even more true in France, where contrary to many other European countries, a national
portal providing access to countrywide door-to-door information does not exist. So-called Multimodal Information Systems play a key role as they cover all Public Transport networks over an administrative Région or Département and include a multimodal journey planner; currently, MIS have been deployed by local transport authorities in more than half of metropolitan France. Under the auspices of the French ministry of transport, a national agency for multimodal information and ticketing (AFIMB) was created in 2010 whose missions include ‘to network the multimodal information systems, in cooperation with the local authorities’.

As a way to progress towards interoperability of the multimodal information services, this paper proposes a simple architecture for a web of transport information, and describes a prototype that is being developed in 2012-2013 as a proof of concept and enabling concrete feedback from the stakeholders, in particular Local Authorities, Transport Operators, and Information Service Providers.

Our vision is that the end-user could navigate seamlessly in the transport information provided by several operators to prepare a trip, pretty much like the traveller navigates in the real world and changes his/her mode to get from point A to point B.

In the next sections, we first present the directory of transport information services and PT data web server, then the global architecture relying on the latter two building blocks, finally the current state of our prototype and the perspectives.

2. Transport Information Services directory

2.1. Opportunity for a transport information (web) services directory

There are many portals and information services that encompass transport information covering a variety of territories or modes; however, at least in France, they rarely (or never) cover all types of information.

More importantly, despite the portals and global journey planners, transport operators¹ still run their own information services, so as to communicate with their customers and provide them with services they expect such as ticketing, real-time information, mobile app, etc.

A second key trend is that transport operators or their transport authorities not only want to provide themselves information to the customers, but they want to provide data that can be reused by third-parties, so other media also promote the transport services they operate. In the current technology landscape, the provision of transport information for reuse is done by means of web services (in particular REST² web services because they are the easiest to use). The web

¹ in a broad sense: public or private road and parking operators, public transport and demand-responsive transport operators, passenger ports and airports, rental, car-sharing, or ride-share operators, and so on.

² REST means in practice that the user request is defined in the url (http address) and thus can be obtained programmatically but as well in a click, enabling navigation
services are made available to developers as programming Interfaces (API), often public. A single transport service can provide several APIs, for example for Public Transport: planned or real-time passing times at stops, maps around a stop, journey planning, and so on.

In this paper we will focus on Public Transport but web services APIs exist for other travel modes, including of course for road traffic information. As exemplified by recent European projects such as In-Time, or local French projects such as Optimod in Lyon, standardisation has nowadays progressed enough so that specifying a standards-based API is quite straightforward, although no official standard REST API for travel and transport information have been yet published.

2.2. Context: the current Passim directory

Passim is a public directory of existing transport and traveller information services in France, developed by the ministry of transport. The directory enables a user to find the list of relevant transport information services for a particular location in France and is freely reusable.

In Passim, an information service is mainly described by the geographic extent (commune, agglomeration, department, region), the modes covered (local PT, inter-urban PT, demand-responsive transport, road, parking, car-sharing, ride-sharing, ports, airports, bicycle rental...), the media (web site, call centre, mobile app, kiosk...) and information type (e.g. schedules, fares, perturbations, real time...).

On the [www.Passim.info](http://www.Passim.info) site, end-users can find the list of relevant information services near any place in France. Also, the directory content is freely reusable (it is open data, published on
data.gouv.fr). In practice, the content is a simple XL file with around 1200 rows, each one describing an information service. The major reuse cases we envisage are:
- a municipality, a tourism office, or a local newspaper website can include very simply the relevant links and references into its website;
- a car journey planner service can include systematically in the roadmap instructions a link to public transport information at destination.

Passim is online since 2004, and has around 300 unique visitors daily, which is little, but shows that a significant number of people look for where to find transport information, despite regional portals and private search engines.

Passim was initially developed as a demonstrator. Over the years we have used Passim internally as a way to monitor the deployment of transport info services and maintained it, as it is quite cheap, without any budget for communication and unfortunately no effort for promoting reuse. However we believe it is an interesting tool with a real reuse potential, and it can certainly be improved in many ways.

2.3. The Passim+ prototype
The creation in Summer 2010 of the French Agency for Multimodal Information and Ticketing (AFIMB) hosted by the transport ministry gave the impetus for launching an exploratory study so as to improve the Passim directory and provide true added-value to 4 types of users:
- authorities who want to have an overview of the transport information landscape;
- transport information service providers (including of course transport and road operators and the local authorities who operate information services) who could benefit from being properly referenced in the directory;
- reusers (developers) who are interested in reusing the directory content in other services and applications domains such as tourism, local media, municipalities, portals, etc.;
- and of course eventually end-users.

After re-assessing the current version of Passim, we designed a prototype (called 'Passim-plus') with the following requirements:
- be cheap, flexible and maintainable;
- describe more completely and more accurately the information services;
- give several ways of accessing the content for easier data reuse;
- provide various indicators and outputs for the authorities.

The prototype should be interesting enough to stakeholders (authorities, operators) so that they could be willing to contribute. It will be submitted to a broad list of actors, so as to decide if we continue and in which direction.

Like Passim, the Passim+ prototype does not have end-users as a priority, because we expect that third parties will reuse it and better address the end-users needs than we can. However, like Passim, Passim-plus also comes with a web front-end permitting to look for information services.
Easter Eggs, a small company specialised in open source and open directories, was awarded a 25,000 € contract for developing the prototype (“Passim-plus”) in early 2012. The prototype is on-line since Spring 2012, but is still under development. Functionalities and content will be improved progressively by the End of 2012.

Passim+ has two main visible components:
- front-office (http://etalage.Passim.comarquage.fr) for end-users and developers;
- back-office (http://petitpois.Passim.comarquage.fr) for content management. For the time being only the project participants at CETE Méditerranée edit the content, however the back-office is designed for letting decentralised users (e.g. regional authorities, or information service providers) manage themselves part of the content.

The Passim-plus directory relies 100% on open source software, so as to facilitate software maintainability, and reuse.

### Service web : RENNES - Rennes-Métropole - Données API Rennes

**Content.**

In Passim-plus, the directory content is completed in the following ways:
- we describe separately the transport offers and the information services, so as to explicitly show which information services are officially attached to a transport offer, or which ones are multimodal information services, for instance;
- mobile applications, route planning services can be more accurately described than in Passim; open data and web services have been added;
- the data model is extensible (other media such as social networks, or functionalities such as NFC payment could easily be added) and adaptable to each individual service (e.g. an information service can have 2 web sites or 3 telephone numbers).
The directory is published with the Etalab open license (which is the licence of the national open data portal [http://data.gouv.fr](http://data.gouv.fr)), and is made available in several ways:
- Python API;
- REST API;
- export in easy to use formats (CSV tables, KML, JSON...);
- copy and paste HTML code so as to include directly the relevant content in a web site.

*Indicators.*

As a special reuse case, we developed scripts to produce on-demand maps or statistics, for national (AFIMB) or local authorities mainly. For instance, we can produce maps showing how many information services have a mobile version, by region, or how many journey planners take perturbations into account, or how many real-time information services are deployed, etc.
End-users.
Besides viewing and searching the directory content, end-users can also (like in Passim) suggest new services or updates. Multi-lingual or mobile versions could easily be developed.

4. Transport Information Web services

3.1. Public transport: Neptune and SIRI profiles, open source servers
Like other European countries, France has developed a national standard for reference Public Transport data exchange: the Neptune XML profile (NFP-99506). Eventually it will be merged into NeTEx, the future European Standard currently elaborated by CEN TC278 WG3 SG9.
As a way to encourage to use the profile, the French ministry of transport decided in 2003 to support the creation of an open source software web application called Chouette with the following functions: (1) validate the conformance of data sets to the standard XML profile, (2) edit data, (3) import / export data to various formats such as GTFS or KML. The current version of Chouette (V2.0, to be shipped this summer of 2012) provides a first REST API.
Concerning real time data, the ministry of transport (AFIMB) funded also an open source web server software complying with the French profile of the SIRI European standard, which should be available by September 2012.
3.2. The need for standard REST APIs

For the time being, there is no official standard for Public Transport REST API, whether it be for reference data, real time or journey planning. However, most information systems already implement web services, including REST web services, even if the APIs are not public. Just visit at any Public Transport information site and look at the url when you fill a journey planning or schedule request form: you will see that many if not the majority of web site already expose a REST url; however the API is often not documented, and does not usually return easy-to-process JSON or XML data but only a web page (in HTML).

In France, several urban and inter-urban transport authorities such as Bordeaux, Nantes, Rennes, Gironde have already published PT data as part of their open data platforms, and others are intending to do so in the next few months. The open data sites usually also expose public REST APIs, because open data goes well along with REST, however the APIs differ from one site to the other. Even when they have not an open data policy, most transport authorities and operator consider or are already implementing public web services, so on the whole, there is a need for standard REST APIs.

The French standardisation group (CN03/GT7, mirror group of CEN TC278 WG3) is working on French ‘profiles’ relying of the SIRI and NETEX ‘light’ APIs.

3.3. Standard REST Web Server prototype

With this context in mind, we intend to develop a demonstrator of the proposed API standards. Web services can be implemented on top of the Chouette and SIRI servers. The following REST API should be first demonstrated:
- list of lines (Neptune)
- list of Stop Points (Neptune)
- schedule at Stop (Neptune)
- real time passing times at Stop (SIRI)

With the available PT open data, it should be straightforward to import it into Chouette and then to make a REST WS demonstrator running with real PT reference data and simulated real time data.

Due to budget restrictions, the prototype will not be completed for the ITS World conference, however most components are already online and will be presented during the interactive session.

4. Making Directory and Web services work together

4.1. Architecture overview

We now propose to combine the directory and REST web services so that they fit into a two-level transport information architecture. The idea is that:

- 1 - the information service directory also references the APIs (and open data) available for each particular service;
- 2 - the web services can be reused in a uniform way in new applications and services, that complement the transport or TIS operator’s own information services.

It is not yet clear under which conditions each TIS shall make web services or reference data available (e.g. in order to conform with the ITS Directive), and this topic is out of this article scope, but we believe that combining REST API standards and an open TIS directory where TIS operators would reference their public REST web services could lower barrier to reusing information and enhance transport information interoperability.

It would enable the development of new services or applications where the user navigates into a web of transport information brought seamlessly by several TIS, even if other services could still choose to centralise data for technical or business reasons.
4.2. Discussion
Our architecture is only a proposition, and is still far from achieved, although technically very simple. Many critics can be formulated. We try to address some of them here.

- several transport information services already exist which let the end-user navigate seamlessly among multimodal transport information:
  Of course, but usually this is at a local level (e.g. for an urban area), or for PT only. Or the navigation works actually on a proprietary platform where data is centralised (e.g. from Google and other heavyweight actors), but this requires considerable resources. This architecture could enable the same thing over a broader scope, in a standard manner, and possibly cost less.

- there is no reason why all transport operators would provide part of their information as open data or free web services
  Certainly, and we take into account the current situation where there is no consensus on whether transport data is freely reusable, and/or which data will be made available freely over REST APIs.

In our architecture, the web services themselves need not necessarily provide free APIs or open data: they could be used only by developers who have beforehand contracted with the web service provider, and the contract need not be free.

Concerning open data though, we believe that there is one particular topic where a consensus could be attained (also it is not attained today, and does not need to): providing a freely reusable repository of PT Stop Points, at the national or even European level, because Stop Points are a
natural entry point for Traveler Information in order to promote public transport and because of
the current context (including European directives: ITS, TAP-TSI, PSI, Inspire...).
- there is no reason why all transport operators would conform to standard REST APIs:
  In the directory, the REST API for the same service (e.g. travel time, or PT stop passing times)
  can differ from one service provider to another: it will be already a great progress if developers
  can find simply from the directory which web services are available from whom, even if for a
  particular service (say passing times) there is not yet a single API for all providers, and that 2 or
  3 different APIs coexist.
- moreover, these standards currently do not exist:
  Yes, but some REST WS are already on line (even if not official standards), and at least in the
  PT domain, TC278 is working on REST WS standards such as SIRI lite.
- how would the directory stay up to date?
  This will not be easy as it requires both that the directory gets sustainable funding, and that TIS
  operators are interested enough that they reference correctly and regularly their services in the
  directory.
Another difficulty is that for the moment we have essentially worked on Public Transport
information and that the directory should in principle be extended to all modes including road
and traffic information. We will try to go in that direction for Passim+.
- it is very unlikely that this architecture will be deployed Europe-wide:
  The proposed architecture could be applied locally (urban area, region) or nationally in any
country, depending on how web service standards are adopted and on how much open data is
available.
  The proposed architecture seems compatible with other European views on travel info
interoperability, such as the Travel Info Market promoted by UITP\(^3\).

4.3. Demonstrators
As Passim+ and PT web services get developed, we intend to show how they fit together by
developing demonstrators.

4.3.a Demo1 : Combining Passim+ and the REST prototype
If the REST APIs are implemented for 2 PT networks or more, we can demonstrate a portal
starting from the list available networks, and presenting in uniform fashion data of any of the 2+
networks: network, line, stop description, schedules and passing times.
Also, web services from OpenStreetMap road open data could be added to the demonstrator.

4.3.b Demo 2: Static HTML as way to improve information navigation
We think that the way to navigate and present transport information is still an interesting subject
of research, as there are of course many possible presentations of this information (including

\(^3\) http://ec.europa.eu/transport/its/multimodal-planners/ideas-for-journey-planners/index_en.htm
map-based, adaptation to mobile device, various style sheets, and so on). If we have resources for that, we will try to work on directory and Chouette database HTML exports in 2013.

We intend to work on generating static HTML pages, as we believe that even in those days, the plain old web page still has a lot of pros: it is distributed, scalable, low cost, robust, fast and adaptable solution, static HTML is useful when the telecom network is off, and can include the call to dynamic data if REST APIs are available (and when the network is working).

Several scenarios could be studied, depending on available data:
- the most basic scenario would be a list transport information services, by mode and territory, as we first implemented for Passim+: http://passim.comarquage.fr/site-statique/;
- the HTML pages could include maps showing the area covered by each service;
- if the directory includes ‘deep links’ such as direct link to the Fare, Timetable, Events or information pages, the HTML generated can be enhanced;
- if PT stop data are available, the map could include the stops as an entry point to finer-grained information;
- if free REST WS are available, realtime data be available (see below).

The static HTML could be configured in order to be adapted to mobile format or translated into other languages. Several stylesheets can be designed, too.

For the transport information layer, we propose to distinguish between the “infrastructure” reference data (eg. PT network topology: networks, lines, routes, stops, exchanges..., roads, parkings, and so on) and the “operational” data (schedules, real-time events and passing times, travel times, fares...) which could be provided dynamically, on demand, by web services. Then if directory content and infrastructure reference data is available (when transport authorities have an open data policy), we can generate static HTML pages for both the directory and the infrastructure data, including the REST calls (url) to the dynamic dynamic information provided by the web services. For instance for PT data, passing times at stop, disruptions or schedules would be provided as attributes of the PT stops (urls of REST Web Services).
5. Perspectives

This paper proposed a simple approach to networking transport information services, and has described a proof of concept in development. Preliminary results will be available during the Year 2012 and will be demonstrated in October in Vienna. Discussions with experts, authorities and operators from other countries will certainly help us (1) improve the concept, and progress towards standard web services, and appropriate use of open data initiatives, (2) simple and low-cost solution to providing seamless transport information, and in any case (3) feed the reflection on how to present transport information to the users and to the reusers (third party developers).

There is no doubt that working prototypes can be developed, technically speaking. However, the hard question is whether adhesion to the principles of the demonstrator architecture can be obtained. The goal of our prototype is to enable concrete feedback in the coming months from the stakeholders, in particular Local Authorities, transport Operators, and Information Service Providers.
References

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9. NFP 99509, CN03/GT7, Profil d’échange Neptune, AFNOR, (Janvier 2010)


Glossary

PSI: Public Sector Information

AFIMB: French Agency for Multimodal Information and Ticketing

PT: Public Transport

REST: representational state transfer, a style of software architecture for the web

API: Application Programming Interface

WS: Web Service