

Toll Collection System Migration at N.V. Westerscheldetunnel

About N.V. Westerscheldetunnel

N.V. Westerscheldetunnel is a public limited company that was founded on November 11th, 1998 for the purpose of building and exploiting the Westerscheldetunnel. Construction was successfully completed by 2003, and ever since March 14th, 2003, the company has been responsible for managing and maintaining the Westerscheldetunnel, handling traffic and incidents in and around the structure, and collecting toll. While the company was initially set up by the Dutch government and the provincial authority of Zeeland, all shares have been transferred to the province since July 1st, 2009.

Executive Summary

Replacement of the toll collection system

In early 2006, N.V. Westerscheldetunnel decided to replace their existing toll collection system, supplied by GEA. The move was motivated by the need to replace an IT infrastructure that was approaching the end of its lifecycle, by the diminishing technical integrity of the toll collection system and by the need for more advanced functionality.

Custom toll collection system and TIPS for CRM and t-tag management

The front- and back-office components of the toll collection system were to be replaced by three custom-built systems: a new front-office system, a new back-office system, and a Transaction Information and Processing System dubbed TIPS, which would provide CRM functionality and t-tag transaction handling. Front- and back-office systems were awarded through a European tender procedure initiated in mid-2007. The development of TIPS was awarded through a regular tender procedure issued by Movenience B.V., a joint venture between the N.V. Westerscheldetunnel, Brisa International S.A. and NedMobiel.

TIPS design joint effort of Technolution and Type 2 Solutions

The three contracts were initially awarded to two candidates. However, after a confidence crisis resulting in the dismissal of one of those candidates, Movenience B.V. approached Type 2 Solutions and Technolution with the request to jointly realize the functional and technical design for the TIPS system. Technolution had already been awarded the front- and back-office contracts by the N.V. Westerscheldetunnel. After completion of the design phase in early 2009, Technolution proceeded with the actual development of the TIPS system, while Type 2 Solutions started coordinating the migration efforts.

First phase of the migration

Following the end-to-end tests early in 2010, both organizations started preparing for the delivery of the new systems. The first phase of the migration, referred to as initial load, started on March 11th, 2010. All data collected since the opening of the tunnel in 2003 was converted and moved to the new systems. After due quality control the second phase, called delta load, was entered on March 15th.

Complete replacement of the GEA toll collection system

During the delta load, all toll lanes were successively upgraded to the new environment. All through that phase, the T2S Migration Platform supplied the new back-office system with real-time transaction data from the remaining old toll lanes. On June 17th, 2010, all toll lanes had been upgraded and the replacement of the GEA toll collection system had successfully been completed.

The Challenge: Migration in a 24/7 Environment

Centralized toll collection system

The Westerscheldetunnel has a total of 14 lanes, seven northbound and seven southbound. Each side counts three attended lanes with toll booths, three card payment lanes, and one lane for On Board Units (OBU). Every lane is fitted with road-side equipment and a dedicated lane workstation referred to as the front-office. That workstation forwards the transactions generated by each passing vehicle to the back-office, a centralized database in which transactions are handled, can be consulted and reported on.

Risk mitigation

Development and approval of the new systems had to be managed in a mock setup at an off-site facility in order to mitigate risk and allow for sufficient adjustment opportunities. Once the systems had been approved off-site, the migration was initiated with the upgrade of the first two lanes.

Complete replacement of hard- and software with no loss of data or unplanned down-time

The entire migration did entail more than just the upgrade of the old lanes and the replacement of the existing hard- and software. It also comprised the conversion and migration of all data collected since the official opening of the tunnel in 2003. The main provision was that the toll collection process had to carry on unimpeded 24 hours a day, and that no transactions could go missing. Further, only one lane would be allowed to be inoperative for upgrade in each direction at any given time. Finally, the migration plan had to be coordinated in a way that end users would not have to work with both back-office systems in parallel.

The migration was deemed the most precarious operation of the entire project.

The Solution – The T2S Migration Platform

Centralized migration team

N.V. Westerscheldetunnel made the choice to have the data migration executed by a specialized team of Type 2 Solutions consultants, using the T2S Migration Platform (T2S MPF) instead of a decentralized approach with dedicated migration teams per target system. By doing so, analysis of the source data and systems was done in a single pass and did not have to be repeated by each team. Further, all data handling could be done centrally.

Optimize data quality

Because of the waning technical integrity of the GEA toll collection, data quality and consistency were severely off-chart. The chosen approach to tackle this issue was to correct all inconsistencies in the source system by adhering to specific standards that would be used to validate, and if necessary automatically correct, the data in the toll collection system. The selected standards were enforced by consulting external references.

XML/XSD

An XML-based exchange format was established in collaboration with the vendors of the new systems. The individual topics were modeled into separate XML feeds which were validated by means of an XML schema (XSD), the XSD being comparable to a contract with which the data in the XML file has to comply.

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| <i>Parallel approach</i> | The use of XML feeds and XSDs allowed for a parallel approach: the team in charge of extracting and converting data from the old system could work towards the agreed XSD, while the team in charge of importing the data into the target systems could use the XSD as their departure point. |
| <i>Migration target "Moving target"</i> | This gave the migration team the assurance that the target system, which was still in development at the time, and therefore could be compared to a moving target, would be able to process the supplied XML feeds as long as they could be validated against the XSD. By managing the process in this fashion, T2S MPF configuration more or less coincided with the completion of the target system. |
| <i>Test migrations using meaningful and familiar data</i> | The migration strategy also entailed full test migrations, allowing for thorough evaluation of the migration code and a realistic estimate of the processing time and performance of the target system. Further, this migration strategy offered the possibility for testing the back-office system and TIPS, which were still under development, using meaningful and familiar data. |
| <i>Initial load to back-office and TIPS</i> | After successfully completing user acceptance and end-to-end tests, the back-office, two lanes fitted with front-office systems and the TIPS system were simultaneously taken into production. Relevant data going back to 2003 was converted by the T2S MPF and moved from the GEA back-office to the new back-office and TIPS. This one-time conversion was termed the "initial load", and was followed by a backup of the source systems for future reference and compliance reasons. |
| <i>Deposit refund scheme for roughly 45,000 subscribers</i> | Unlike in the old situation at the Westerscheldetunnel, Movenience B.V.'s new subscribers would not be asked for a deposit for using their t-tag. Therefore, 45,000 subscribers had to receive a refund, a process that was also handled by Type 2 Solutions. The T2S MPF was used to analyze and extract all data related to the roughly 60,000 t-tags in use, and to generate correctly formed Dutch and Belgian direct debit order batch files (respectively CLIEOP and DOM80 files). |
| <i>Migration functionality to TIPS and the new back-office</i> | After the initial load, the twelve remaining lanes, which were still fitted with GEA front-office workstations, were connected to an uncoupled copy of the GEA back-office. Since there were no more connections to external systems, it was physically impossible for the GEA back-office to issue credit card and direct debit orders. From that moment on, these tasks became the responsibility of the new back-office and TIPS. The first phase of the migration, which was initiated on March 11 th , 2010, was successfully completed 4 days later, on March 15 th . |
| <i>T2S MPF reconciles old and new situation during delta load</i> | Subsequently, the T2S MPF switched from manual batch mode to operate in unattended interface mode. By doing so, the delta load phase was entered. In this project phase, the T2S MPF would forward all the transactions spawned after the initial load to the new back-office system in real-time. This was done in a similar manner to the initial load, using XML feed files validated against an XSD, and by subsequently dispatching them to the new back-office. |

*Lane-side
validation of credit
cards and t-tags*

Since it was necessary to authorize a means of payment in both the new as well as the old lanes, up-to-date lists of valid t-tags, stored in TIPS, and of banned credit cards, stored in the new back-office, had to be distributed to both lane types. The T2S MPF was once more used to handle the conversion of these files to the proprietary format expected by the GEA lanes, and their distribution.

*Automated
notifications*

Data flaws that could not be corrected by the T2S MPF without human intervention, and therefore would have caused the feed file to fail validation against the XSD and upload into the back-office were excised and communicated to monitoring tools that would immediately forward an email and SMS notification to the support organization at Type 2 Solutions. During the delta load phase of the migration project, the migration platform handled roughly 1.2 million transactions, and there was only a single occurrence of such a notification.

*Automated
logging and
archiving*

After the successful delivery of the XML feed files to the new back-office system, the files were compressed, together with the matching log files, and archived per calendar day. Archiving all feed files was a contingency measure that would allow to submit them again to the back-office, should that need arise.

The Result

*Successful
replacement of the
complete toll
collection system*

The last GEA lane was upgraded on June 17th, 2010, making the T2S MPF redundant. After the usual backups of the systems involved in the migration, for the same future reference and compliance reasons, these systems were phased out and the replacement of the initial toll collection system of the Westerscheldetunnel was a fact.

“Type 2 Solutions has handled this job to our fullest satisfaction. Their approach has been utterly professional and thoroughly organized. Another important fact is that they really got into our business processes.”

Patrick Dankart, Operations Manager at N.V. Westerscheldetunnel

Project details

Source Systems

- Centralized GEA Back-Office System + 14 Front-Office Systems at the Lanes
- Customer Information System
- Financial System
- t-tag Inventory System
- Customer Portal

Conversion Software

- T2S Migration Platform (T2S MPF)

Target Systems

- Centralized Technolution Back-Office System + 14 Front-Office Systems at the Lanes
- Transaction Information and Processing System (TIPS)

Technology

- Windows 2003, 2008
- Linux CentOS 5.4
- Oracle 10.2.0.3 Standard Edition
- SQL Server 2008 Enterprise Edition
- Perl / AWK / SED / Shell Scripting / C
- PL/SQL / Transact SQL
- XML / XSD