A CAPI Logistic System

Gerrit de Bolster, Statistics Netherlands

1. Introduction

As of October 2010 The Netherlands consists of European Netherlands and three islands in the Caribbean: Bonaire, St Eustatius and Saba, also called The Caribbean Netherlands (CN). Statistics Netherlands (SN) is therefore also responsible for statistics in CN and for this reason runs a small office on Bonaire, the largest island of CN. From 2013 this office started using Windows tablets with a Blaise tool for data collection. In 2013 it was still limited to a tool with its own shell on each of the tablets. As it was expected to expand in the future a new system was developed. This system makes it possible for the involved departments in The (European) Netherlands to easily maintain the instruments and survey cases on the tablets in connection with the group of interviewers involved. The first questionnaire to use this system was the Labour Force Survey (LFS) which was specially designed to work on these tablets. The LFS was deployed in the field using the new system in the beginning of October 2014. This paper will give more insight about that system, the LFS questionnaire and experiences in the field in CN.

2. History

2.1 A Proof of Concept

In 2011 as a spin-off of the Case Management working group which is focusing on the requirements for a CAPI case management system, an initiative of the BCLUB, at SN a begin was made with the creation of a Proof of Concept (PoC) of a so called CAPI Case Management System (CCMS). The PoC included an application that was aimed at running on a laptop of the interviewer. Additionally a very simple application was created to run in the office to communicate with the application on the laptop. This PoC was presented during the IBUC 2012 in London.

2.2 The Omnibus Survey CN

In the beginning of 2013 the office of SN in The Caribbean Netherlands (CN) decided to use tablets to replace their paper based data collection. For that reason they requested the creation of a questionnaire for the Omnibus Survey to be held only on Bonaire, the largest island of CN. As it was an opportunity to get experience with Blaise on tablets the request was granted but considered as a PoC. It was also necessary to create a shell program to select the survey case at the opening of the questionnaire and to export the completed statements to a USB-key as the tablets were not connected to the Internet for security reasons. This shell program was built in Maniplus in combination with VBScript and some small freeware programs. This software (shell + questionnaire) was installed on the tablets using a MSI package. The survey cases were also included in the installation package packed in an encrypted zip-file. To send the exported completed statements to the SN office in The Netherlands through secure data communication from a laptop existing upload functionality through HTTPS was used. The survey should run on Dell tablets with Windows 8. The screen size was 10 inches with a resolution of 1366x768. Therefore the questionnaire was designed with a font size of 18 and a special menu including a numeric keyboard on the right hand side. The Omnibus Survey was held in June 2013. The tablets were working well to the great satisfaction of the interviewers and the local office. The results were presented during the IBUC 2013 in Washington DC.

2.3 The Consumer Price Index

Because of the success with the Omnibus Survey our office in CN wanted to continue with CAPI on tablets. Their next target was the monthly Consumer Price Index (CPI). Until then the interviewers (4 on Bonaire working 2 at the same time and 1 on Saba and 1 on Sint-Eustatius) went around the shops with a paper form printed locally on the islands that they copied afterwards to an Excel spreadsheet at home. This spreadsheet was then sent to the office in The Netherlands by e-mail. It was a troublesome and error prone process. So again the office in CN asked for a solution for the tablets. In this case a Maniplus setup for the CPI was built as the demanded functionality was not suitable for a standard Blaise questionnaire. Again an additional shell program was built similar to the one for the Omnibus Survey. Only this time it should not only export completed statements but also import files with new products for the next month. These files were transported from our office to CN using the existing functionality of download portals. The results were uploaded using the existing HTTPS functionality as before. To install the software on the tablets a new and more flexible installer (also built in Blaise) was used. The CPI on tablets started being used on Bonaire in April 2013, in August 2013 on Sint-Eustatius and in November 2013 on Saba.

2.4 The Economic Cycle Survey

At same time as the CPI instrument was being developed the office on Bonaire started to develop a Blaise questionnaire for the Economic Cycle Survey (a survey amongst enterprises asking them about their business expectations for the near future). Having no training in the use of Blaise whatsoever they soon called for help. Finally the questionnaire was mainly developed in SN. Again a separate shell program was added and the Blaise built installer used. Also the same data communication solution (HTTPS upload) was used again. Running in November 2013 it was again successful.

2.5 A new system for CAPI

Although the data collection process applying tablets was successful the office in CN was missing functionality to follow the progress. Also the repeated installation of the software on the tablets for each survey started to be a burden and the data communication process required several manual operations. Moreover there was not enough capacity available to continue the building of the individual shell programs. As it was clear that CN wanted to continue to use the tablets for data collection at the end of 2013 an informal project was started to design and build a complete new system for CN in Blaise 4.8.4. The new system was put in action on Bonaire in October 2013 and on Saba and Sint-Eustatius in November 2013 with the questionnaire for the Labour Force Survey specially built to operate with this system and tablets. As it was a first version it was considered as a pilot.

3. The architecture

3.1 Overview

The system consists of 4 separate applications mainly built in Blaise 4.8.4 including some additional VBScript (encrypted: .vbe), HTML application (.hta) and freeware programs. It supports the deployment of instruments, survey cases and additional data to interviewers (optional via local agents) and collecting the completed or cancelled statements. It also contains a messaging system for human readable and

system messages. The configuration of the software involved can also be managed remotely. Data communication is invoked using separate scripts and can be adjusted to the local needs. Any data that is exchanged is encrypted and thus protected.

Although this kind of system is generally called a CAPI Case Management System it is not really managing cases. Its functionality is clearly logistic functionality. Therefore the name "**CAPI Logistic System**" (CPLS) fits better.

3.2 The roles

In the scope of the CPLS we recognize 4 roles:

- **The main office**
  The main office can manage directly one or more local agents (or none), one or more local coordinators (or none) and one or more interviewers (or none). The main office should at least manage a local agent and/or an interviewer.
- **Local agents**
  A local agent can manage one or more local coordinators (or none) and a group of interviewers.
- **Local coordinators**
  Local coordinators only play a role as hub between 2 transport modes. E.g. between an Internet connection with the main office and USB-keys used by a group of interviewers.
- **Interviewers**
  The interviewers collect the data by interviewing the respondents.

3.3 The applications

The CPLS consists of the following 4 applications:

- **BLS-Collector**
  This application runs on the network (or computer) in the main office of the data collector. The complete CPLS is controlled (directly or indirectly) by it. Instruments and Survey cases are imported in BLS-Collector before they are sent to the interviewers. The completed statements are received by BLS-Collector before they are distributed to the survey departments.
- **BLS-Agent**
  The BLS-Agent application runs on the computer of a local agent. A local agent is an in-between between the office and a group of interviewers. It receives instruments and survey cases from the main office sent with the BLS-Collector application and divides them over the interviewers it manages. The completed statements received from these interviewers are sent directly to the main office. This action is registered in BLS-Agent so the local administrator always has an overview of the progress of the data collection by the group of interviewers it manages.
- **BLS-Connect**
  BLS-Connect serves as a connection hub between the main office on one side and one or more interviewers on the other side or between a local agent on one side and a group of interviewers on the other side. With BLS-connect 2 different types of data communication can be connected. The main office can e.g. use a Secure FTP (sFTP) connection to a local coordinator who can copy the data to USB-keys used by operating interviewers in the area and vice versa.
- **BLS-CAPI**
  With the BLS-CAPI application running on its laptop or tablet an interviewer can manage and perform the assigned interviews and communicate with the local agent or the main office using the messaging function. A laptop or tablet can be used by several interviewers each with his or her own working space.

Figure1. The main dialog of BLS-CAPI.
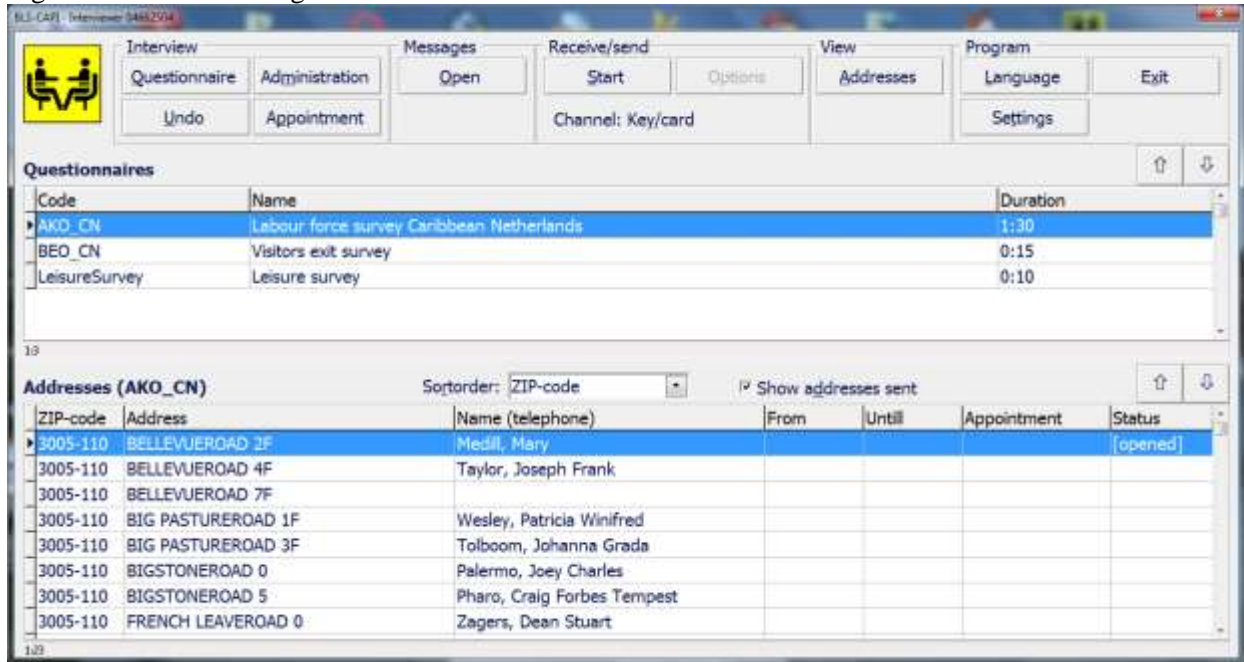
The 4 applications can be combined in different configurations. Any combination of these 4 configurations can be applied in the CPLS.
1. BLS-Collector — BLS-CAPI
2. BLS-Collector — BLS-Connect — BLS-CAPI
3. BLS-Collector — BLS-Agent — BLS-CAPI
4. BLS-Collector — BLS-Agent — BLS-Connect — BLS-CAPI

In configuration 1 the main office communicates directly with the interviewers and visa-versa. The main office is responsible for defining the interviewers and distributing the instruments and survey cases amongst them. In configuration 2 the communication between the main office and the interviewers is using a hub created with BLS-Connect. For the rest this configuration is the same as configuration 1. Configuration 3 introduces the use of local agents. In this case the main office only communicates with one or more local agents. These local agents are responsible for defining the associated interviewers and distributing the instruments and survey cases amongst them. The main office in its turn is responsible for defining the local agents and the distribution of the instruments and survey cases to these agents. Similar to configuration 3 is configuration 4. The only difference is that for the communication between the local agent(s) and the associated interviewers the hub is used. There is no configuration defined with the hub BLS-Connect between the main office and a local agent. The BLS-Connect is mainly designed to bridge some kind of Internet protocol with a remote storage protocol (USB-key or memory card). It is supposed that for a local agent at least some kind of Internet protocol is available.

In the case of CN a combination of configurations 3 and 4 was used.

Figure2. The architecture used for CN.
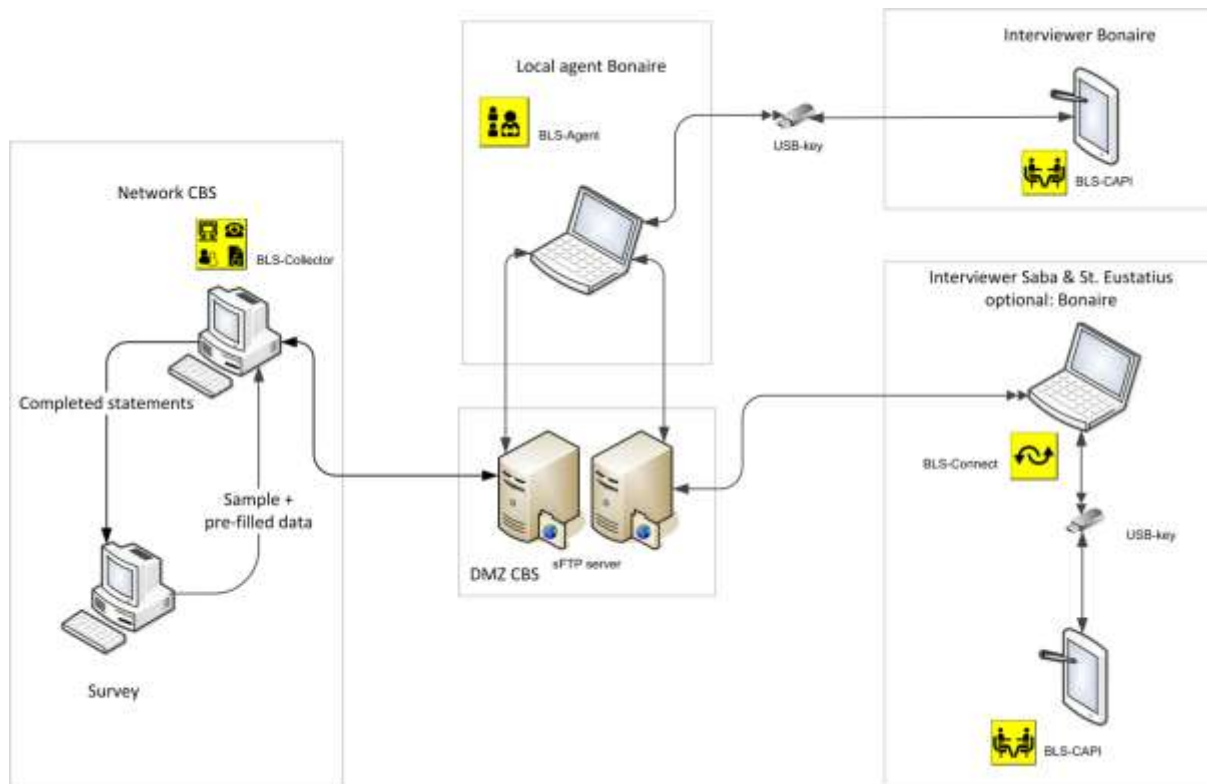
3.4 Data communication (general)

The data communication process can take place between the BLS-Collector and a BLS-Agent, between the BLS-Collector and a BLS-CAPI or between a BLS-Agent and a BLS-CAPI. If BLS-Connect is included in the communication as a hub there are also connections possible between BLS-Collector and BLS- Connect, BLS-Agent and BLS-Connect and BLS-Connect and BLS-CAPI.

These connections are configured according to some kind of "Client-Server" approach. The first one mentioned operates as server, the second one as client. During a data communication process so-called packages are transported: encrypted zip-files containing the objects with data (see also the paragraph Packages and Data objects). The main difference between the role of the server and that of the client is that only the server can delete packages from the intermediate storage devices such as an sFTP-server or a USB-key. The client only copies the packages from and to the device. Because the client identification is part of the name a client can select the proper packages from an intermediate storage. When a package contains the configuration of a new client it is encrypted with a key constructed from the PIN-code of the client and a common (secret) key of the system. This is necessary because the new client does not know its zip-key until the package is unpacked and processed. All the data communication actions are registered in a log. All packages that are sent or received are stored in an archive folder.

The data communication process always consists of 2 consecutive actions: receiving followed by sending. It can be started from the side of the server as well from the side of the client. The (sub)folders involved in the transport of packages from the office (BLS-Collector) to the interviewer (BLS-CAPI), including the communication via a local agent (BLS-Agent) and/or a hub (BLS-Connect), are called "Off2Int". The (sub)folders involved in the transport in the opposite direction are called "Int2Off". With the exception of BLS-Connect the applications store all the received and sent packages in an archive folder.

If the server side started up the data communication the following steps are executed:
1. Move all the packages from the "Int2Off" folder on the intermediate storage to the receive folder of the application.
2. Unpack the packages and process the content.
3. Remove the packages from the "Off2Int" subfolder in the send folder of the application if a confirmation of receipt was received from the client.
4. Add the new packages (including receipt confirmations) to be sent to the client to the same "Off2Int" folder.
5. Synchronize the "Off2Int" folder on the intermediate storage in a way that it is a copy of the "Off2Int" folder of the application.

If the client side started up the data communication the following steps are executed:
1. Copy all the packages from the "Off2Int" folder on the intermediate storage to the receive folder of the application.
2. Unpack the packages and process the content.
3. Create the new packages (including receipt confirmations) to be sent to the client in the "Int2Off" subfolder in the send folder of the application.
4. Copy the complete content of this "Int2Off" folder of the application to the "Int2Off" folder on the intermediate storage.

The archive actions are left out in this overview.

3.5 Data communication (tablet)

The Dell tablets have 4 methods of data communication:
- Wireless Internet
- Bluetooth
- SD card reader
- USB port

Because of security demands the data communication with the tablet is restricted. The Bluetooth, the wireless Internet and the SD card reader are disabled in the BIOS. Storage using the USB port is disabled through the registry. Every tablet has an administrator account and a normal user account. Only using the administrator account can the USB port be activated for storage devices by changing a registry value so it is used for the data communication and even then in a very protected way. The data communication process is invoked by the interviewer by clicking on the start button in the application BLS-CAPI on the tablet. It runs a process that opens the USB port in the registry with the following steps:

1. The process is elevated to administrator level by using its credentials which are stored encrypted in the configuration file. The following steps are run "as administrator".
2. A task is scheduled which will close the USB port at start up to prevent the situation that if the tablet is stopped the hard way by pushing the power button, the USB-port stays open even after a restart. Restarting the tablet the task will close the USB port automatically.
3. Any active Task Manager is stopped preventing the user from interrupting the process.
4. The Task Manager is disabled so it cannot be started again.
5. The auto play function is disabled.
6. A script is started waiting for the event caused by the insertion of a USB key in the USB port.
7. The user is prompted to insert the USB key.

8. The moment the event is received the script detects which drive it is and closes the USB port so no other USB key can be inserted. The USB-key that was inserted stays accessible even if the USB-port is closed.
9. The files intended for the interviewer are copied from the USB key and the files that are to be sent by the interviewer are copied to the USB key. All files are encrypted with a key unique for every interviewer.
10. The USB key is ejected and the user is prompted to take it out of the USB port.
11. The Task Manager and the auto play function are enabled again.
12. The scheduled task is removed.
13. The received files are decrypted with the unique key of the interviewer. Files that are not encrypted or encrypted with the wrong key are removed.

Finally the USB-key has to be delivered to the local administrator to synchronize the data on it using the BLS-Agent application. On the island of Bonaire the key can be delivered by the interviewer personally to the administrator due to the small distances. However, the other 2 islands Saba and Sint-Eustatius are 900 km away. For that reason a hub called BLS-Connect was developed. This hub, running on the laptop of a local coordinator (can be one of the interviewers) only synchronizes the content of a USB-key with the sFTP server in our office (See Figure 2). The local agent can connect to this sFTP server using BLS-Agent to synchronize the data on his side.

The synchronization between the local agent and the application BLS-Collector at the office also uses the sFTP server.

3.6 Data communication (protocols)

All the data communication processes are built as separate scripts and can easily be replaced by other scripts thus changing the data communication protocols. The software on the laptops and tablets used for the data communication consists of Maniplus scripts, (encrypted) VBScripts and freeware.

There are different types of data communication protocols possible. The protocols are defined in the configuration or settings files and using procedures in separate alien MSU-libraries and are therefore easy to replace. At the office side (BLS-Collector) all the available data communication protocols can be enabled at the same time. This can also be done by the local agent (BLS-Agent) when communicating with interviewers (BLS-CAPI). However, the local agent can only select the protocols that are assigned to him by the office. For the communication with the office the local agent can only choose one of the assigned protocols. The interviewer side can use only one protocol at a time. The possible protocols are assigned by the local agent and are a subset of the protocols assigned to the local agent by the office for this purpose. The local coordinator (BLS-Connect) uses a fixed protocol to communicate with the interviewers (key/memory card) and can select one protocol from the assigned protocols to communicate with the local agent or office (depending on who created the local coordinator). The subset is stored in the settings of the local agent/local coordinator/interviewer and can be updated remotely by the party who assigned them.

All the data communication protocols use an in-between medium. This can be a server (e.g. in the case of sFTP or HTTPs) or a remote storage medium like a memory key or card or even a set of folders on the computer in the case of a dummy data communication process for testing purposes. All the in-between media use two separate folders: one for the traffic from the interviewers to the office and one for the traffic from the office to the interviewers. Although the names are configurable and therefore not mandatory it is highly recommended to use the names "Int2Off" and "Off2Int" for these folders.

There are 4 procedures in the alien MSU-library available to support a data communication protocol. These procedures has the fixed names "Preset", "Receive", "Send" and "Close". Not all the procedures are compulsory, this depends on the application. Also the set of parameters can be different for each application.

3.7 Packages and Data objects

During a data communication process so-called packages are transported: encrypted zip-files containing the objects with data. The packages are named "*clientID_dateTtime*.csp" (csp=Capi Survey Package) and are encrypted with a 64-character key from the client, applying 256-bits AES encryption. The "*clientID*" is the ID of the client involved in the data exchange. It can be the interviewer or the local agent. In some very special cases it is the ID of the BLS-Connect. Every package contains one or more data objects. Normally these data objects are packed in the root of the packages. Only in the cases where a local agent (with the application BLS-Agent) is sending on data objects from an interviewer (e.g. completed forms) are these data objects packed in a subfolder with the ID of the interviewer. Not only does it avoid conflicts between equal names of data objects coming from different interviewers it also passes on the ID of the interviewer who sent the data object in the first place.

All the data exchanged between the 4 applications is packed in so called data objects. These data objects are zip-files named "*Type{name}dateTtime*.cso" (cso=Capi Survey Object). The Type can be "ISM" (= instrument) in case the content is related to an instrument, "SVC" (= survey case) in case the content is related to survey cases or "NTF" (= notification) in all the other cases. The "name" depends on the type of object and its content. The "*dateTtime*" contains the date and time of creation and makes the name of the data object unique. Every data object zip-file contains an xml file called "_object.xml" with the properties of the object and, in most of the cases, a zip-file called "Data.zip" with the payload.
Any received object (with the exception of a confirmation object) causes a confirmation message to be sent back. This is done in the same data communication process as that in which the objects were received. At the office side the data communication process includes the updating of the in-between folders based upon these confirmation objects. At the interviewers side no updating is done. If at the interviewer side the same package is received more than once because the in-between folder has not been updated yet by the office side it is skipped based upon the registration in the logging.

3.8 Languages

The display texts of all the 4 applications are stored in separate text files with the same layout. Adding a text file with a new language will be automatically detected by the application and made available for selection. However, only languages that are based upon the same code page as is installed on the computer can be used. To use languages that use other code pages the active code page should be replaced using the standard Windows functionality. Only ANSI based code pages are supported. Up to 9 different languages can be added.

Instruments that are created as a Blaise data model can use other code pages through settings in the data model properties. See the Blaise help file for more information on this subject.

The names of the text files with the language dependent texts are "*xxx*.lng" were "*xxx*" is a 3 character code identifying the language (e.g. ENG , NED, ESP). They are stored in the subfolder "Languages" in the data folder of the application. The first record must contain the name of the language between double quotes ("*name*"). This name will be displayed in the selection list. The rest of the text in the record is optional but should not contain any double quotes. The texts are divided into sections. Every module in an

application has its own section. A section starts with the name of the section (which must be the same as the name of the module) between square brackets ("[*section name*]"). Every subsequent record until a new section contains a text item with the layout "*nnn~text*" in which *nnn* is a number (unique within the section) from 001 till 255. Which numbers are used depends upon the application involved. Empty lines are ignored. Substitution parameters in a text are declared as "^*x*^" were the *x* is an integer starting at 1.

3.9 Tablet enhancements

The BLS-CAPI application is designed to run mainly on tablets although it is no problem to run it on a laptop or notebook. Due to the fact that Maniplus dialogs have fixed sizes the screen resolution should be (set to) 1366x768.

As tablets can be used in landscape or portrait orientation, for some of the Maniplus dialogs 2 versions were created, one for each orientation. Before opening a dialog the orientation is detected with a small VBScript and the right version is activated. If the dialog is already opened and the orientation is changed it is not possible to switch automatically to the other version in Maniplus. Instead an invisible image button is added to the dialog in the background. By clicking on a place were no other control is available this invisible button invokes a procedure that detects the current orientation and activates the right version of the dialog. To prepare Blaise questionnaires for both orientations 2 layout sets have to be created in the Mode Library. They must have the same name but with "landscape" or "portrait" added to the end. The questionnaire will switch automatically to the right layout set thanks to some enhancements in the latest versions of Blaise.

A tablet is mainly managed through its touch screen clicking on buttons or radio and/or checkboxes. However, for filling in text an on screen keyboard is needed. In the dialogs where this is the case the standard on screen keyboard (TabTip.exe) can be opened by a separate button. If a laptop is used the on screen keyboard can be closed with the same button (toggle). These dialogs are designed in a way that the on screen keyboard does not cover the text field when it is opened. During the Tablet Workshop held at CSO Ireland in the beginning of December 2014 UMICH presented a keyboard built entirely in Maniplus which could be a good alternative. Touch screen functionality is replaced by the use of the mouse when a laptop is used.

4. Instruments and Survey cases

The CPLS supports different type of instruments. An instrument is normally a questionnaire to be filled in with the answers given by respondents. In some cases, like the Consumer Price Index, the interviewer fills in the questionnaire based upon his/hers own observations. The instrument can consist of one or more Blaise data models, one or more Maniplus setups or a combination of these two types. There are several options regarding the behavior of the instrument stored in a property file. Data files that are used as e.g. a lookup in an instrument do not have to be a fixed part of the instrument. They can be added (or replaced) later in a separate action. The activation of the audit trail is optional. It is even possible to activate the audit trail for a subset of the survey cases. The results are automatically sent together with the completed statements.

The CPLS also supports different types of survey cases:
- **Person**

If the survey case is a person that person should be interviewed. So if the person does not live at the given address any more it normally leads to a non-response unless the interviewer can locate the person at another address. Only one form per person should be filled in.

- **Address**
  If an address is the survey case an interviewer should normally interview more individuals at that address. E.g. in the Labor Force Survey for every household living at that address a questionnaire must be filled in. Another example is a visitor exit survey for which a random set of travelers in an airport has to be interviewed. The airport is then considered as an address.

- **Establishment**
  In the case of an establishment (enterprise) being a survey case only that establishment should be interviewed, similar to a person. Who is giving the answers for that establishment is not important. It can be the director, the head of bookkeeping or even an accounting office doing the administration for that establishment. It is also possible that several individuals are giving the answers.

The Labour Force Survey (LFS) is based upon an address sample. That means that the survey cases are addresses but the questionnaire is to collect data from a household. At each address one or more households can be living. All the households living at an address should be interviewed. This implies that the interviewer must be able to add households to an address. To support that a special type of instrument was defined called "multiform". Activating a form of that type in the BLS-CAPI application causes a dialog to be opened with which the interviewer can add and select households.

Figure3. The "household" dialog from the LFS.
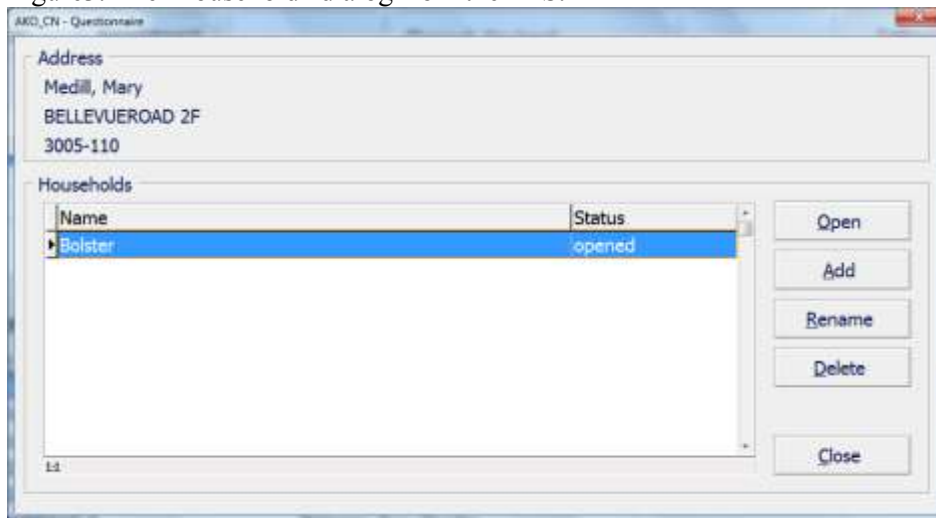
The questionnaire involved must have an extra field in the primary key that will receive a sequence number for each added household. The function is designed in such a way that the (multilingual) labels (texts) for this dialog are taken from the property file of the instrument. This makes it possible to use the same functionality also for other types of surveys such as the Visitor Exit Survey.

5. The pilot in The Caribbean Netherlands

One remarkable problem occurred for the LFS on the islands Saba and Sint-Eustatius. As it was an address sample the interviewer should visit addresses and not try to locate certain individuals. Although formally there were addresses they were not known to the population. Also street signs and house numbers were lacking. Finally maps were used to locate the addresses.

In general the interviewers were quite satisfied with the tablets and the application. They had no problem with the size or the weight of the Dell tablets. The contrast of the screen was sufficient. As the interviews were held inside they were not bothered by sunlight. The battery lasted for several days so there was no problem during the interviews with the energy.

Starting up the tablet and the LFS questionnaire was easy although the fact that they had to log on to the tablet first and after that to the application was considered annoying because they had to remember the different numbers and codes. This could lead to the situation were interviewers kept the codes on a note with the tablet. As the protection is regarded as necessary a solution should be found in making it easier to get the interviewer code e.g. by using a dropdown box.

The interviewers had no remarks about the layout of the main dialog as well as the layout of the questionnaire. All the texts were clear, equally well in Dutch as in English, and no buttons were missing. As usual there was no need for context sensitive help. Even the separate manual was hardly used. As there was only one questionnaire available the interviewers mainly used the single address list in the main dialog instead of the separate list for questionnaires and addresses.

Figure4. The opening screen from the LFS.

The On Screen Keyboard was used without any problems. However, the staff expects that with a physical keyboard less typo's will be made. The interviewers normally put the tablet down on a table or their lap during the interview. Because the tablet was placed on a surface there was no need for a special handle to hold it up. Maybe during the upcoming Visitors Exit Survey where the interviewers walk around on the airports a handle could be an improvement. It was decide to lock the tablets in landscape mode as the interviewers were complaining about the automatic rotation. The tablets were too sensitive, so a small movement quickly caused a re-orientation. Besides, they also found the portrait mode less pleasant to use.

The majority of the interviewers used their finger to operate the touch screen instead of the pen. The staff at the office preferred the pen. Although there is a function included in the main dialog to register

appointments the interviewers mainly used their own agenda or notebook. As they don't have to logon to the tablet and the application this worked faster. Also the function of sending and receiving messages was not used. On the island of Bonaire there was often personal contact between the interviewers and the staff so even sending messages was superfluous.

The main problems that occurred were in relation to the data communication. Due to security policies the communication with the tablets was done by USB-key. Starting the synchronization the program prompts for insertion of the USB-key. It automatically detects when this is done and consequently processes the content. However, in the beginning the detection did not work always. It appeared to be caused by the USB-keys. After changing to another type of USB-key the problem was solved. The next problem involved the sFTP connection between the office and the agent. At a certain moment our office in CN reported that for some time they hadn't received any packages from the sFTP server. It appeared that the infrastructure department migrated the server to another environment and that the host key fingerprint was changed without informing us, this due an overload of work for the infrastructure department at that moment. After updating the configuration with the new host key fingerprint the sFTP was still not working. A lot of more errors were made during the migration, all caused by an understaffing of the department. The errors were solved immediately when they were reported and the packages were sent and received again. Later a problem occurred with the sFTP connection with island of Saba. This was caused because the communication was invoked from behind a firewall that blocked the sFTP port 22. The lesson learned was that the software should report any communication problems immediately and store, in case of an error, as much debug information as possible in the logging.

The staff using the applications on the side of the office and the agent were also content with the system. Assigning addresses to the different interviewers was at first reported as difficult but after adding another sorting capability it became much easier. There is no doubt they will continue to use the system for data collection. Of course, based on the first experiences they reported some points of improvement. The next intended surveys will be the Price Level Survey and the Visitors Exit Survey. The Price Level Survey is built in Maniplus. The Visitors Exit Survey will be a Blaise 5 instrument.

6. Further development of the CPLS

As a result of the pilot in CN several small errors were detected and repaired in a newer version of the applications. Also some missing functionality was added.

To be prepared for the future a run-time version of Blaise 5 was created by adding the necessary files (mainly dll's) to BLS-CAPI and creating and starting the Blaise 5 service during installation. To get it running several Blaise 5 configurations files (text but also SQLite) also had to be updated during installation while adding a new instrument. All these functions were added to the latest version of BLS-CAPI. As the rest of the CPLS is still working with Blaise 4.8.4 stored statements were, after closing the interview, on the fly converted to a Blaise 4 data base. It appeared that the Blaise 5 conversion program was too slow so a small C# program was developed using the Blaise 5 API to convert the record from the Blaise 5 bdbx file to an Blaise 5 XML-file. As the XML definition is the same in both versions the record could easily be loaded into a Blaise 4 bdb-file using a Maniplus setup. This solution makes it possible to run Blaise 5 instruments on the tablets or laptops while the office can still process the data using Blaise 4.
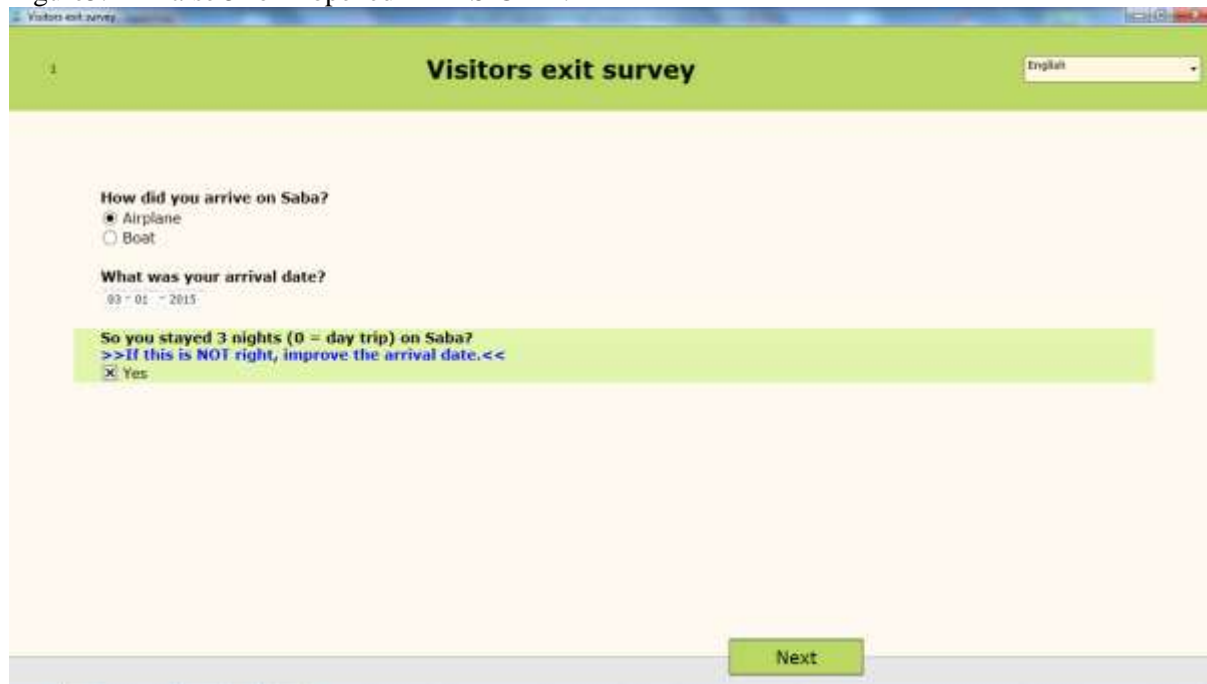
Although the CPLS has already proven its added value further use will create needs for new functionality. The final version is not yet there. Already several improvements and extensions have been implemented in newer versions:
- Remote update of languages, configuration and software

- Including survey case related data with survey cases
- Showing the content of received statements
- Improved search and export options for survey cases
- Returning an unused survey case to the office
- And other similar enhancements

Maybe more organizations can join to improve, extend and test the CPLS as a kind of Open Source project.

Figure5. A Blaise 5 form opened in BLS-CAPI.

7. Epilogue

I want to thank Rod Furey for reviewing this paper. He improved the spelling and his comments made it more understandable.