

# **City2Navigation: Linking public traffic management to private routing services (C2N)**

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## **Executive summary (English)**

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The continuing increase in motorised individual and road freight transport, coupled with a growing awareness of its negative environmental and climate impacts, are challenging public traffic management. The possibilities for implementing local traffic management strategies (TMS) by traffic control centres (TCC) are currently technically limited: For instance, not all traffic lights can be controlled remotely, dynamic signposts and other information systems (e.g. parking guidance systems) are only available along selected strategic roads and at selected points in the centres of major cities, and also the possibilities to publish information as TMC messages are limited – both in terms of scope and quality of their information content. In general, only larger cities have a TCC, so that small and medium-sized towns currently have only little opportunities to take active traffic management measures.

At the same time, nowadays road users enjoy a wide range of technical options to get informed and guided through traffic, to find the cheapest means of transport and the best traffic routes, depending on the purpose and destination of their trips. Modern, convenient and intermodal mobility apps offered by routing services are playing an increasingly important role in this.

However, the latter have so far acted on a large scale independently and uncoordinated from the interests and traffic management strategies of public authorities. While routing services design their services to optimize routes for an individual user, public traffic management strategies are focusing towards optimising the overall transport system, which in many cases leads to conflicts and thus ultimately to uncertainty by car drivers when they receive divergent route recommendations (Fig. 1). A direct information exchange between public systems and those of routing services, which could help preventing such conflicts, does not exist until now, or only in pilot studies in form of siloed solutions.

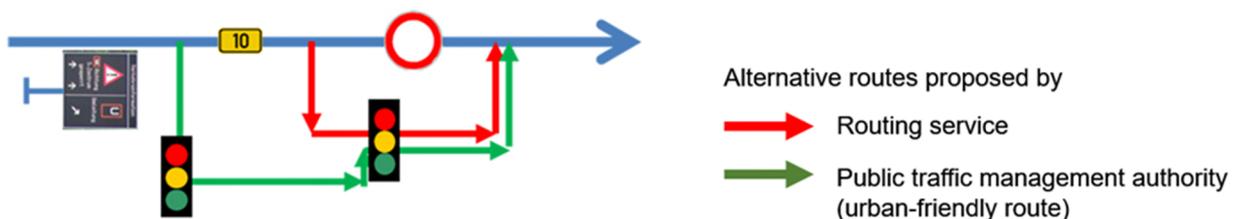


Fig. 1. Different routes proposed by routing service and public traffic management authority.

If municipalities, including small and medium-sized ones without traffic control centres, would be able to publish their traffic management strategies in a standardised digital form (spatial, temporal, intermodal, vehicle and purpose-specific), and the routing services would take up this information cooperatively, mutual synergy effects would result contributing to increased efficiency in traffic management and thus provide better results for the individual road user. As a side effect, the route optimization for the individual user would then also move closer to the optimum of the overall traffic system

The objective of the City2Navigation project was therefore to develop a concept and an ITS reference architecture for the introduction of a cross-organizational, Germany-wide C2N service and thus to create the technical basis for linking public traffic management to routing services; the latter one being an essential objective of the ITS Action Plan "Road" of the German Federal Ministry of Transport and Digital Infrastructure. This makes the C2N service a crucial building block for future-oriented digital traffic management. The reference architecture is primarily dedicated to strategic aspects, the identification of roles and their responsibilities, as well as value creation and governance of the service. In this way, it makes a significant contribution to the consistent definition of the core building blocks of the C2N service. In addition to the reference architecture, the project developed a requirements specification for the so-called "strategy editor" (product requirements document – PRD), a cooperation and evaluation concept, and identified framework conditions and further requirements for its implementation. With these objectives, the City2Navigation project contributes to the standardization of the C2N service in Germany.

Six key technological components characterise the C2N service (Fig. 2): The strategy editor (1) is the central access point for municipalities to the C2N service. It is used for the definition, editing, administration, publication, activation, termination and evaluation of TMS. In large cities the editor is supposed to be connected to existing traffic management systems. When a TMS is activated, it is published by the strategy editor via the Mobility Data Marketplace (MDM) (so-called "forward channel"). The MDM (2) is the central information hub of the C2N service. Through this broker, the active TMS of all participating municipalities are provided, from where they can be accessed by the routing services. Depending on the triggering event, a TMS publication may consist of one or more individual measures and actions, including potential changes to the "map" (for instance, changes to the maximum permitted speeds on a road section) or recommended alternative routes. Information is passed on via the MDM in a standardized manner via defined DATEX II profiles (3), which allow immediate and automated information processing by the routing services. In order for municipalities to continuously evaluate and improve the quality and effectiveness of their TMS and of the TMS publications, the concept foresees a so-called "feedback channel" (4). Information about the degree of compliance of the strategies should be sent from the routing services via the MDM to the publishing municipality in DATEX II format. This format will also be the technical basis for further and in-depth cooperation between public authorities and private routing services in the future, i.e., with regard to the joint identification of key performance indicators (KPIs) or the incentivization of traffic measures, and thus for the development of new business models. The feedback channel information provided by the routing services is analysed and processed in the strategy evaluation module (5) of the strategy editor. If two or more neighbouring municipalities activate TMSs at the same time, there may be cases where the TMSs negatively influence each other, resulting in conflicts in traffic management. This may especially be the case with ad hoc measures published in reaction to accidents or natural disasters. Therefore, as another core building block, the C2N service provides for automated conflict detection (6), identifying possible TMSs conflicts and informing the concerned public authorities.

While basic functionalities of strategy evaluation and conflict detection are provided by the strategy editor, the C2N service foresees options for offering advanced functionalities through specialized applications. In addition, the publication of TMS allows the development of further applications or new business models beyond routing applications, such as information systems, by private vendors.

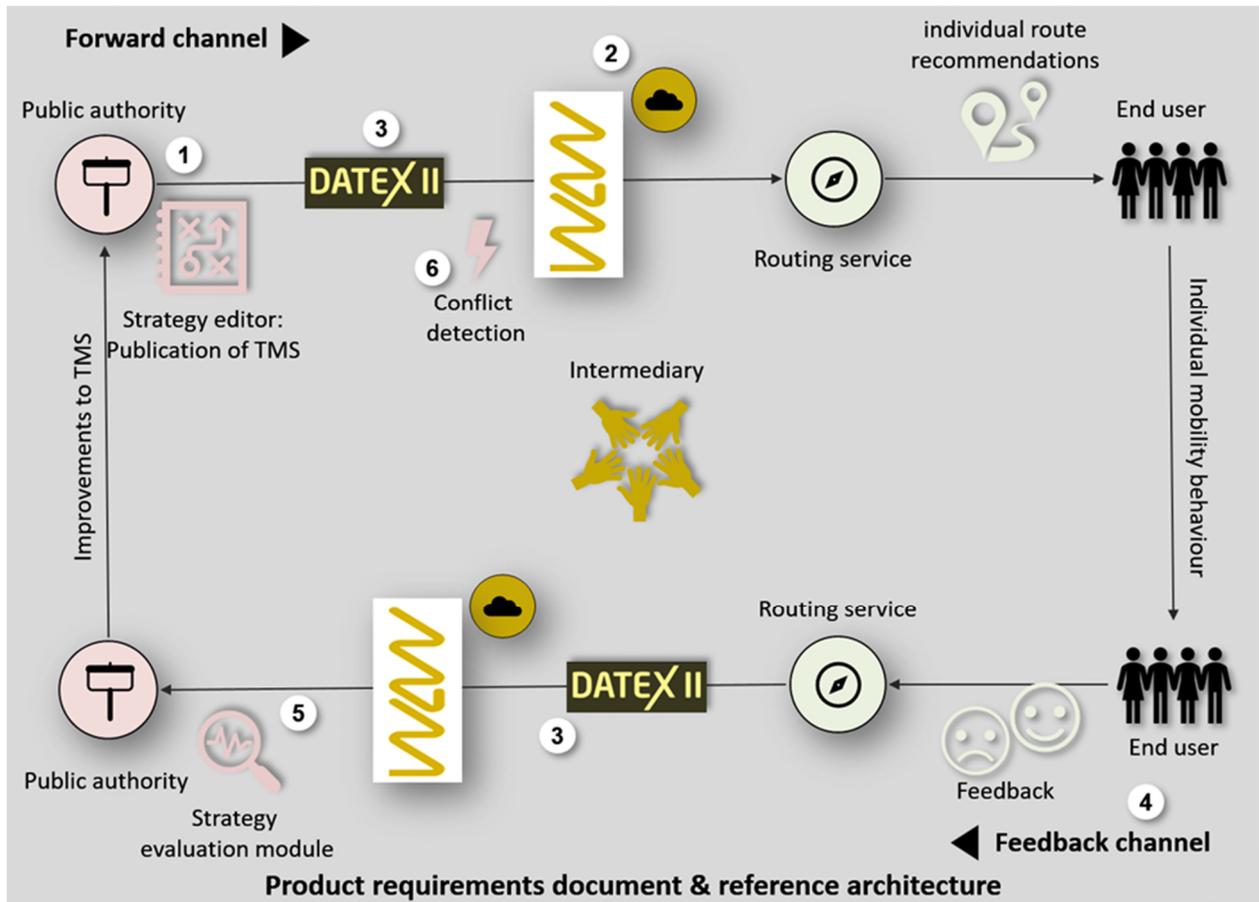


Fig. 2. Interaction of the C2N components.

Compared to the current situation, the C2N service expands the possibilities of traffic management for public authorities in several aspects:

- Public authorities are enabled to carry out traffic management comfortably and comprehensively for streets and areas without roadside actuators away from the strategic network.
- As a result, the service can also be used by public authorities that do not yet have traffic management systems and roadside actuators.
- Traffic management measures can now be defined very specifically with respect to time, location, vehicle type and trip purpose, including intermodal measures.
- Strategies for congestion prevention can be proactively published, including advanced information on when a particular TMS will be activated.
- Public authorities are alerted about possible conflicts of their TMS with those of other authorities.
- They can better analyse the impacts of their TMS, thereby improving the quality of their TMS gradually over time.

There are also advantages for private routing services:

- They can use the more accurate TMS (including proactive ones) to generate even more individualized and target group-specific route recommendations, thereby increasing customer satisfaction.
- They benefit from additional and better information, which is widely available in a standardized, machine-readable form.
- Through the feedback channel, they get the opportunity to provide feedback to local authorities (including feedback from road users) and thus supporting public authorities in developing even better traffic management measures in the future.

In addition to the presented technical solutions, the City2Navigation project developed proposals for the implementation of the C2N service, based on the following guiding principles: The C2N service should be introduced as quickly and seamlessly as possible in Germany. In this process, siloed solutions should be avoided and different conditions and requirements of the municipalities should be taken into account. Temporary applications, for instance in form of pilot projects, should also be avoided in favour of permanent operation solutions.

In order to appeal to the widest possible number of users of the C2N service for both public authorities and routing services, the City2Navigation project provides on the one hand for a simplification in the handling of the MDM, in particular with regard to the registration, subscription, publication and pooling of TMS. On the other hand, different options for the implementation of the strategy editor are proposed, taking into account the different requirements of municipalities (extension of existing TM editors or of existing applications; stand-alone desktop software; centrally hosted web application). A central intermediary represents the C2N service to the general public, develops uniform terms of business, ensures its continuous technical operation, promotes the C2N service and implements the developed cooperation concept. The intermediary is supported by a number of decentralized mediators from the regions, establishing and maintain close contacts with all actors involved.

In order to enable the C2N service addressing a maximum coverage of traffic in Germany from the very beginning, selected large cities, the state authorities responsible for traffic management and the new Federal motorway authority should be among the first users of the C2N service in the first implementation stage. In a second stage, the C2N service should be extended to regional associations and organisations responsible for traffic management in an entire region on behalf of affiliated municipalities. In a third stage of expansion, the C2N service should then be extended to medium and smaller municipalities.

To support implementation projects, the City2Navigation project developed various supporting materials and toolboxes:

1. Product requirements document for the strategy editor defining its mandatory and optional functionalities.
2. ITS reference architecture: Comprehensive documentation of all architectural modules, roles and actors including the implementation and further development of the DATEX II profiles.
3. Simplified access to the MDM: Suggestions for simplifying the processes of registration, subscription, publication and pooling of TMS at the MDM.
4. Checklists: Separate checklists ("to-do" lists) for public authorities and routing services wishing to participate in the C2N service.
5. Certification: Proposals for the certification of implementations of the C2N service by the intermediary.
6. Evaluations and success factors: Suggestions on how public authorities can regularly evaluate the success of the C2N service in practice.
7. Documentation: All results of the City2Navigation project will be published in a comprehensive final report by the German Federal Highway Research Institute (BASt) in spring 2021.

These results provide a comprehensive toolbox for implementation projects of the C2N service and for interested stakeholders.