



Photo: Stefaan Van Hui

Illustr. 1: Belbus and fixed line bus in Flanders.

Belbus: Pooling-on-Demand in Belgium

Key success factors - dispatch operations in one of the world's largest Call-a-Bus systems

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De Lijn operates one of the world's largest Call-a-Bus services in Flanders, Belgium. It is available to the general public and is fully-flexible (Pooling-on-Demand) to cover whole regions. Why was this transport service – in contrast to Germany – introduced in Flanders on such a large scale? What technical challenges had to be overcome during such a vast operation in order to make it a success? This article explains the reasons for its success.

Facts

Flanders is one of three regions in the Kingdom of Belgium. It lies in the north and is home to most Dutch-speaking Belgians or the 'Flemish' as they are known. It covers approximately 13,500 square kilometres and has a population of around 6.5 million.

De Lijn (pronounced : de lane) is a public urban and regional transport company.

It operates a large-scale, public bus and tram network in all five Flemish provinces. Its fleet comprises 390 light rail trains as well as 2,240 of their own buses and 1,390 buses from contractors to transport around 500 million users annually.

Belbus: Development

Belbus (pronounced: belbues) was first launched in Flanders in 1991. Its main attributes are shown in Table I. In 1996 a dispatch soft-

Table 1: Belbus attributes.

Operational in well-defined regions
Transport requests are bundled
Bus stops are serviced
Public Transport tariffs

ware called 'Ring' was developed as part of an EU project called 'Sampo'. 'Ring' was based on virtual fixed lines that ran along an interwoven string of bus stops. Using the shortest routes, buses held only at bus stops that had been requested through prior bookings. The aim was to use public transport potential to the full with telematics and at the same time reduce operating costs. 'Ring' offered a software solution that catered exclusively to the needs of dispatching Belbus.

Test-runs for non-time-tabled Call-a-Bus systems had already begun in Friedrichshafen (Lake Constance) in Germany as early as 1977 but, since then, it has only spread sporadically. In contrast, Belbus is currently in operation in 112 regions and serves two-thirds of Flemish communities and areas. It covers about 38,000 vehicle kilometres and transports almost 5,000 passengers daily. This is achieved by combining Belbus' own, as well as rented, small city buses and taxis.

This development owes a great deal to 'Basismobilität' or guaranteed mobility for the general public - a policy since 2001 on public transportation, secured in Article 4ff. In comparison to §1 of the German 'Regionalisierungsgesetz' (a regional regulation which only calls for public utility services to provide an 'adequate' public transport system), 'Basismobilität' offers each

Profile: the Authors



Odette Buntinx has been working at De Lijn in Mechelen since 1990 and for the past eight years has been responsible for the technological development of Belbus. Before that she was also at De Lijn and, among other things, was involved in the EU projects 'Sampo' and 'Samplus' as well as being the Head of Marketing in Limburg.



Dr.-Ing. Christian Mehlert, has been a consultant at KCW GmbH since 2013. After finishing his studies in Transport at TU Berlin, his PhD research was on Call-a-Bus. He has since then been working as an advisor for consultancies and transport companies. Mehlert is a member of the 'FGSV' working committee for ridepooling.



Dipl.-Inform. Bernd Oswald is the Managing Director and owner of PPS/EDV GmbH, founded in 1987. Initiated at Volkswagen's research department for 'Umwelt und Verkehr' (Environment and Transport), his company has been specialising in developing IT dispatch systems for Transport-on-Demand since 1992.

citizen a minimal Public Transport package according to legal standards.

Belbus, in addition to public fixed-line transport services, has an important role to play in achieving this. It helps to guarantee mobility without incurring unviable high costs which would arise with an inflexible time-tabled transport service during off-peak times in suburban, small town or rural areas.

Technical Requirements

The expansion of Belbus services during the millenium year meant that the requirements for dispatching and planning also grew in number and quality. Seeing that the software, i.e. 'Ring', used until then had limitations (e.g. no real-time dispatching, no alternative to public transport or option to combine with public transport), De Lijn decided to seek

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Table 2: Service Standards for Basismobiliteit

	Peak Times	Off-Peak Times	Weekends	Distance to next Stop
Time Frames	6-9 + 16-19	9-16+19-21	8-23 Uhr	–
City	every 12 min	every 20 min	every 15 min	max. 500m
Town	every 15 min	20-min-Takt	every 30 min	max. 500m
Suburbs/Small Towns	every 20 min	every 30 min	every 60 min	max. 650m
Rural Areas	every 30 min	every 60 min	every 120 min	max. 750m

Source: Decreet 2001



Photo: Stefaan Van Hul

Illustr. 2: Belbus as a guarantee for mobility

tributing their expertise in project management.

At this time, the transition from fixed to demand-responsive public transport planning took place at DeLijn with the aim of supporting public mobility for access to local facilities and amenities. This basically means new regulations for demand-responsive public transport with the following changes, i.e. requirements:

- public transport as a solution to mobility needs
- integrated public transport system instead of singular public transport solutions
- multimodal links using Belbus/bus/rail
- detailed information regarding mode of transport, travel times and stops

This is shown as a network time-table with three rows, and with Belbus as an important element of the demand-responsive linking network.

Further Developments: cover® – Dispatch System

Technical challenges are being met with the help of a PPS dispatch system called cover® which has been customised to suit De Lijn’s specifications. An optimisation algorithm takes single rides and calculates an optimal shared route based on vectorised maps.

The Belbus system is configurable; for example, it can prevent Belbus routes from using parallel fixed line public bus routes or check if a fixed line bus route can be used within a certain time corridor around the requested time. It is also possible to book combinations of Belbus/fixed-line public bus, Belbus/tram or Belbus/Belbus (and vice-versa). Illustration 3 shows this with a change to a fixed-line public bus at the bus stop for Overpelt Ziekenhuis.

This process takes all current service lines for public transport into consideration. All time-tables for rail and bus links through-

Table 3: Public Transport Planning using three network levels

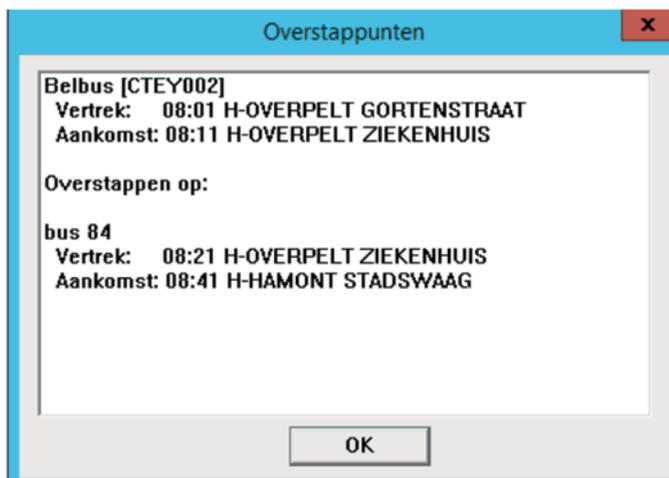
Network levels	Types
Main network	Public Transport connections for buses and trains
Ancilliary network	Public Transport time-tabled buses
Fill-in network	incl. Belbus

a new dispatch system within the framework of an EU tender.

as well as provide the necessary adaptations.

However, De Lijn’s multiple and specific requirements as well as the large scope of Belbus operations led to developments being discontinued twice. At the third attempt in December 2013, it was a consortium between KCW/PPS which was able to meet De Lijn’s requirements

PPS/EDV GmbH, Braunschweig is an IT company that has decades of experience in developing and operating dispatch software for flexible shared passenger transport in Germany and Europe. KCW GmbH are strategy and management consultants in Berlin who have been con-



Illustr.3: Pop-up in cover® with combined Belbus/time-tabled bus tour.

Photo: Stefaan Van Hul



Illustr. 4: Belbuses suitable for barrier-free stops .



Illustr. 5: Driver's App indicating transfer to fixed-line.

hout Belgium are fully integrated in cover® for at least the next 30 days at a time; they are automatically updated overnight and are for checking Belbus bookings or any nationwide travel requests. Updates also contain information on diversions (and as a consequence prolonged travel times) as well as temporary closure of Belbus stops to cancel out bookings for these routes.

An important feature are the stops themselves which can have diverse attributes, such as 'Belbus Only', 'Fixed-Line Buses Only', 'Mini-Buses Only', or 'Hop Off Only' or 'Hop On Only'. Moreover, there is information on temporary closures or barrier-free stops.

Every passenger must register before making their first booking with their name, address, telephone number, email address and personal details. Bookings up to now are stored under the customer's ID. A note is made to block a customer for repeated failure to turn up for a booking - this avoids

allowing bookings during the time the customer is blocked.

The driver's App requires a 4.0 Android system or a higher version as well as an Internet connection for 3G, 4G or LTE. The App enables GPS tracking via your smart phone so you can follow the route and use the navigation system to your next stop. At the same time, delays and vehicle breakdowns are registered. The driver's App also provides information on transfers to bus and rail.

Current Status and Prospects

The project requirements were updated from 2014-2017. Adaptations and test-runs were made in order to gradually introduce using cover® in the provinces and to finalise its implementation in October 2017. At present there is a 12-month guarantee phase to test the dispatch system thoroughly on an everyday basis with annual booking figures that run into millions; it is also to debug

the system, if required.

Currently, it is only possible to book Belbus through De Lijn's call-centre. Once telephone bookings have been successfully completed and are running smoothly, the next step is to extend passenger bookings so they can be made online or via an app, together with cashless payments.

Literature & Remarks

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Zusammenfassung/Summary

Belbus: Pooling-on-Demand in Belgium

Im belgischen Flandern betreibt De Lijn unter der Bezeichnung „Belbus“ eines der weltweit größten, für jedermann zugänglichen Rufbus-Systeme im vollflexiblen Flächenbetrieb (Pooling-on-Demand). Warum ist diese Betriebsform in Flandern – im Gegensatz zu Deutschland – de facto flächendeckend eingeführt? Welche technischen Herausforderungen sind bei der Disposition eines derart großen Rufbus-Systems zu meistern? Die Antworten auf diese Fragen liegen in einer per staatlichem Dekret garantierten Basismobilität sowie in einer speziell auf die Anforderungen von De Lijn zugeschnittenen Weiterentwicklung des Dispositionssystems cover® von PPS/EDV.

Belbus: Pooling-on-Demand in Belgium

Operated by De Lijn, the 'Belbus' is one of the world's largest Call-a-Bus services already available to the general public in Flanders, Belgium, and has the benefits of a fully-flexible transport service (Pooling-on-Demand). How, in contrast to Germany, has it been possible to establish this transport model practically throughout all of Flanders? What kind of technical hurdles have to be overcome when it comes to using a dispatch system for such an extensive Call-a-Bus service? The solutions came in the form of a public decree, guaranteeing the basic right to mobility and in PPS/EDV's optimised dispatch system, cover®, customised to suit De Lijn's specifications.