Coltex: software management for textile collections

WAN and mobile devices in Smalltalk

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Introduction

The concepts described in this report are the result of the experience gathered in the implementation of a software solution using object technology to manage the textile collections of a social enterprise with headquarters in Belgium counting with more than 1,500 textile bins spread across the country. The project extended from late 2005 until mid 2007.

The problem

Prior to ColTex, the organization of the collections was not formalized, the use of technology was largely adhoc with no specific software and the knowledge was fragmented among the domain experts.

The management had poor indicators to evaluate the performance of its two subsidiaries (called 'bases' in ColTex parlance) responsible for the collections in their respective geographical area.

The challenges involved not only the implementation of a software solution but also the definition of work standards and the infrastructure to support it.

The solution

The initial vision of the solution recommended the use of traditional technology, the purchase of a third party product for PDAs developed in .Net and a long term service agreement with a third party that would have provided the server infrastructure and tracking services.

Thanks to a previous experience with some Smalltalk projects (XML parsing and a reporting tool based on an OLAP engine written 100% in Smalltalk), the company chose Smalltalk for prototyping the domain model.

Twenty days later, a prototype of the system representing 70% of what it is today at the domain level was ready. The company weighed the evident benefits of this technology against the supposed technical challenges and decided to fully implement the solution in Smalltalk and to adapt its infrastructure in order to handle all of Coltex in house.

Team

A modest team counting of one domain expert/design advisor (José Constant) located in Belgium and one smalltalker (Claudio Campos) located in Argentina build solution with an effort in a symbiotic/synergic relationship within one and a half year time frame.

Infrastructure

The infrastructure provides support for the activities at the two local bases, at the main office and in the field or during transit. It consists of a database, a communications server, several workstations used by the collection managers over a WAN and a fleet of 25 rugged enterprise mobile assistants (PDA's) equipped with bar code readers and telephone.

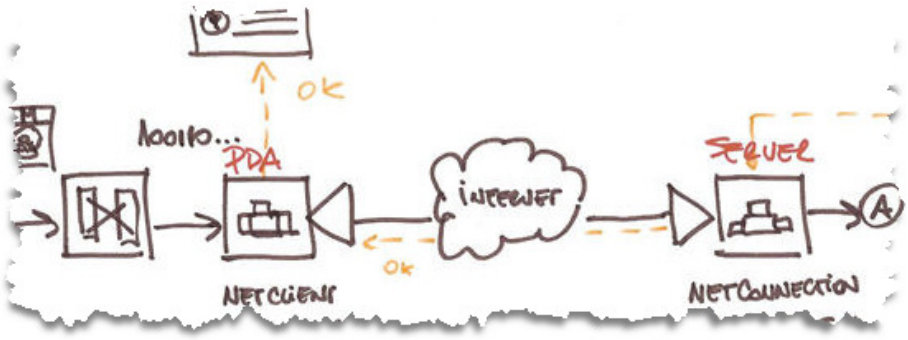
Main applications fully written in Smalltalk

CMS -Communication Server (Dolphin X6)

The application that links mobile devices with workstations. It consists of an object server and a

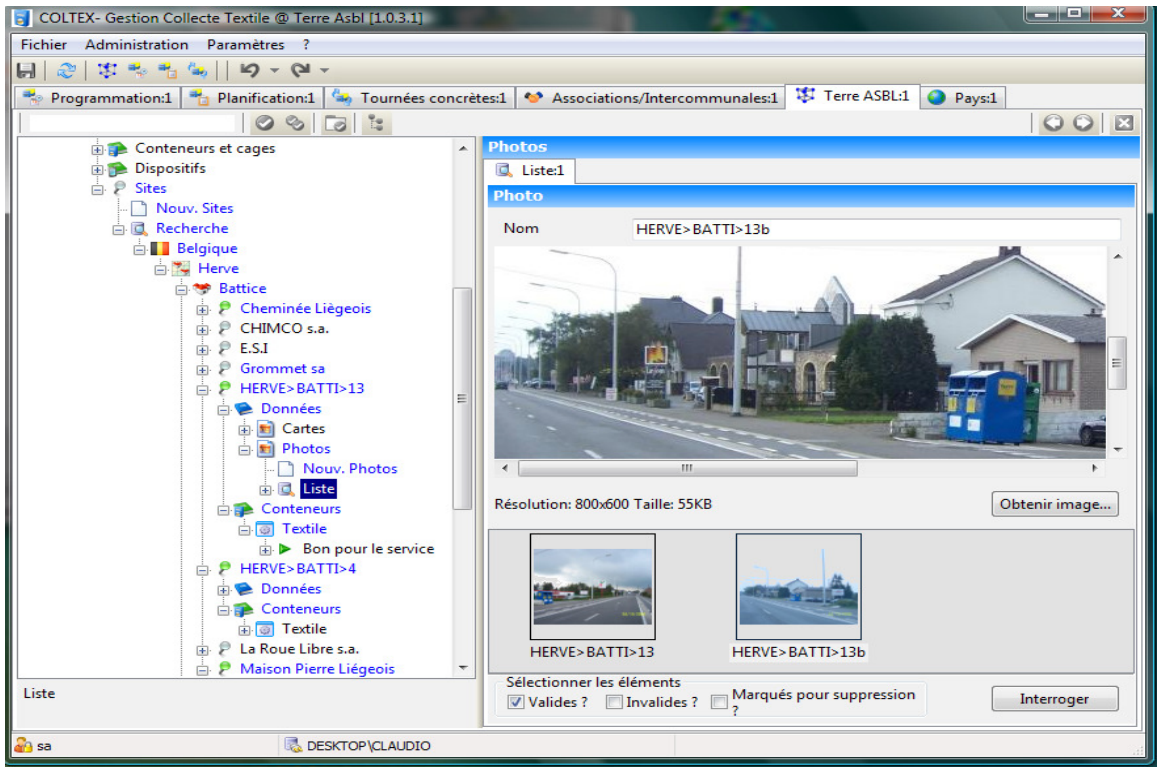
communications pipeline. Different teams have access to this server in the context of a virtual private network (VPN).

CMM -Communication Monitor (Dolphin X6)
An application installed on the collection managers' workstations monitoring messages from and to the PDA's, their state (connected/disconnected) and providing chat communication between the members of the network.



Communication Pipeline sketching

Coltex WAN (Dolphin X6)
The system for managing the bin network structure, planning and organizing the collections, as well as managing all the required resources (human and material) to carry them out.



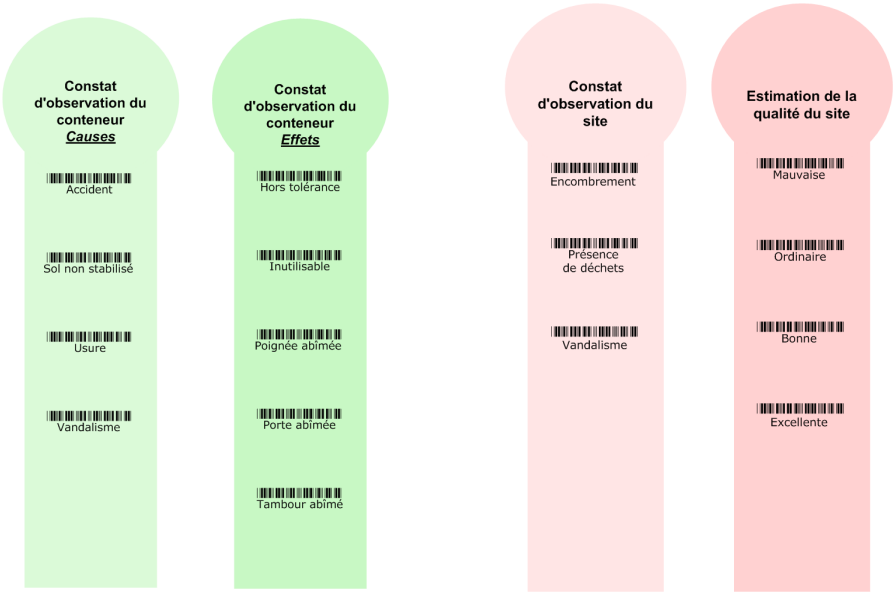
Coltex WAN > Bin network > Site

Coltex PDA (Squeak for WinCE)
The system for registering the collections in the field. It runs on mobile devices and shares ColTex WAN domain model with no adjustment.

The PDA has access to all the information of the network of sites and bins managed by its base, i.e. approximately 700 sites and 800 bins per base at the moment. Each site shows its street address, gps coordinates, collection of bins and other useful information.

It supports the visualization of a collection plan and records actions such as emptying a bin or

observations, like the current state of a bin or the state of a site where the bin is placed.
It also sports a bar code scanner in asynchronous mode: the user can scan at any time and the system responds with a voice message if necessary. The user has no need to focus on the user interface, just scan (with the help of a bar code language) and the system interprets the information and inform him with voice messages.

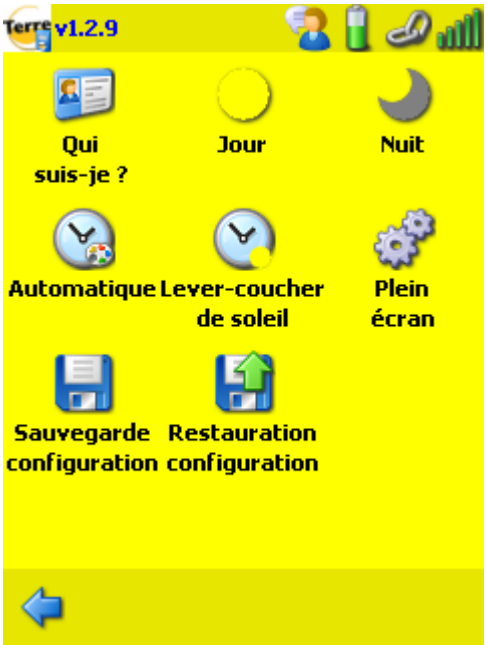


Bar code language

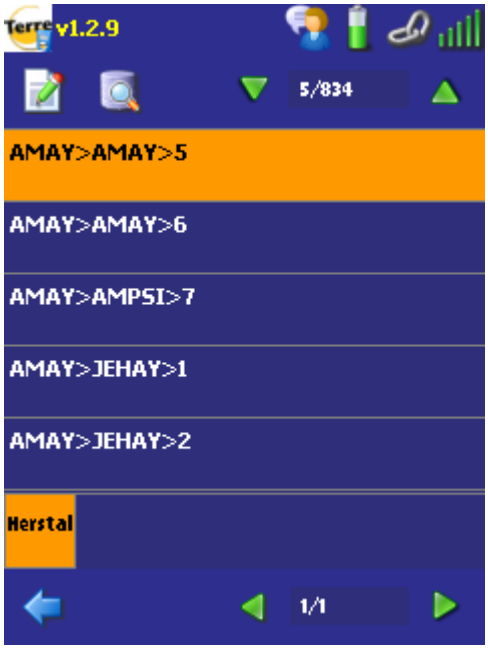
The status of several peripherals is monitored: battery, phone, GPRS connection to the VPN, and so on. The monitors was implemented without having the production equipment at hand.

The user interface has been designed specifically with the final user in mind, is so delicate that takes into account even the amount of natural light of environment.

ColtexPDA > Main menu (sun)

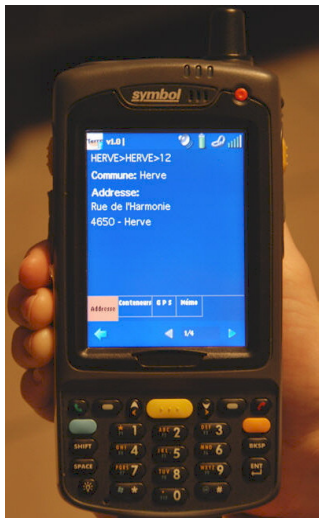


ColtexPDA > Preference menu (sun)



ColtexPDA > Site list (night)

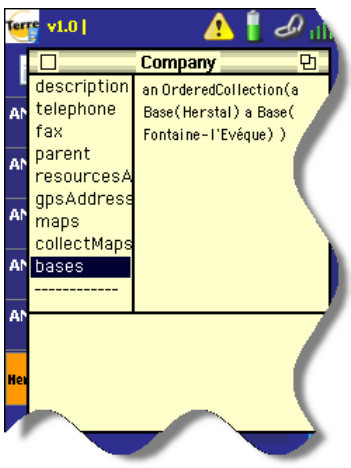
ColtexPDA > Tour points (night)



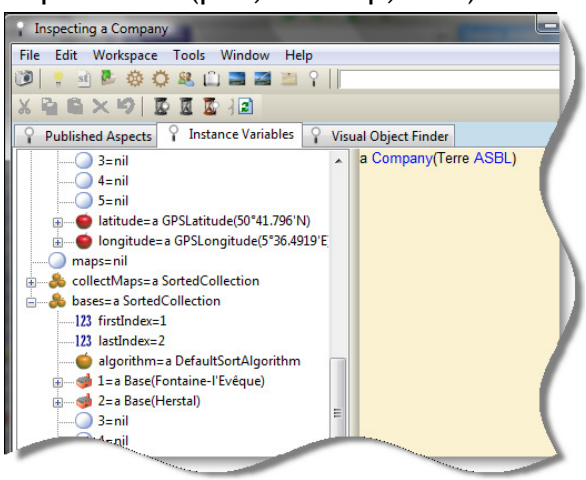
Each textile collection truck is equipped with a PDA

Domain model

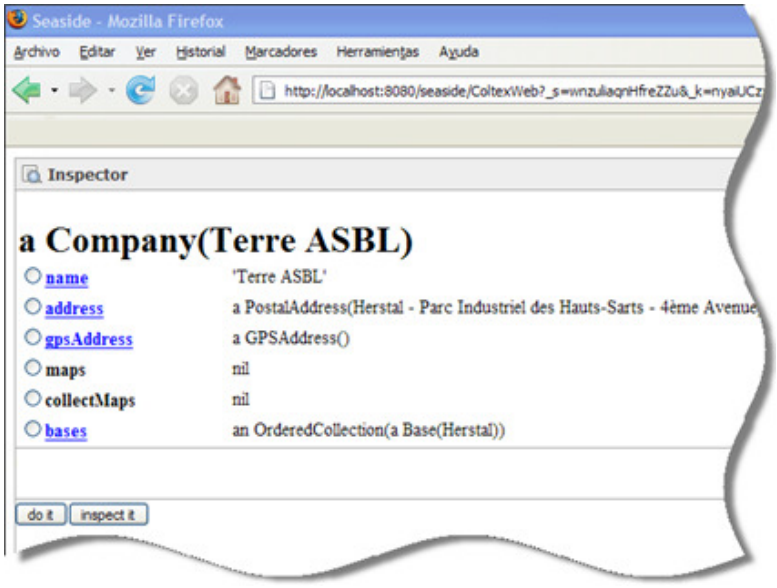
The same domain model is shared among the several platforms (pda, desktop, web)



ColtexPDA (Inspecting the company)



ColtexLAN (Inspecting the company)



ColtexWEB (Inspecting the company)

Other techincal details

Within a single compact executable file of 2.7 mb fully writing in Smalltalk you can find the domain model, a persistence framework for create and update the database, a dynamic ui framework, a rule engine, a communication pipeline, etc.

Conclusion

The various difficulties that the development team had to overcome as well as the gradual revelation of the complexity of the project left them with the opinion that the choice of object technology had been vital to address these difficulties.

Also, the model flexibility allowed a smooth extension of the solution to the collection of other types of materials like paper, glass, plastic, etc… and other types of collections as well (territory based rather than site based).

Future plans

- RFID for the identification of the textile bins.
- GPS to monitor in real time the location of the collection teams and for autorouting on PDA and Desktop
- ColTex WEB in Seaside, a website for general public information (Where are the bins located? Provide the street maps and pictures of the sites).