HanzeKenniscentra
University of Applied Sciences

Ondernemerschap

Overview ITRACT project
Smart mobility

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Abstract

Transport planning, both public and private, is increasingly supported by IT tools, such as route planners and online bus schedules. So far, however, these IT tools primarily use static information, e.g., information on scheduled departure times and travel duration. Increasingly, dynamic information becomes available – also online – e.g., on delays, temporary detours, congestion, and current traveling needs. Ideally, this type of information would be used to create smarter mobility solutions that are more flexible and more fitting to current travel needs. Especially in rural areas, smarter mobility services are desirable to create a better match between a relatively small number of travellers and a limited offer of transport options. Dynamic information can be used to create more tightly fitted travel solutions and to update travel plans along the way when relevant changes occur. Within the ITRACT project[1], we have developed an IT platform that supports the use of dynamic information generated by users, sensors, etc. to create smarter transport services and update travel plans based on current information. The IT platform is based on novel technology such as event processing, sensors, GPS data, web- and mobile apps. Furthermore, the platform incorporates existing IT systems and services such as trip planners and public transport open data (GTFS). Several new smart mobility service concepts have been developed and are being piloted within the ITRACT project. This document gives an overview of the project. It contains several examples of the smart transport service concepts that have been developed. Furthermore, the overall architecture of the underlying IT system is described that supports novel mobility concepts for adequate transport solutions in rural areas.

The Interreg IVB North Sea Region Programme

Investing in the future by working together for a sustainable and competitive region

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[1] The ITRACT project is sponsored by the Interreg IVb programme. For more information please refer to website www.itract-project.eu.

Contents

1. Introduction

The objective of the ITRACT[2] project is to create attractive transport options for regions with low population densities including rural areas. The ITRACT project runs pilots within five such areas: the Yorkshire Dales in the UK, the North-eastern region of the Netherlands, the North-western region of Germany, Värmland in Sweden, and the region around Stavanger, Rogaland, in Norway. In some of these regions, population is in decline, in others, population size is low, but fairly constant. The economics for public transport in areas with low population density are such that it is hard to maintain a frequent and regular schedule. In turn, a low frequency transport service attracts a low percentage of actual customers, decreasing the economic viability even more.

A basic assumption of the ITRACT project is that information and communication technology can be used to build IT services that allow for more adaptive transport services and that these adaptive transport services create a better match between supply (transport schedules) and demand (traveller needs) and therefore a more viable business case.

Traditional public transport consisting of, e.g., bus and train services offer a service that is fixed with respect to departure times and routes according to schedules. More flexible transport services such as dial-a-bus, taxis and ridesharing are available in some regions, but services that take into account a possible mix of multiple modes of both public and private transport– so called multi-modal transport – are still very rare. Also, the full advantage of collecting and combining all sorts of dynamic information such as current delays, expected travel times, individual travel needs, and available vehicles has not yet been exploited in optimising transport supply to meet individual travel demand flexibly.

2. Innovative smart mobility services

During an initial brainstorming and concept modelling project with students from the Hanze University of Applied Sciences, a number of conceptual ideas for IT services were created to illustrate the potential of a more flexible, tailor-made use of transport. These conceptual ideas were:

- **Hospital transport**
  Everyday a lot of people are travelling to and from a hospital for policlinic visits, patient visits, hospitalisation, or release. This service clusters different visitors according to location and desired arrival (or departure) time to plan an optimal pick up (or drop off) service for visitors with similar transport needs.
- **Just in Time Travel**
  For those travellers who hate to wait, this service uses information about the nearest bus stop or train station, as well as real-time departure times and the time needed to walk to the nearest stop, to send a notification to start walking for a guaranteed 'just in time' arrival at the stop.

[2] The ITRACT project is sponsored by the Interreg IVb programme. More information can be found on www.itract-project.eu

- **Multimodal planner**
  This route planner proposes a route that may consist of both public and private transport and adapts the advised route according to traffic congestion and other transport delays. This way a traveller may be advised to start by car and to drive to a Park+Ride just outside a congested urban area to change to a train for the remainder of the journey.
- **Connection helper**
  When a journey requires the use of transport vehicles operated by different organisations (train and bus, or two different bus companies), connections may not be guaranteed. This service can be used to inform the driver or conductor of the connecting service in case of a delay on the number of travellers that would like to make the connection and how much the delay actually is. The driver can then decide if it is worth the wait.

Later during the project, significant effort was spent on creating new service ideas together with user groups and professionals from transport organisations and local government. Several idea generation and service development techniques were used to come up with more innovative smart mobility services that would match closely user needs. 40 new applications were developed for the 5 participating regions. These applications are listed in Table 1.[3] Currently, 14 apps are being tested in real life situations during pilots in all the regions.

The project will create Best Practice Guides on the process of creating new and innovative services, on the pilots and running the new smart mobility services, and on the developed information architecture. The project will also create a report on the potential impact of smart mobility services on the economy and quality of life of rural areas and areas with low population density.

Smart live travel map	Active Bus Stops	Price-Flex
Order on demand travel	Price-Flex	Bus stop info
Business Travel App	Ridesharing	Real time info in busses
Realtime Travel App	On demand Traffic Management	Real time data – GPS low cost
Step-by-step	Bus schedules	Check of monthly season tickets for pupils
Tell-Us! Real time feedback	Real time feedback	Online bus route stops & lines
Get-Connected	Paymentapp	Dynamic passenger information
ShuttleDrive	Active bus stop info	Tariff calculator
Scan and Go	Real time info in busses	Quality rating system
P+R	Smart Live Travel Map	
Smart Live Travel Map		

Table 1. Some smart mobility applications developed within the ITRACT project

[3] Some applications were developed for different regions in different languages, which means that the list in Table 1 shows less than 40 apps.

3. IT demands of smart mobility

Service Oriented Architecture (SOA) is currently the dominant architecture for IT systems. The architecture supports a situation where different IT services can access and use all kinds of available data. Services in a SOA follow a request-response pattern and once the response is given, there is no more interaction. Or, in other words, you ask a question, get an answer, and that's that.

However, the examples given above require more complex interactions. In the Hospital Transport example, several requests need to be collected before an adequate response is generated. Several people indicate their travel needs and the system calculates an optimal time and route to service everyone.

In the Just in Time Travel example, a response (notification) is generated only when a certain condition is met. A traveller asks the system to be notified at the right time, and the system has to wait until that right information comes in before the system responds with the requested information. In the Multimodal Planner example an initial response is generated upon a request, but subsequent responses are generated if and when relevant changes occur. In this case the system needs to remember that someone might be underway and might be interested to hear that things have changed and the original travel plan is no longer feasible.

The examples given above of more complex interaction patterns between IT services and underlying IT platform and data require additional technology. The technology of event processing can be used for this. An *event* is a change within the system: e.g., new information that comes in or existing data is updated. Event processing allows you to define events and to specify which *actions* should be undertaken when that event or a combination of events occurs. In that case we say that an action is *triggered* by an event and the specified event is called a *trigger*. Within the concept of event processing, a service can do more than interacting following a request-response pattern. A service can also post a trigger to receive certain information as soon as a specified event occurs. All interaction patterns described above can be modelled and implemented by using event processing.

An Event-Driven Architecture (EDA) extends a SOA with event processing mechanisms, i.e., a language for specifying triggers, components for producing, detecting, consuming, and reacting to events.

Since the start of the ITRACT project, several of the ideas formed within the project have become more commonplace through developments of companies such as Google. In general, the technology is there, but getting them to work in real life typically requires multiple travel organisations, companies, citizens, and transport authorities to collaborate. Innovative mobility solutions require more than just technological innovation alone. The main innovations made possible by technological innovations such as developed by ITRACT are the following:

- Being able to update travel plans automatically as situations change and new information becomes available.
- Planning trips involving both public and private transport.

- Planning trips involving various modes of transport, such as bus, train, bicycle, taxi, etc.
- Planning trips that cross regional, city, or country borders, crossing the areas of responsibility of multiple travel authortities.
- Creating optimal mobility solutions combining transport requirements of multiple, independently traveling passengers.

4. ITRACT architecture

The ITRACT architecture assumes the availability of various data sources and travel planning functionality. Typically, these include travel planners, public transport schedules, route maps, delay information, traffic information, and social media platforms. Many of these data sources consist of so called *open data*, data that is made available free of charge for anybody who wishes to use them. Often, these data sources provide data according to a standardised format, such as GTFS (General Transit Feed Specification) and GTFS RT (GTFS Realtime). The data can be either static or dynamic.

These data sources are not part of the ITRACT system itself, but can be accessed from the ITRACT system. The ITRACT architecture contains interfaces for communication with these external data sources. These interfaces are provided within the ITRACT system in the form of Application Programming Interfaces (APIs), i.e., interfaces that can be used by programmers to implement specific data exchanges as required for the applications they are developing.

The ITRACT architecture consists of three separate layers, or platforms:

- The **integration platform** translates data from different data sources into a single data model for use within the ITRACT architecture.
- The **transformation layer platform** monitors new and changed data and combinations of data to generate potentially relevant events for processing by the event-oriented service platform.
- The **event-oriented service platform** includes functionality for specifying triggers and for matching events with triggers and generating actions triggered by events.

Applications (or services) interact with the rest of the ITRACT architecture via service APIs. These APIs allow access to the underlying data sources and connected functionality (in fact, following a service oriented architecture – or SOA) and support the definition of triggers and notification of events.

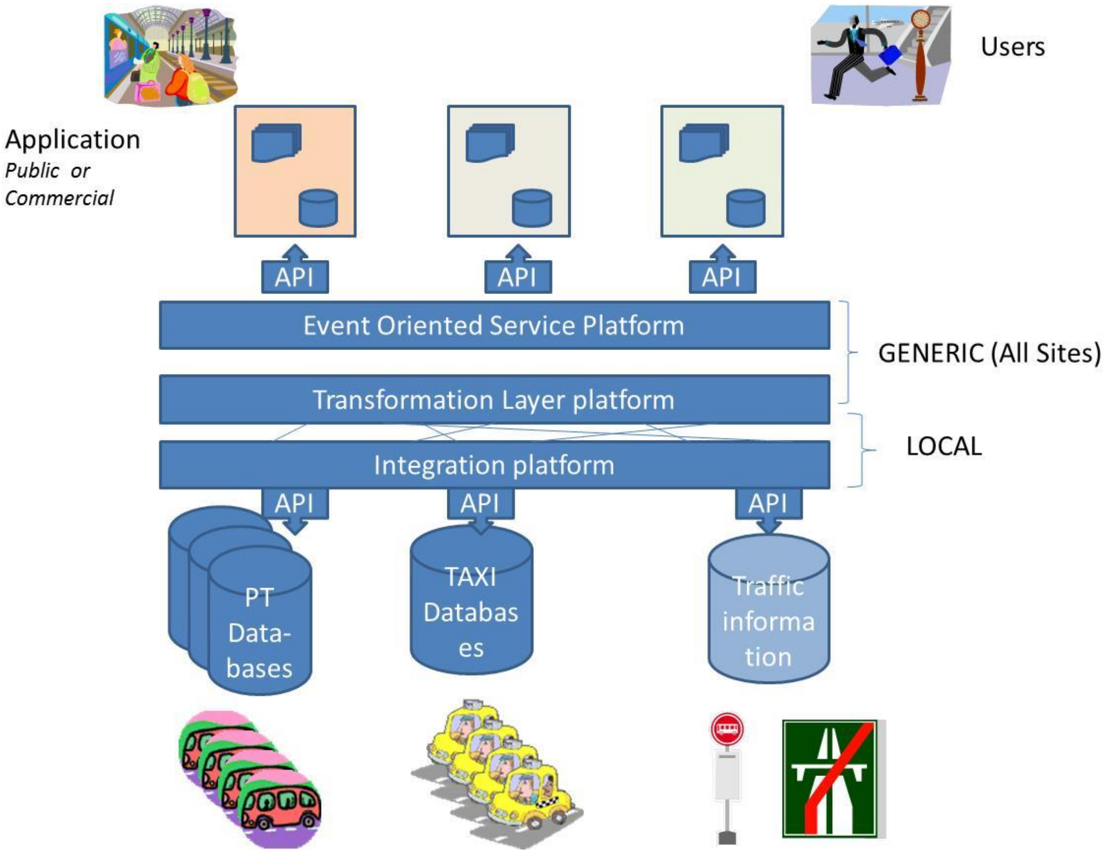

Figure 1, The ITRACT architecture

Currently, the ITRACT system connects to public transport data (including realtime) in Värmland (Sweden), North Netherlands, and North East Germany. Several standard building blocks have been added for incorporation by application developers, such as:

- Ridesharing: functionality that supports matchmaking between on the one hand drivers planning a trip and offering to take passengers with them, and on the other hand travellers who would like to have a lift. The building block also supports a rating system of both drivers and passengers and a way to pay for getting a lift.
- Multi-modal planning: a planning tool that builds travel plans consisting of different modes of transport such as bicycles, private cars, buses and trains.
- Interactive map: a tool for displaying stops and current locations of vehicles on a geographical map.

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