

Bolzano Traffic: An Example of Open ITS Deployment for Advanced Traveller Information Services

Roberto Cavaliere

TIS Innovation Park S.C.p.A., Via Siemens 19, 39100 Bolzano, Italy

Abstract: This paper aims to present the experience gathered in the Italian alpine city of Bolzano within the project "Bolzano Traffic" whose goal is the introduction of an experimental open ITS platform for local service providers, fostering the diffusion of advanced traveller information services and the future deployment of cooperative mobility systems in the region. Several end-users applications targeted to the needs of different user groups have been developed in collaboration with local companies and research centers; a partnership with the EU Co-Cities project has been activated as well. The implemented services rely on real-time travel and traffic information collected by urban traffic monitoring systems or published by local stakeholders (e.g. public transportation operators). An active involvement of end-users, who have recently started testing these demo applications for free, is actually on-going.

Key words: Real-time advanced travel information services, cooperative mobility services, open data.

1. Project Background

Bolzano is a medium-sized town of about 100.000 inhabitants located in an alpine environment, which is naturally limited in terms of accessibility because of its particular geographic and orographic position. The city is located in a natural bowl at the confluence of three valleys and surrounded by mountains, and acts as the main collection and sorting point of the principal arterial roads of the entire South Tyrolean province. Being closed to the Italy-Austria border and positioned exactly on the Corridor 1 Berlin-Palermo, it represents an important transit node for the trans-national transport of goods and people.

The city is characterized by a relevant modal split, probably one of the best in all Europe. According to detailed surveys carried out in year 2012, only 33,9% of local travellers chooses a motorized vehicle for intraurban commuting (Table 1). The majority of the inhabitants of the city move by foot or bicycle, thanks in particular to the many initiatives taken by the Municipality of Bolzano in order to foster sustainable mobility in the city. The most important measure has probably been the creation of an extended and connected network dedicated to cyclists and pedestrians of about 50 [km] which is presented in blue colour in Fig. 1, together with the planned extensions (in red colour) and the limited traffic zone (in green colour). At present, there is no detailed evidence about how contingent factors such as bad weather conditions can perturb this internal travel choices equilibrium, even if a limited number of trip mode changes towards the use of public transportation or private car have been observed.

On the other hand, the city suffers from heavy seasonal traffic congestion phenomena influenced by particular conditions such as bad weather conditions and/or peaks in tourist flows (Fig. 2). In fact, apart

 Table 1
 The modal split in the city of Bolzano [1].

Travel mode	%
Foot	34%
Bicycle	24%
Public transportation (bus / train)	8%
Motorbike / motor-scooter	4%
Cars / trucks	30%

Corresponding author: Roberto Cavaliere, research fields: cooperative mobility systems, environmental traffic control and management.



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Fig. 1 The cycling network of the Bolzano (Source: Urban Mobility Plan 2020).



Fig. 2 Traffic jam during a heavy rainy day in summer. (Source: Municipality of Bolzano).

from being a crucial node for transit traffic, Bolzano is also characterized by being an important point of interest for mass tourism, due to the surrounding natural landscapes (e.g. Dolomites), skiing facilities, summer resorts as well as local events such as the Christmas market. The main motivation for this is not only as a consequence of the limited number of road accesses to the urban area, but also in terms of lack of real-time travel and traffic information (RTTI) services that can properly inform travellers about current traffic conditions and thus lead to an optimal use of the available transportation infrastructure and services [2].

2. The Bolzano Traffic Project

In order to properly face these issues, the Municipality of Bolzano in partnership with TIS innovation park started in 2011 a local innovation project called "Bolzano Traffic", funded by the European Regional Development Fund (ERDF). The objective of the project is to create an open ITS platform that can put 3rd parties RTTI service providers in the condition to offer advanced travel information services to the local travellers through a business-tobusiness (B2B) chain. More specifically, the platform is directly linked to the Traffic Control Centre (TCC) of the Municipality of Bolzano, which collects several real-time traffic data via different roadside monitoring systems (e.g. parking occupancy, traffic levels, etc.). The platform is technically based on two elements: firstly, on the free and open source software (FOSS) GIS reference implementation developed in the INTERREG Italy - Switzerland "FreeGIS.net" project for the publication of geo-spatial information in compliancy with OGC services and the EU INSPIRE directive [3], and secondly on the ITS standard harmonization work carried out in the EU projects eMOTION, In-Time and Co-Cities, with which an active cooperation has furthermore started [4-6]. Thanks to the open ITS platform, in fact, it has been possible to insert Bolzano as a Co-Cities PRIME city by simply connecting the Co-Cities Common Agreed Interface (CAI) to the standardized web-services activated in Bolzano Traffic.

The first part of the project has dealt with a detailed analysis of the targeted situation, and in particular with the identification and the associated impact of all the different sources of inefficiencies and in the definition of a set of a reference use cases to be concretely addressed by the project. Based on these initial studies, partners have designed a harmonized platform integrating different RTTI applications, in part already existing and targeting different users' groups. This has been carried out through a strong involvement of the Faculty of Computer Science of the University of Bolzano, which is specialised in spatial and temporal databases and personalization techniques, and private partners (e.g. SASA, one of the public transportation operators of the Province of Bolzano, which provides a urban bus transportation service in Bolzano and Merano, the second main provincial centre). The main goal are: (i) stimulating R&D activities in this field through a more closed cooperation between research and industry; (ii) putting the basis for future system exploitations based on win-win business models; and (iii) immediately activating RTTI services that local travellers could begin to use in order to improve the efficiency of their travel choices based on their different habits and needs. The overall architecture developed within the project is presented in Fig. 3.

3. The Demonstrative Applications

A first beta version of the end-users applications was finalized and officially released to the public through a public press conference in October 2013. This first launch was organized mainly with the intention to immediately experimenting the potential impact of specific RTTI services on the target audience, and to create an active involvement of the local community by receiving feedbacks about actual and future functionalities offered by these applications. Bolzano Parking is a beta HTML5 application reachable at parking.integreen-life.bz.it which shows in real-time the parking lots availability in the main parking areas of the city. This information is directly managed by the urban TCC and already published to drivers through a network of specifically designed Variable Message Signs (VMSs). This application is mainly dedicated to motorized drivers, in particular those who are planning a trip to Bolzano in the short-term period from outside the city. In order to support this use case scenario, a model for forecasting the parking lots availability was moreover developed by the University of Bolzano. This functionality is going to be included in the second release of the application, together with a significant improvement of the GUI (Fig. 4). A widget is also available for 3rd parties interested in embedding the graphical visualization of the parking lots availability within their web site. SASAbus HTML5 is another beta HTML5 application accessible at html5.sasabus.org and implemented by the community SASAbus as a FOSS project, in line with the recent company choice to move towards open solutions.

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Fig. 3 The overall high-level architecture developed within the Bolzano Traffic project.



Fig. 4 Final graphical layout of BZ Parking application.



Fig. 5 The SASAbus application (Source: Davide Montesin "SASAbus HTML5 & related Java free software", SFScon conference 2013).

Being FOSS most of the functionalities are continuously updated and extended by the community, also considering requirements coming from other client applications (e.g. Android). At present, the application publishes static information only (e.g. timetables, lines, rides, etc.); a traveller may check for example the next bus schedule at a specific bus stop, plan a trip through the urban PT service or check if there are any communications about disservices (e.g. strikes). The application includes the parking information published by the Bolzano Traffic platform, and will integrate in the next release the real-time position of the bus fleets, in order to provide the current schedules instead of the planned ones. This kind of service is thought mainly to public transportation users, or to travellers coming from outside the city wanting to reach the city centre through a park & ride combination (Fig. 5). South Tyrol Suggests (STS) integrates the result of several years of research activities done at the Free University of Bolzano that acts as "mobility personal assistant" for citizens and tourists, helping them in choosing and reaching a variety of local Points of Interests (POIs) [7]. It is an advanced recommender system, with a server component connected to a range of tourist information sources and an Android app client front-end. STS suggests POIs dynamically as a function of (i) the specific user's preferences and (ii) contextual conditions (e.g. meteorological the conditions, parking availability etc.). STS provides valuable support, especially for occasional travellers (e.g. tourists), who may more efficiently decide what places to visit, when and using which transportation means. Further improvements in terms of capabilities and performance of the recommendation model, and also in the usability of the application, will characterize the second release of this service, which is hopefully going to turn in a commercial one supported by a solid business model. The application will be moreover enriched by the integration of a real-time multi-modal engine, developed as well by the Free University of Bolzano, capable to provide actual routing indications for the different transportation modes based on the available RTTI provided by the Bolzano Traffic platform (Fig. 6).

This routing model will represent in a certain way an evolution of the concept of "isochrones" coined by Gamper et al. in [8]. **Co-Cities iOS and Android applications** include real-time parking and public transportation data of Bolzano and multimodal journey planning capabilities as well. By using these additional



Fig. 6 The trip recommendations provided by the STS application.

services local travellers may moreover have an active feedback channel for indicating the experienced quality of the transportation services, or for sending traffic notifications. Thanks to this partnership with the Co-Cities project, it is possible for local travellers from one side to use these instruments within all the pilot cities where the CAI is in use, and above all to let foreign travellers to continue to be supported by these applications when moving in the city of Bolzano. This cooperation has demonstrated the potential of putting at disposal local available RTTI data at the advantage of the final users.

4. Preliminary Results

The pilot phase of the project is currently on-going, and it is far too early to make final conclusions about the impact that this initiative will have on the mobility situation in the city. Applications' usage statistics have demonstrated interest in testing these new RTTI services, at least in the period immediately after the official launch. For example, as far as STS recommender system is concerned, the Android application was deployed on Google Play on September 18, 2013, and up to April 6, 2014, 535 users have downloaded and tried the system. Overall, the system collected 2.528 rating for POIs and many were entered together with a contextual description of the experience. The number of uses of the pilot services has then started to slowly decrease, mainly as a consequence of the following two factors: (i) a significantly reduced number of traffic congestion events observed during the testing phase, and thus a globally reduced need to check this RTTI in order to improve the trip choices, and (ii) the limited number of real-time information provided by the applications. As far as the first point is concerned, the observed stability can be in a certain way associated to the introduction of the Bolzano Traffic platform: reliable RTTI services have in fact the capability to improve the stability domain of a transportation service [2]. The second conclusion has been supported by looking at the results of the launch of another RTTI portal in the city of Merano, bus.meran.eu, in which local travellers can visualize in real-time on a map the positions of the SASA buses. This information is made available by SASA thanks to Automatic Vehicle Monitoring (AVM) controlling the operations of the bus fleet, which has been recently introduced in Bolzano as well. On average, 1 person out of 40 living in Merano checks this application at least once a week, which is already a significant critical mass. The evolution of the services in Bolzano towards the integration of additional RTTI will probably generate a similar impact also in Bolzano.

5. Conclusions and Next Steps

During the final phase of the Bolzano Traffic pilot further channels will be activated in cooperation with other local stakeholders. In particular (i) an interactive totem presenting the real-time information on parking and public transportation status will be installed within a "smart" modern bus stop in one of the most visible places in the city centre of Bolzano; (ii) the parking information will be included in an application offered by hotels to their guests, so that they can visualize directly in their rooms on a certain TV channel the current accessibility conditions to the city together with other information about local events and attractions; and (iii) other partnerships will be built in order to push the inclusion of the available RTTI by other service providers covering larger road networks (e.g. the Province of Bolzano, the A22 highway). One of the most relevant outputs of Bolzano Traffic, which has been already achieved, has been the decision by the Municipality of Bolzano to follow a strong open data licensing strategy, in order to create the conditions for the proliferation of advanced end-users applications and services for the end-users. Following the example of other cities, in particular Rome [9], the approach is to publish the available RTTI information through a creative commons licence, such as CC0. The project is going to be further extended and directly linked to other local initiatives, the most relevant being (i) the EU LIFE+ project "INTEGREEN" which will put at disposal very accurate traffic and air pollution information through an hybrid demonstrative system made up of static detection units and mobile probes [1], and (ii) the ERDF project "The Green Mobility of the Future", which is a local action aiming at promoting advanced co-modal schemes (car/ride/bike sharing) towards local stakeholders and users and paving the way to the deployment of cooperative ITS (C-ITS) technologies in the region. The ultimate goal is to let this open ITS platform keep growing thanks to more and more accurate data, automatic elaboration and forecasting

routines, and advanced and standardized services to the local travellers.

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