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SAFIR

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Document Summary

Keywords: Generic Needs, Strategy for the WP6 Specific user pilot "Belgian Pilot Project".

Abstract: This document describes the strategy for the WP6 being developed by the CIRB.

This report defines the generic needs for the Brussels SAFIR pilot project.

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1 Executive Summary

1.1 Project description

The CIRB (Informatics Centre of the Brussels Region), a public organization depending on the Brussels region, is responsible for the production and the distribution of the official map of the Brussels region. This map is called UrbIS that stands for the Urban Information System.

UrbIS is a GIS (Geographical Information System). It means that it is a system that owns a set of geographical data which can be used among various types of applications. A good example is the association of the population density with a specific area of the Brussels region. The services of the land register of mobility use these data and thus the GIS systems.

The mission of the CIRB is to maintain the data stored into the system in order to allow all the services of the region to access an up–to-date information. This work is mainly executed at the office thanks to several administrative documents, among others the « as-built » plans. However, ambulations are necessary in order to control, in situ, the work really carried out. Indeed, it happens frequently that documentation is incomplete or missing.

1.2 Milestones

The main milestones are already defined:

Pilot Preparation : 31st of August 2005
In depth Analysis : 28th of February 2006
Technical Environment : 30th of April 2006
Development : 31st of March 2007
Tests : 30th of September 2007.
Documentation : 29th of February 2008.

2 Pilot Selection Process

2.1 Dissemination Potential

The CIRB has planned to disseminate the voice technology across all the GIS services of the administration thanks to the new methodology and the UrbIS system already used accross those services. The number of potential users is around 20 people for the whole region. The need for an up-to-date geographical system is important. The maintenance must be as easy as possible and the voice technology developed by the SAFIR partners seems to be an appropriate answer that can help the CIRB to reach its goals.

2.2 Sustainability

This project offers a certain potential of development. This project can always be completed by adding some new voice-enabled functionalities. All the administration services have not all the same needs and some of them can easily extend the number of operations they would like to implement. The methodology the CIRB would like to build responds to this request.

Besides, the CIRB is responsible for the “Bornes i+” and there exist some interest for the voice technology and the solution the SAFIR project can bring to this device.

2.3 Social Effect

The goal of the SAFIR pilot project is to modernize and simplify the way the information is collected on the field. through the use of voice technology. If this operation is successful, it is clear that the quality of the data produced in this way will be better as the service offered to the society

2.4 Organization Benefit

The CIRB will directly benefit from the SAFIR technology, mainly because a large amount of time will be saved by maintaining vocally thousands of geographical elements and their attributes. Most of them can be handled and modified vocally. For example, a parcel limit does exist in the system, the inspector controls the parcel and notes that its limit is, in fact, a wall of 1 meter high. Just by saying “This limit parcel is a wall of 1 meter high.”. He saves several actions : display walls, create new wall, change attribute Height to 1 meter and delete/remove parcel limit.

The gain of time can be considerable depending how easy it will be to select objects and managing/handling them vocally. The gain resides probably also in the fact that field modifications allows higher accuracy than differed remote update.

3 In depth Analysis

3.1 Problematic

The need for geographic information system has, the last years, seriously increased. The necessity of up-to-date maps, with a lot of details, has become essential for managing and organizing the different administrations as well as improving the services offered to the citizen.

Nowadays, several administrations of the Brussels Region have a team of collectors whose role consists in walking round the streets of the Belgian capital and noting the modifications for a well defined types of information, for example, the address change of a building or the adaptation of the road signs.

Today, this ambulation has still been done with paper and a pen. This work is fastidious and the modifications take times before being published. The need is tremendous and this problem has to be taken into account so the data quality remains unchanged, or increases, and the speed of the publication is increased to a significant degree.

3.2 Needs

The CIRB, a public organization depending on the Brussels region, has the role of providing services, primarily information technology, with the various administrations of the area. The Geomatic department provides a detailed map of the Brussels area under the name of UrbIS.

Several public administrations and services came into contact with the CIRB to require of them to improve and increase the information available on the map. The requests consist of the addition of data such as the pavements, the panels of circulation or one linear of traffic network.

The need is very diversified and is not very reproducible. It would be, consequently, useful to set up a methodology that will make it possible to better apprehend the problems and to estimate the development costs for a future implementation.

The pilot project that the CIRB proposes consists in setting up mobile technology, available to the inspector, i.e. Tabletpc combined with a GPS system and a vocal system to update the geographical objects and the linear traffic network which will be based on the first version of GIS system UrbIS.

The traffic network map will have to be migrated in order to be compatible with the last version of the UrbIS v2 database.

It is noted that the vocal technology brought by the project SAFIR is an added value which will largely facilitate the work of people on the field. It will enable them to navigate very easily on the map, to select certain objects and to modify some of their properties. This will happen only using the voice. The commands will be given in the mother tongue of the user and it will not be necessary to practise a lot on the system.

3.3 Constraints

There exist several constraints for this project. The reorganisation of the Geomatic department, the expertise and the availability of this team and the maintenance budget for the amount of data recorded have a serious impact on the choice of the solution.

4 Objectives and Scope

4.1 Objectives

The goal of the project is to provide a solution to the various organizations of the Brussels Region which would be interested by further information of the UrbIS system provided by the CIRB.

This solution would consist in providing a methodology, an architecture and an work environment which would follow the GIS standards, which would use the UrbIS system and which would easily make it possible to add a layer of information specific to the user.

With the framework of the project SAFIR, an aim would be to evaluate the technology and to activate a maximum of « standard » orders by the voice.

4.2 Solution

The solution to consider dictates the use of a centralized geographic information system. Actually, this tool enables a big improvement of the speed of publication. Next, with the development of the technology, it should be possible to send collectors equipped with portable computer, like Tablet pc.
This would allow storing the data from the system locally into the Tablet pc and, after the inspection, the computer will automatically upload the changes to the central repository. Finally, in which measurements, it would not be possible to vocally activate certain functions with an adequate tool.

This solution offers several advantages that are not negligible : A speed of access to an up-to-date information, a simplification of the maintenance procedures of the geographical data, an improvement of the work conditions on the ground. The possibility of adding a GPS system and a voice recognition engine.

4.3 Expectations

The expectations of this project are high. Indeed, the CIRB would like to improve the delivery of the UrbIS products. This implies a serious enhancement of the collection process of the current elements on the streets of the Brussels region and also an improvement of the production delivery. We hope the technology and the software used will help the Geomatic department to achieve this goal thanks to the new architecture allowing multi-users access and the new tool provided for the maintenance of the geographical data.

5 Strategy

5.1 Context

The CIRB (Informatics Centre of the Brussels Region) is responsible for the production and the distribution of the official map of the Brussels region. This map is called UrbIS that stands for Urban Information System.

UrbIS is a GIS (Geographical Information System). It means that it is a system that owns a set of geographical data, which can be utilized among various types of applications. A good example is the association of the population density with a specific area of the Brussels region. The services of the land register of mobility use these data and thus the GIS systems.

The mission of the CIRB is to maintain the information stored into the system in order to allow all the services of the region to access an up to date record. This work is mainly executed at the office thanks to several administrative documents, among others the « as-built » plans. However, ambulations are necessary in order to control, in situ, the work really carried out. Indeed, it happens frequently that documentation is incomplete or missing.

For information, Brussels is a bilingual area where French and Dutch are the two official spoken languages.

5.1.1 Goals

To reach the goal of maintaining the information within UrbIS up to date, the CIRB needs several changes. The technical architecture as well as the way of working will be modified in order to allow people being more efficient.

Currently the inspectors of the CIRB are working with paper and pencil. The maps are printed on a large sheet of paper and it happens frequently that they have to handle 2 or more sheets at the same time. This is why the CIRB would like to provide Tabletpc to the inspectors.

The architecture should also evolve. It should allow the connection by several users to the same geographical information. Indeed, it can happen that two inspectors have to control areas that possess a common intersection. So it can happen that the data is updated twice and the system must be able to handle this without too many human interventions.

Besides these needs, since the Brussels region is a bilingual area and the mother language of the employees of the CIRB is either French or Dutch, the application have to support both languages.

Another goal of this project is to create one common data structure model for the different linear traffic network maps. A preliminary fusion of the different traffic network maps versions produced in the past must be performed. This should be composed of one UrbIS v2 database system and the migration of the geometric and alphanumeric of UrbIS v1 into the common structure.

5.1.2 Existing System

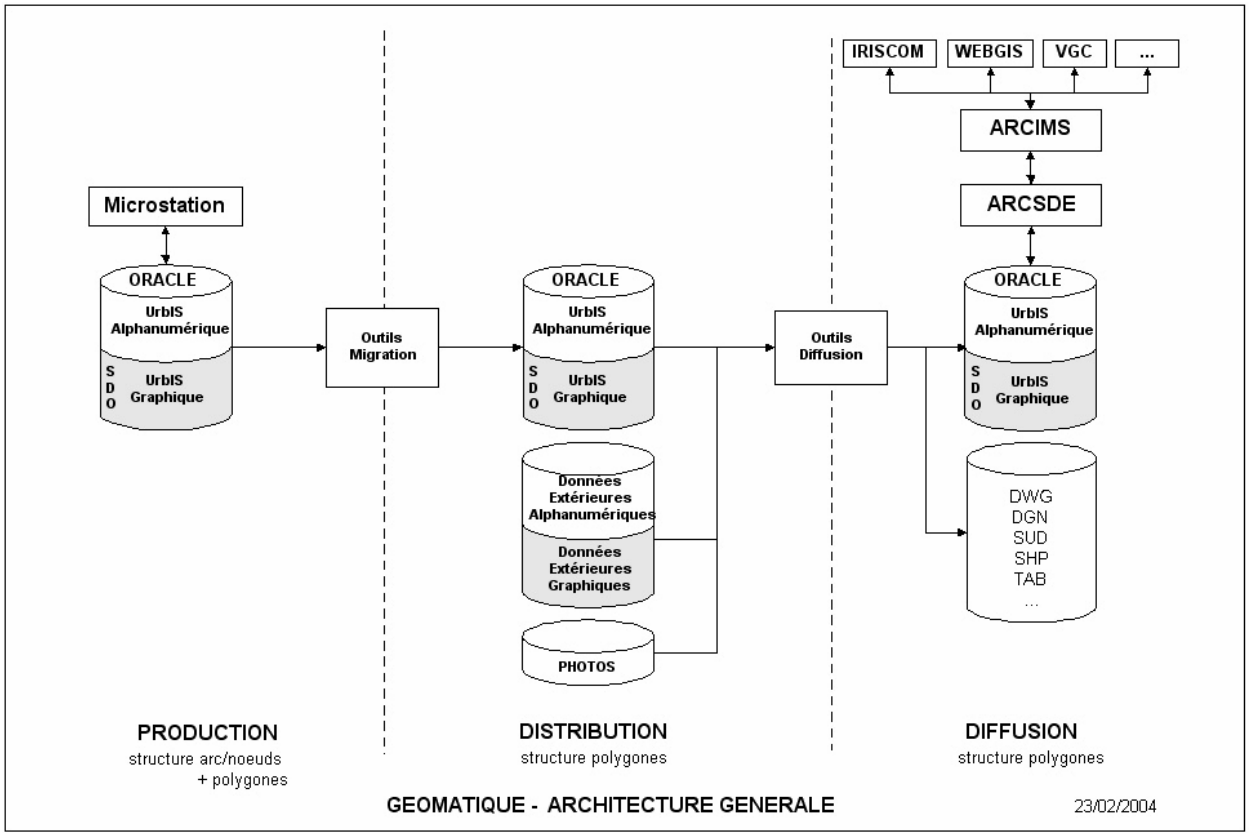
The current architecture of the GIS system at the CIRB is documented below. The architecture is divided into three different systems. The production, the distribution and the delivery systems.

Within the production environment the client tool is MicroStation. It is a DAO tool which allow to manipulate the topographical objects of the UrbIS system. The data is stored into a RDBMS database. This system serves to maintain the basic information.

Thanks to tools for the migration of the type of data, the nodes and arcs of the topographical map can be regroup to form a shape or a polygon. Combining this information with data provided by other organism of

the Brussels region, it is possible to create the map of the Brussels region with all the necessary data. This information is accessible through different formats of data.

Once the complete set of data is correctly integrated into the system, other tool helps the CIRB to disseminate the UrbIS map to the customers. On the top of the database, ESRI products help the CIRB to publish the map onto the web and other channels into several formats.



5.2 Technical Solution

The solution we would like to implement is based on products already available on the Belgian market. The CIRB already possesses several ESRI software licenses. The products that are involved within the project are : ARCSDE for the management to the database access and ARCGIS for the users to get access to the maps and some functionalities.

5.2.1 Tablet PC

We consider using a Tabletpc. As its name implies, the Tabletpc is a computer that's approximately the size of a paper tablet. It's not only its name that is similar - we can now write with a digital pen directly on the screen of the Tablet PC. It gives us portability, flexibility and usability that are changing the way we work with our computers. The Tablet PC can replace both an aging laptop and PDA with state-of-the-art portability. If the user often needs to be away from his desk or in an area where a notebook isn't practical, then a Tabletpc is the answer. It can be used when using a keyboard may be awkward. The Tablet PC includes many innovations, including handwriting recognition, longer battery life, a low-heat processor and an operating system that's a superset of the very stable Windows XP Professional. There are many other applications made specifically for the Tablet PC's capabilities with more being developed.

The choice is still not made. However Tablet PC from Xybernaut (rugged) and Fujitsu-Siemens possess all the requirements. The definition of the screen as well as the resolution, the battery life and the weight will be the major's criteria of selection.

5.2.2 Microphone

For the specific outdoor use of the application, the choice of microphone (within a hear set) is essential. The noise robustness is quite important. It should be wireless to avoid as much as possible the obstructions during the inspections. The bluetooth microphones that are for the moment on the market are well suited for telephony. They sample the voice of the user at a rate of 8 kHz which will not give good results for speech recognition. Nevertheless, Voice-Insight is developing bluetooth microphones with sampling rate between 16 and 44 kHz. So these kind of microphones could be used for this pilot.

5.2.3 ESRI Software

ESRI is the world leader in GIS (Geographic Information System) technology. ESRI offers a wide range of solutions that are designed to meet the specific business needs : Explore a routing application for the Web, a production and maintenance system for digital cartographic databases, or a collection of software components that enable developers to build custom applications.

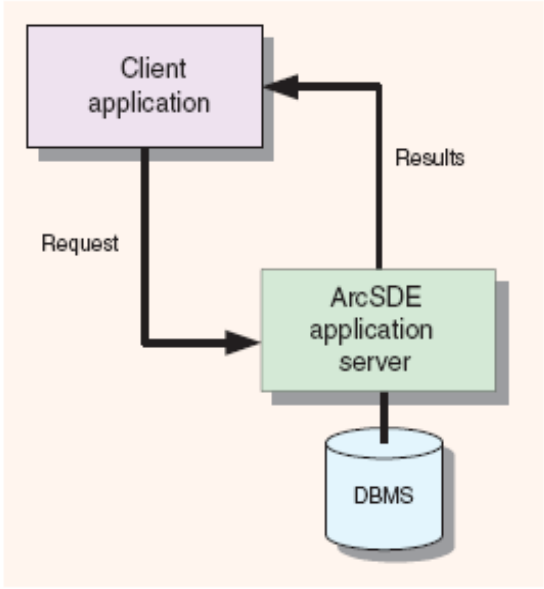
ESRI offers a whole range of products, called ARCGIS, grouping DesktopGIS, serverGIS, embeddedGIS and mobileGIS. The desktopGIS is based on a family of 3 softwares : Arcview, ArcEditor and ArcInfo.

ArcView is full-featured GIS software for visualizing, managing, creating, and analysing geographic data. Using ArcView you can understand the geographic context of your data, allowing you to see relationships and identify patterns in new ways. ArcView helps tens of thousands of organizations make better decisions and solve problems faster.

ArcEditor is the complete GIS desktop system for editing and managing geographic data. ArcEditor is a member of the ArcGIS family of GIS products and includes all the functionality of ArcView in addition to comprehensive GIS editing tools.
ArcEditor supports single user editing as well as a collaborative process between many editors. An extensive set of tools is included for simple data cleanup and input as well as for sophisticated design and versioning.

ArcInfo is the most complete and extensible GIS available. It includes all the functionality of ArcView and ArcEditor and adds advanced geoprocessing and data conversion capabilities. Professional GIS users use ArcInfo for all aspects of data building, modelling, analysis, and map display for screen and output.

A complete GIS out of the box, ArcInfo provides all the functionality for creating and managing an intelligent GIS. This functionality is accessible via an easy-to-use interface that is customisable and extensible through models, scripting, and applications.



The ArcSDE server handles simultaneous requests from multiple users to update and retrieve information in a geodatabase.

ArcSDE is a server software product used to access massively large multi-user geographic databases stored in relational database management systems (RDBMSs). It is an integrated part of ArcGIS and a core element of any enterprise GIS solution. Its primary role is to act as the GIS gateway to spatial data stored in a RDBMS.
ArcSDE provides a suite of services that enhance data management performance, extend the range of data types that can be stored in a RDBMS, enable schema portability between RDBMSs, and offer configuration flexibility.

The CIRB already possesses several of this software licenses. One of the goals of this project is to work with them and using them more in depth. For example by implementing the multi-user accessibility to the geographical data.

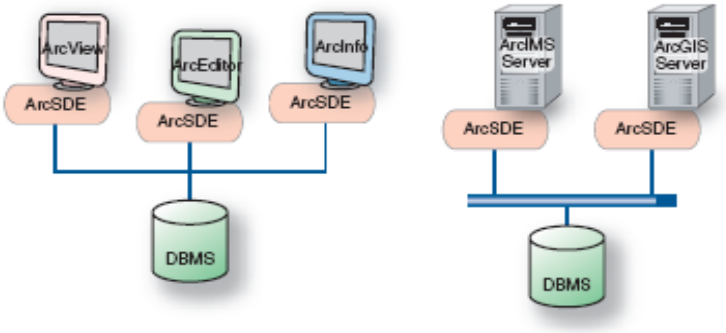
5.2.4 SAFIR Technology

The main aim of the SAFIR project is to implement and utilize the voice technology developed by the partners. (eVV – embedded ViaVoice, the recognition engine of IBM and VQL – Voice Query Language, the tool to request vocally information to the database).

Because of the parallelism of the work packages of the SAFIR project and the milestone for delivering the technical specifications, it is highly recommended to consult the last version of the architecture document to understand the role and the functions provided by this tools.

5.2.5 Architecture

The architecture we will implement for this project is the same as the one already existing at the Geomatic department. The system consists mainly of a client/server based GIS application, a vocal interface and an input/output device, all embedded in the overall GIS Application.

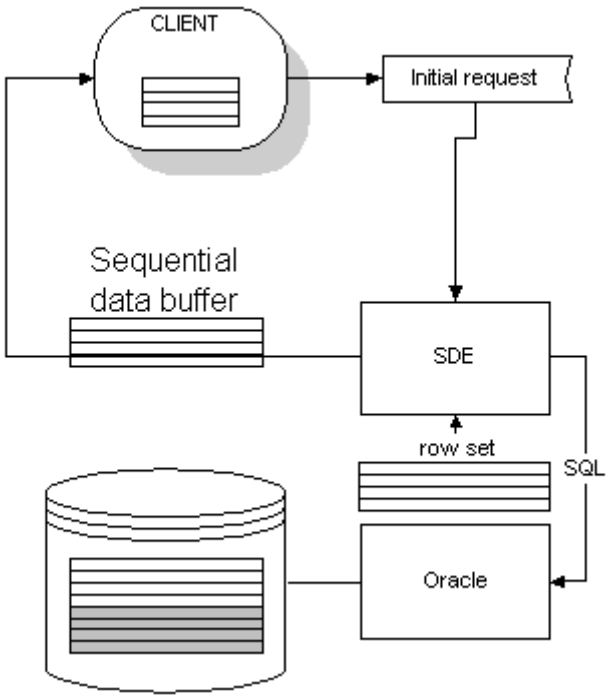


ArcSDE is built with client/server architecture. A client application sends requests to the server. In turn, the server receives the request, generates results, and delivers them to the client.

The ArcSDE server accesses spatial data based on highly efficient spatial search functions, provides geometric data validation, and works within heterogeneous hardware and network environments. Data can be delivered to any client from any server anywhere on a network.

In a typical configuration, an ArcSDE application server resides with your relational database on a server platform. The ArcSDE application server performs spatial searches and sends data that meets the search criteria to the client. For example, a common query handled by the ArcSDE application server is to retrieve all the features in a particular map extent to be drawn in the display window.

ArcSDE sends data to the client using « data buffering ». Buffering is the process of collecting large chunks of data and sending them all to the client application, rather than sending one record at a time. Processing and buffering data on the server is much more efficient than sending all the data across the network and having the client determine which data to send to the end user application. This becomes critical when applications are simultaneously using thousands of records in the database.



5.3 Business Solution

The Business solution we would like to implement is similar to the following.

5.3.1 Scenario 1

Scenario 1 - Continuous update of the UrbIS GIS system of the Brussels Region.

A team of cartographers is in charge of collecting and validating the data necessary to update the UrbIS system. The mission of these cartographers is to check the geographical elements. They need to check if the UrbIS objects are in conformity with the existing information encoded within the system. This type of work is composed of 3 phases:

- Phase 1. Transfer the data to be validated on cartographers' device. A sector of the UrbIS Map is prepared and transferred on the Tablet pc of the cartographers. This sector is defined by the user (It means it can be the whole Brussels Region) and contains the basic layers of UrbIS Map, as well as the objects that must be checked. Currently, the cartographer uses a paper support.
- Phase 2. Update the data. The cartographer goes on his sector. He launches the application for updating the UrbIS objects, application which has a voice interface. This application also allows the voice encoding of general remarks and integrates in the same time the position via a GPS functionality.
- Phase 3. Update of the UrbIS database. The cartographer returns to his office and transfers the data recorded on the Tablet pc to an application that carries out possible conversions and also validates the data. The cartographer performs the modifications based on general remarks recorded by voice interface. These modifications generate specific interventions, which can be carried out only in the back-office.

5.3.2 Scenario 2

Scenario 2 - Update of the linear traffic network based on the UrbIS GIS system

The CIRB has implemented a vectorial geographical database on which routes are mapped out. Updating this database requires an ambulation on every street of the Brussels Region territory (up to 1700 km total linear length). This ambulation can be considered only by using a vehicle. This makes the use of a system based on voice interface of greater interest. This type of work comprises 3 phases:

- Phase 1. Preparation of the work of the agents. A route based on the UrbIS Map is prepared and transferred on the Tabletpc of the employee. This route includes the UrbIS map background and the extract of the linear traffic network to be updated. Currently, the agent uses a paper support.
- Phase 2. Ambulation. The agent carries out the route in a vehicle or walking and encodes by means of the voice interface the information associated with the arcs, which are crossed (direction of circulation, speed authorized, number of ways, restrictions, etc.). The agent launches the application to update the UrbIS objects, application which uses a voice interface. It also allows the encoding of the free observations, as well as an automatic positioning via a GPS functionality. The application also checks if the work to be done is completely carried out by the cartographer.
- Phase 3. Update of the UrbIS database. The agent returns to his office and transfers the data recorded on the Tabletpc to an application, which carries out possible conversions and also validates the data. The agent performs the modifications based on general remarks recorded by voice interface. These modifications generate specific interventions, which can be carried out only in the back-office.

5.3.3 Actors

A Collector is a CIRB employee who receives the update information and introduces it into the internal UrbIS system.

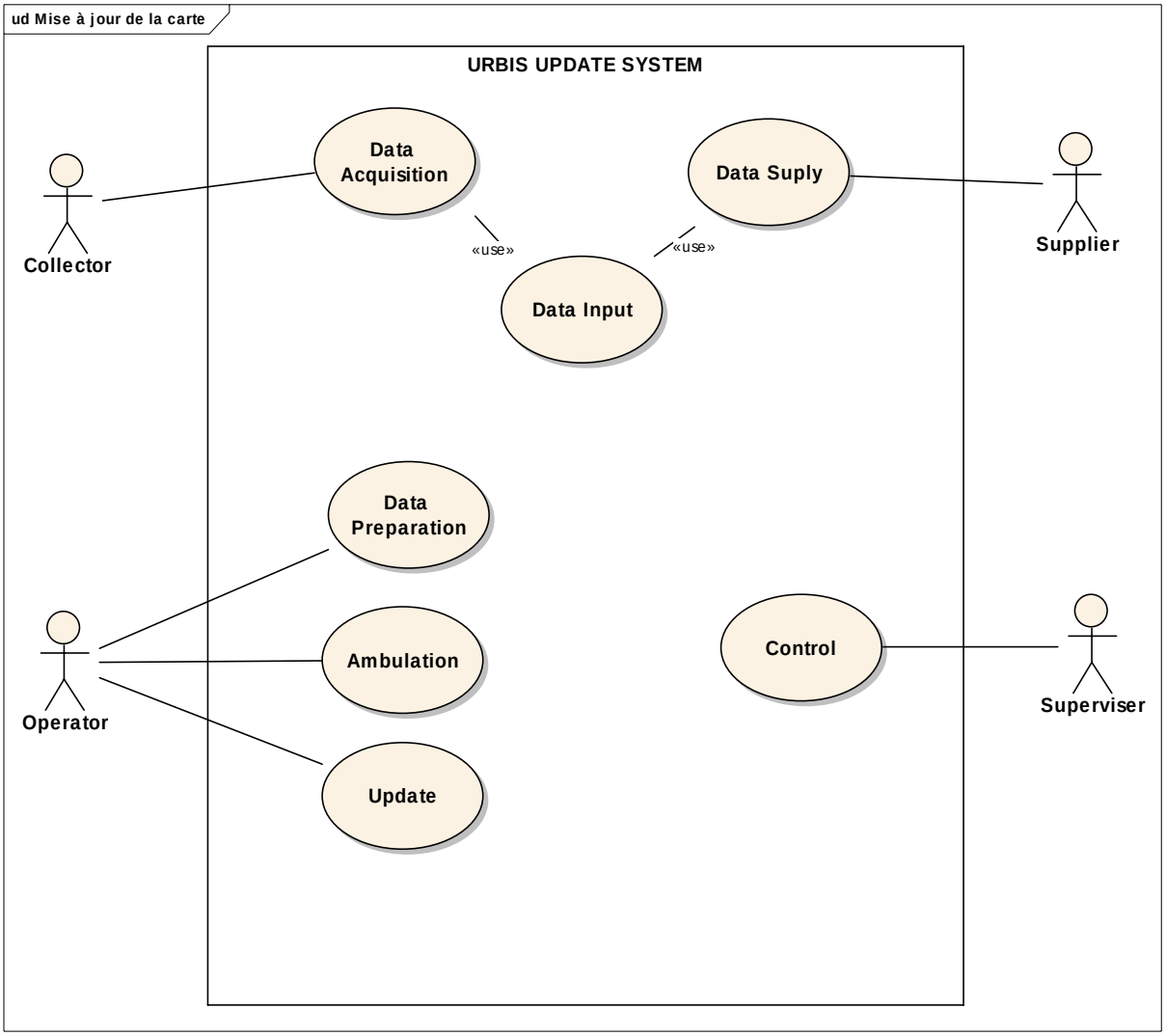
An Operator is a person charged to control, to validate the collected data and to modify the UrbIS data

A Supervisor is a person charged to check the execution of the collections and to analyze the quality of provided work.

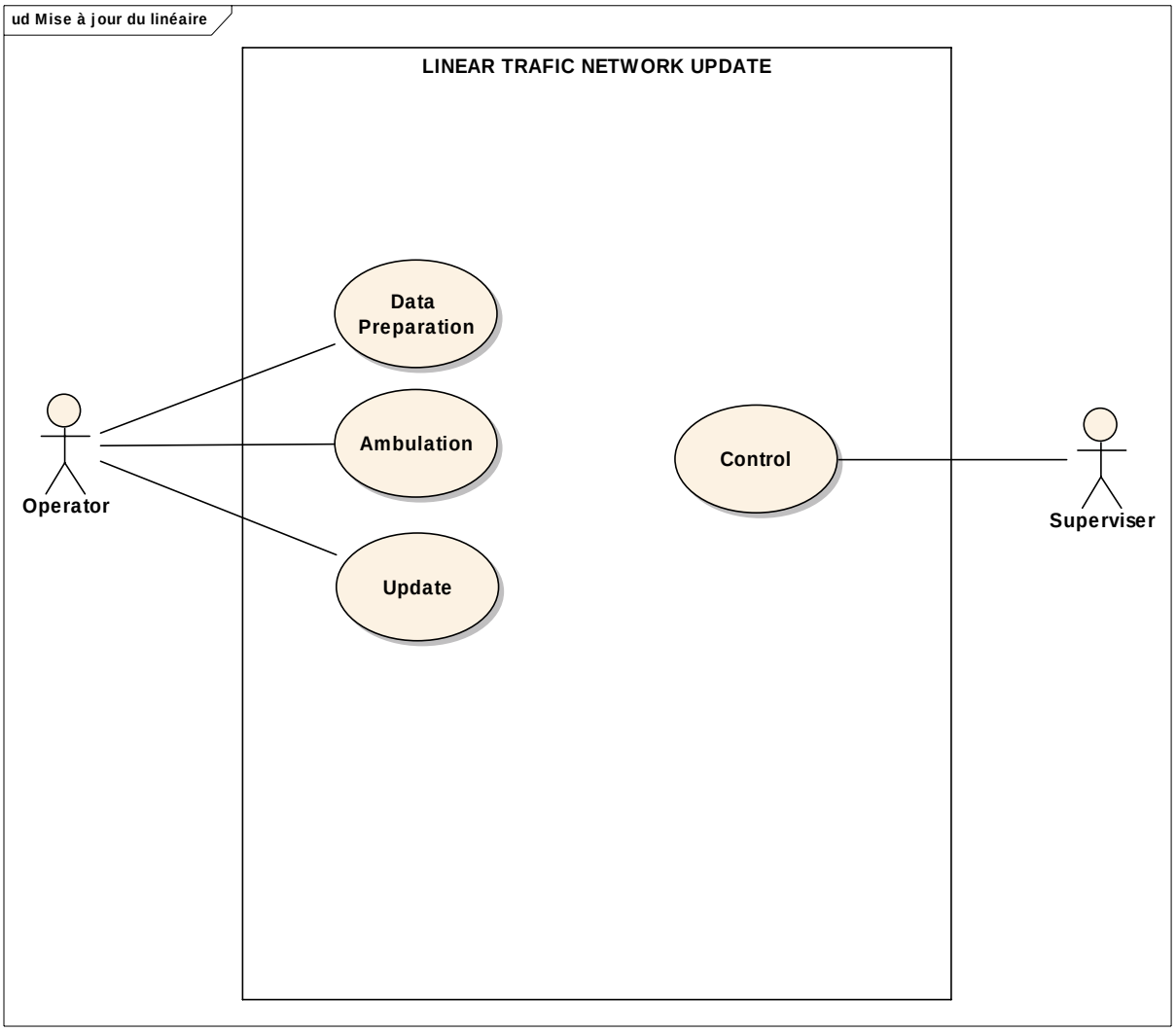
A Supplier is a person/society who provides information for update the UrbIS data.

5.3.4 Use Cases

Scenario 1 : Update of the UrbIS system



Scenario 2 : Update of the UrbIS system



Use case : Preparation

Operator	System
Login	
	Display a graphical zone of seized
Select the zone to check	
	Display the map
Logout	

Use case : Ambulation

Operator	System
Go and annotate the map	

Use case : Update

Operator	System
Login	
	Display a graphical zone of seized
Select the zone to check	
	Display the map
Logout	

The uses cases described above are the one that were defined at the very beginning of the project. Those cases are still valid although slightly modified.

Hereafter the general behavior of the user and the system.

- Step 1 : Open application – the user selects the ESRI application and opens the application.
- Step 2 : System Activated – the application is open and display the functions, the project the user has configured.
- Step 3 : Selection of an area – the user selects the area he is interested in and select the geographical elements he wants to be displayed.
- Step 4 : Display Information - the system retrieves the selected information and display the data with a predefined layout.
- Step 5 : Uploading Information – the user asks the system to store the information locally on his Tabletpc by clicking the option.
- Step 6 : Data Stored Locally – The system stores all the information locally and manage at server side the version of this data.
- Step 7 : Update of the data – The user controls the information on his display and what has really been executed on the field. He changes what is necessary (manually or vocally).
- Step 8 : Changes Recorded – The system stores the modifications made by the user.
- Step 9 : Downloading Information – The user connects his Tabletpc to the network and clicks on the downloading function.
- Step 10 : Commit Changes – The system stores the records that have been modified according to the rules defined.

5.4 Linear Traffic Network

The linear traffic network has to be created as from the existing maps available within the administration services of the Brussels region.

The complete analysis of the needs is foreseen in September 2005 but the following elements must be taken into account.

A linear traffic network is always composed with arcs and nodes. It is either displayed in a monofilar or a bifilar manner.

The following analysis is a summary of the existing linear implemented within the UrbIS version 1.

The nodes must be created each time there is a modification of the status (traffic light, number of ways changes, speed restriction, road structure…).

The arc links two nodes. It possesses some attributes, among which a link to the street faces and the addresses, a classification attribute (Highway, 2x2 road, street, …), tram circulation flag, number of traffic lanes (with or without road marks), level, restrictions (height, weight, width, speed limit, one way) and restrictions “bis” that represent restriction not visible on the field but that exist because of the previous node or arc.

The goal here is to create a common data structure model for the different linear traffic networks. This is composed of one database linked to the UrbIS v2 system and the migration of the geometric and alphanumeric of UrbIS v1 into the common structure, tools for the maintenance of the data, tools for the distribution and dissemination of the system across the region services, the documentation of what has been implemented and one documentation for the users and finally with a collect procedure for the update of the specific information of the linear.

It will also be necessary to build a support team for the different administration services.

6 Phases, Milestones and Major deliverables

6.1 Milestones

Pilot Preparation : 31st of August 2005
In depth Analysis : 28 th of February 2006
Technical Environment : 30th of April 2006
Development : 31st of March 2007
Tests : 30th of September 2007.
Documentation : 29 th of February 2008.

6.2 Work Breakdown Structure

The first step will consist in a more detailed analysis of the traffic network map. The set of objects to collect, the database model that will be implemented and the structure of the linear have to be defined.

The analysis consists in analysing what does exist today at the customer side, what are the needs already foreseen, what are the data formats used by the existing route planner applications and modelling the information.

Afterwards, the migration of the existing data, coming from UrbIS v1, has to be executed. This will be done either partially or in once, for a big part, by a program that will try to convert old records into new ones respecting some rules that have to be defined. This conversion will necessarily require a manual migration because either the rule is to complex to compute or the quality of the existing records is not sufficient.

Ones this conversion finished, there will still remain some areas where it has not been possible to determine how it should be represented/converted. In this case, the SAFIR technology will be tested. Its usability will be analysed and evaluated. Actually, we will be able to estimate the time we can earn/spare by using the voice for the collection of the geographical information.

In order to use the SAFIR technology, it will be necessary to create some macros within the ESRI software ARCGIS. Indeed, to make this application « voice-enabled », it is mandatory to encapsulate the functions into macros that call the ArcObjects.

The specific business functions for designing and maintaining the geographical objects of UrbIS will also have to be developed within macros. The definition of these functions must still be done.

Besides, in order to control the quality of the data converted and created, it is important to use one application that will use this records and compute them to return a route. To achieve this goal, two solutions are possible. The first one consists in reusing and modifying if necessary the existing application of one our clients. The other is to create a small application from scratch. Because of the complexity it can afford, the first solution seems the more feasible.

6.3 High Level Plan

- In depth Analysis (6 months-men)
  - Analysis of the existing traffic network maps
  - Analysis of the current and future needs
  - Analysis of the of the route planner softwares (data format)
  - Implementation of a unique data model
  - Production of a first version of data (partial or full migration of the existing linear traffic network)
  - Development of derivation process of the peculiar linears starting from the common model
  - Integration of the maintenance process of the linear into the continuously update procedure of the UrbIS system.
- Technical Environment (3 months-men)
  - Software installation
  - Networking
  - Security
  - Software configuration
- Development (12 months-men)
  - Development of Macros with ArcObjects
  - Specific development for SAFIR
  - Unit Tests
- Tests (6 months-men)
  - Integration Tests
  - Acceptance Tests
- Documentation (2 months-men)
  - User documentation
  - Education

7 Resources

The department of Technology is responsible for managing this project to the end. It will study, analyse, and develop the application.

The Geomatic department is the client; it will be involved within different stages of this project. The analysis, the development and the tests of the application, the quality inspection are certain of their collaboration phases

8 Major Risks

The risks for this project are the following :

The availability of the Geomatic team to provide information to the business analyst. This team is currently fully occupied by business critical projects.

Another major risk is linked to the technology selected for this project. The voice technology is under development and its support is still not officially documented. The GPS technology doesn't work perfectly downtown due to electromagnetic waves propagation and physical obstacles. An Alternative to that is to take into account the objects already present in the geographic database and to reference relatively to these objects for the location of the new objects.

Although the technology developed by the SAFIR partners exists for a certain time now, the enhancements made to it represent a certain risk as always for early adopters.

9 Organ gram

The department of Technology is responsible for managing this project to the end. It will study, analyse, and develop the application.

The Geomatic department is the client; it will be involved within different stages of this project. The analysis, the development and the tests of the application, the quality inspection are certain of their collaboration phases

10 Reception criteria

The criteria of reception are not defined yet. They will depend on certain choice that must be taken during the period of analysis. However, the visual control techniques, the software functionalities of the GIS tool should be used. Besides, because of the difficulty of control, tests within dedicated applications will be executed in order to be able to compare with the current results.

11 Conclusion

Speech interfaces are well suited for the command of GIS based application devices especially when used with an embedded system while on the move. Indeed, the number of objects and selection criteria on a map may easily reach several thousand items and voice interfaces will considerably ease the access and the modification of data.

Voice technology can bring an added value to the updating system we are currently working out for Urbis; as well on the effectiveness level than on the security level for our operators on the field.
Effectiveness is critical considering the rate of change and the amount of data we have to update. Today, an up-to-date GIS database is a must to have for our clients including the Brussels citizens. This will help the CIRB to provide a better service quality while pursuing the goals of e-government.