Multichannel Hub:
An M-Government Case Study For The City Of Turin

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Abstract : *The aim of this project, called Multi-channel Hub and developed by CSP – ICT Innovation and the City of Turin (Italy), is to work out a multi-channel application as a concrete solution of m-government that can meet social, psychological and technical needs. Thanks to its hardware and software architecture, it is possible to modulate the information supply, on the basis of different users and devices. In fact, it is able to optimize the content publishing process, from Governments and Public Administration bodies to citizens, on different media. The project deals with many considerable research themes, such as mobile devices, multi-channel publishing processes, integration of different information providers, mobile government issues.*

Keywords: M-government and City case, Public Administration services, publishing processes, mobile devices, multi-channel data access, mobile standards and protocols.

1. Introduction

Modern society is developing around a global information infrastructure, even more complex as the process of information exchange has grown. It is supported by new capabilities, and potentialities, offered by the spread of information technologies, and especially of web-based internet applications.
An Information Ecosystem is a network of interactions arising between information providers and users. In an m-government context, the information exchange is focused on interactions between citizens and Public bodies in an environment of continuous changes, caused by commercial, political, social and technological developments. This new environment is characterized by the proliferation of communication channels and devices and by a process of diversification of user needs.

The presence of regions and local agencies in Internet is increasing both in terms of quantity and quality, even though in Italy this growth is not uniform because of the digital divide between northern and southern regions. As concerns communication between Public Administration bodies and citizens, Turin, Florence, Rome and Boulogne represent good practices thanks to their acquired experience and to their planning and investment capabilities (Holmes D., 2002).

Institutional web sites, that are widespread applications and communication instruments for cities, are the main results of the Italian Innovation Action Plan (Ministero per l'Innovazione e le Tecnologie, 2002). Nowadays in the second phase of the e-government process the public investment policy is funding innovative projects focused on the development of mobile government solutions and multichannel applications.

2. Objectives

According to this approach our project, called Multichannel Hub, aims to create a software application to modulate the Web supply of such a complex organization as the web sites network of the City of Turin. In fact, the Multichannel Hub is part of a wide-ranging project developed in recent years for the City of Turin, the first Italian city in terms of technological innovation services (CENSIS, 2004).

This system is directed towards the collection and delivery of heterogeneous information, optimizing the information exchange from Public Administration bodies and citizens, using different media (such as personal computers, multimedia applications, PDA, traditional and new generation mobile phones, digital terrestrial television, voice applications and so on).

This project not only deals with technological matters, but also with all the problems concerning the publishing process too: as a consequence, this research includes psychological, sociological and economic aspects.

With this purpose, the paper is structured around a survey of several aspects of the Multichannel Hub, applied to the system application to the website network of the City of Turin. In order to understand the potentialities of different technological tools, it is necessary to focus not just on technological aspects but also on the communication capabilities given by this application to real services recipients: the users.

3. Background

The multichannel access to information is one of the most innovative themes in the transition process from e-government to m-government. The main objective of this process is to increase the efficiency and productivity of information delivery, focusing on a model for the improvement of relations between citizens and Governments.

In these terms, the Multichannel Hub project aims to define hardware and software architecture, able to promote an Information Ecosystem, i.e. a virtual space potentially accessible by everyone, from everywhere and with any device.

In 2003 CSP – ICT Innovation and City of Turin developed the first prototype of "Città di Torino Mobile Edition", characterized by some selected information optimized for PDA, useful mobile services, brief and clear texts and easy and direct information browsing.

At the beginning of 2004, on the basis of usability tests and further analysis, the first redesign of the prototype was made. That release provided a refinement of the usage model and scenarios, more information providers, an improvement of the information architecture and PalmOS portability.

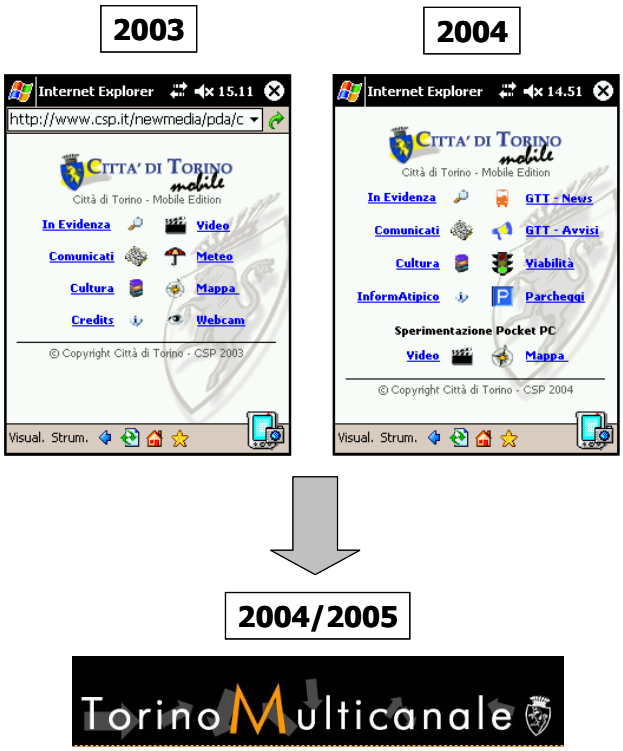

Figure 1. From "Città di Torino Mobile Edition" to the Multichannel Hub ("Torino Multicanale")

The last step of this project led to a prototype of a multichannel editing and publishing system able to guarantee the content supply from different providers: the Multichannel Hub. This prototype is a normalization tool for complex systems, characterized by heterogeneous content providers and management rules, different types of content, media and users.

The methodology followed for the development of the Multichannel Hub started with the drawing up of a user requirement analysis. Afterwards, a feasibility study was conducted with the technological aim to integrate and transform information coming from different providers, through standard web languages and technologies. The use of XML format, in fact, allows the integration of different sources and data formats, supporting the information exchange from one application to another (Crevola A. et al, 2004).

The Multichannel Hub has been correlated with the development of a prototype coming out soon integrating several projects carried out by CSP – ICT Innovation for the City of Turin during the last year, as will be discussed below.

4. Integrated Information Systems

An integrated information system focuses on conveying contents coming from distinct information sources. The critical factors linked to the design of these systems are primarily of management nature: from the administration point of view, it is essential to define and schematize the processes that involve the various suppliers of information i.e. the information providers. To ensure the integrity and consistency of the information conveyed it is therefore important that the recommendations, policies and strategies are defined and dealt with in the design phase for the system and the relative information architectures.

The potential of an integrated information system lies in its ability to contribute added value to the individual information sources, thanks to the valorization and integration of the various contents conveyed.

In addition to defining the specific features of the information system, it is essential, in integrating the contents, to devote sufficient time to considering the system requirements, with regard to both the contents conveyed by the various information providers and the management modalities within the system itself (Curran S., 2003).

In the definition of the infrastructure within the Multichannel Hub, it was necessary to specify the standards and protocols supported in the development and transmission of the contents.
In essence, the architecture model for the integrated system is articulated on three levels:

- Provision Layer: comprises the actions carried out directly by the information providers, in terms of creation, maintenance and updating of data;
- Integration Layer: in this phase, the metadata produced, coming from various information sources, is subject to an aggregation process, in order to make it available for the various applications operating on an integrated system level;
- Transformation Layer: on this level, the integrated system components interact with those of the various information providers, so that the information conveyed can be published.

With respect to contents that are distributed and integrated by an information system in order to catalogue them, it is necessary to verify different aspects, such as: where they are located, the purpose for which they are used, the possibility of being used in other applications, the archiving and updating policies, as well as those of management and control, the updating frequency of the contents.

5. Design and architecture

The design of the Multichannel Hub is based on the following guidelines:

- Independence from external information sources: the system has been conceived without being conditioned by sources currently or shortly to be available; the initial information basin acts as a test bench, in order to allow the importation of contents that are as heterogeneous as possible in formal terms, yet without being conditioned in a restrictive sense;
- Independence from contents distribution formats: the formats for contents syndication are in a constant state of evolution. The Hub is ready for every change, as far as possible separating the data formats in input from the processing scripts of the same, by means of appropriate integration layers;
- Independence from final distribution channels: as with input formats, the Hub has its own contents structuring format, with meta-information that is independent of the destination channel, and which can in turn be modified by a transformation layer in relation to the distribution channel;
- Adherence to web standards: a guarantee of compatibility, extendibility, ease of maintenance, optimization of resources, accessibility of information and adherence to the main information management standards is defined on an international level by the W3C; in particular, it embraces conformity with languages like HTML 4.01, XHTML 1.0 transitional, CHTML, CSS 2, CSS Mobile profile and RDF;
- Open: the system is provided with appropriate interfaces which permit affiliation with sources that are not contacted initially but maybe potentially interested or which also permit the withdrawal of information by third parties. As regards information gathering, the Hub makes a script or tool available which can be withdrawn and configured to create a data flow that can be managed by the application. As concerns information output, it creates a direct data output, without any subsequent transformations, which can also allow third party developers to realize their applications (obviously respecting the laws on copyright and other policies).

During the feasibility study, a series of potential users were identified, such as: citizens, tourists, public administration, media (newspapers, local TV etc.).

The feasibility study also produced profiles for those who will be inserted and who will manage the contents, thereby creating not only a list of desirable functions but also preparing the necessary usability and accessibility tests for the system back-end.

Another issue which the system has tried to deal with involves web services and semantic web. The Hub provides an information output that can be consulted by software agents or by web access programmes (feed reader, for example). Or an agent that extracts notes and translates them into a format that is compatible with handheld agendas and which final users can exploit for the synchronization of their devices.

The definition of the "integration layer" was symmetrical with regard to the analysis of the "transformation layer". The integration layer carries out a series of operations prior to memorization of content. This essentially involves two situations:

- Original contents insertion: the layer receives the content segments from the insertion masks and directly memorizes them in the database;
- Insertion of contents coming from other sources: the layer analyses the content received (typically in an XML format), recovers the information, adapts it (example: removing existing HTML tags, carrying out a transformation into an XML base format) and passes it on to the transformation layer.

If XML data sources already exist the layer must recognize and interpret them. On the other hand, if they are not present, it is necessary to prepare conversion scripts to be supplied to the content producers (in ASP, in PHP, in JSP) which are sent in execution directly on their servers. The integration of the Multichannel Hub with other projects managed by CSP and by City of Turin, as we will see below, has made it possible to carry out experiments to verify the validity of this approach.

The transformation layer does not operate in a sole formatting manner but it also has a modifying function along various routes, such as contents structure, quantity of information, information architecture, presentation style.

As regards technical requirements, the first prototype was built on Windows operating system, because of the portability of the selected software used for the system management: Apache, PHP, MySQL.

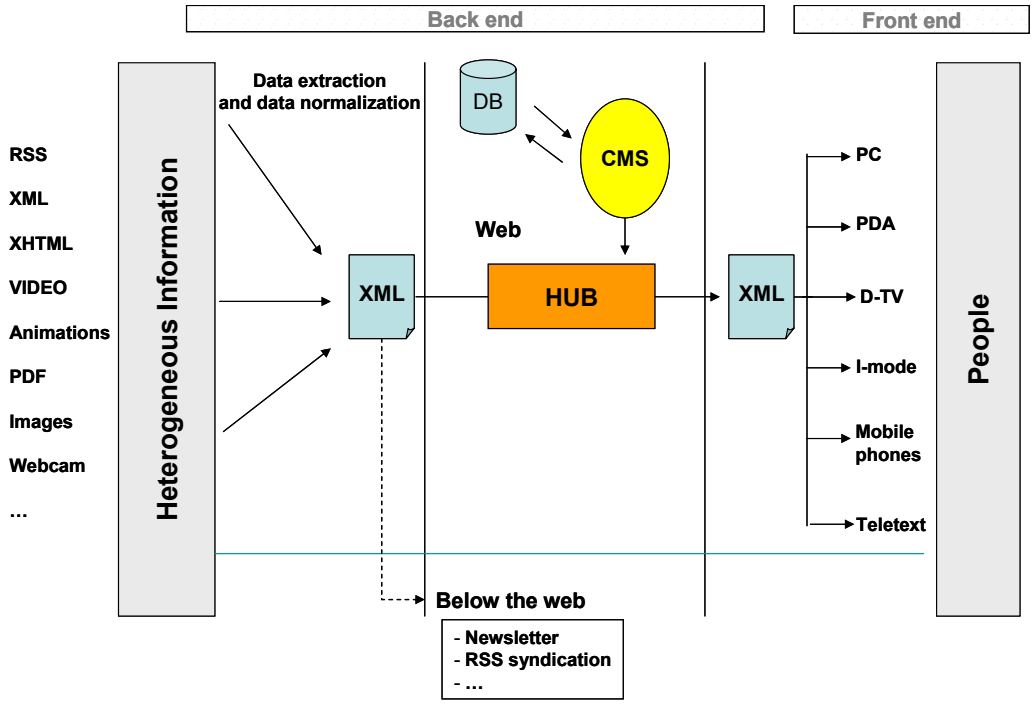

Figure 2. Multichannel Hub Architecture

6. User scenarios

In order to contextualize the real potentiality of the developed prototype, we propose some application scenarios for the information multichannel data access and delivery:

- Public Administration bodies applications: the supply of multichannel services can be considered as a possible solution for approaching a body of users that usually, and for different reasons, are not reached by traditional communication channels. For example, a superteletext application for the digital terrestrial television can be used to reach Public Administration services by all users who, for technical and cultural deficiencies, are not able to use a personal computer. Besides, another important application could be focused on the integration of heterogeneous information sources, originally produced, managed, organised and handled by several information providers in different ways, as we will see in the case of Torino Espresso, i.e. the real application of the Hub described in this paper.
- Tourist applications: Public Administration bodies themselves and trade associations can use the Multichannel Hub to deliver aggregated services, beginning from the contributions of different information providers. According to this approach, tourists can access relevant information during their tour itineraries using several devices, for example mobile phones.
- Cultural applications: in this scenario too, it is possible to use an aggregating technology to publish information on particular artistic and cultural resources. Also in this case, it is useful to reach information in a multichannel way.
- Territorial applications: in industrial zones, technological parks, mountain communities, the possibility to gather different sources in a single "information knot" facilitates collaboration between individual entities. For example, it can be used by a central editorial staff to check the whole publishing system.

- One-shot applications: it is useful to create small web sites, with information coming from different sources (for example tourist info, information about road practicability or particular occurrences), related to special events or temporary occurrences, such as music festivals, theatrical reviews, or road conditions.

7. A real application of the Multichannel Hub

"Torino Espresso" is one of the possible real applications of the Multichannel Hub, applied to the Web sites network of the City of Turin. "Torino Espresso" collects news from several sources dealing with the City and other topics.
The information is delivered on different devices, such as personal computers, handheld devices and mobile phones.

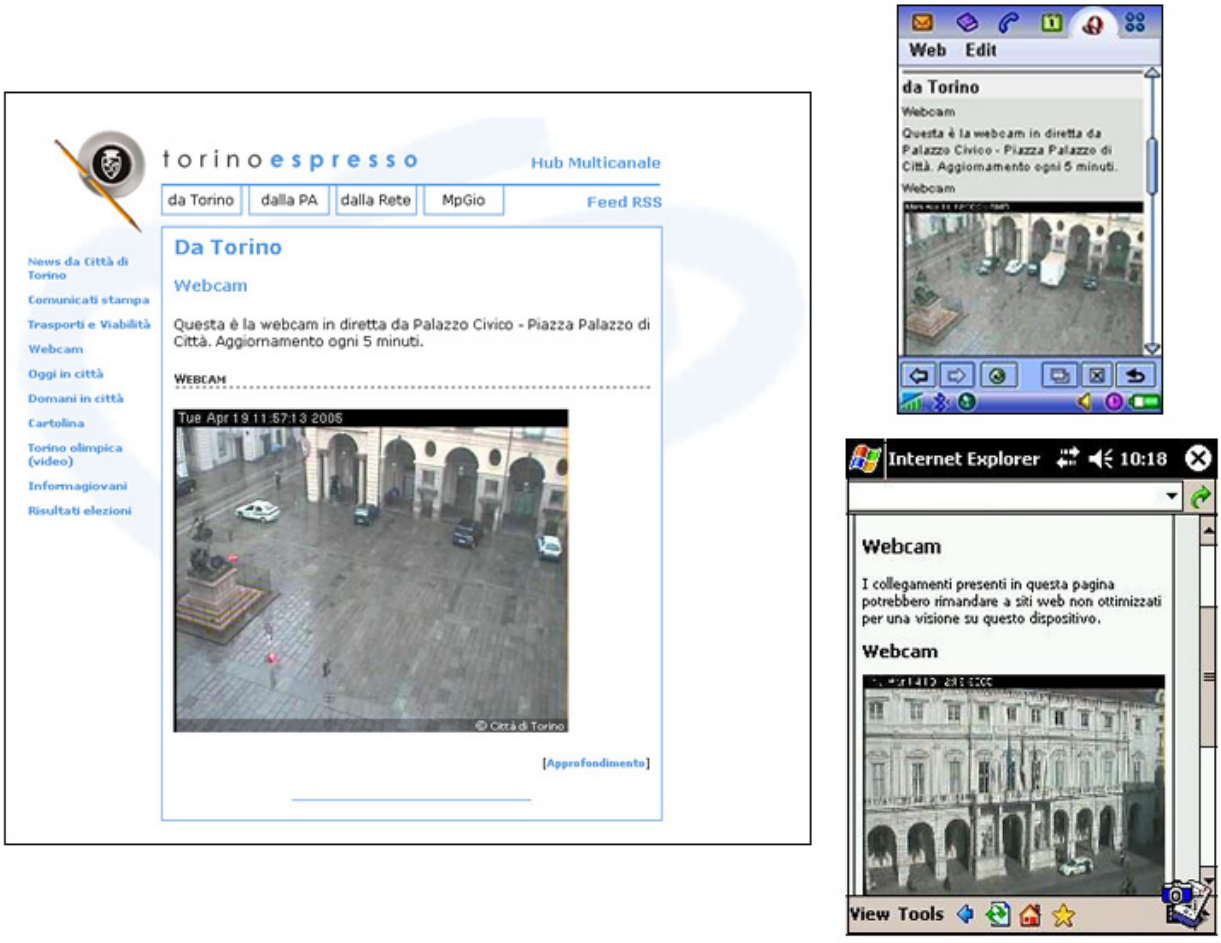

Figure 3. Torino Espresso: on the Web, on a smartphone, on a handheld device

From this system the readers receive a sample of the main daily news, classified in three sections. The first one collects news about the City and press releases coming from the Turin website, but also multimedia contents such as webcams, videos and Flash movies. The second section deals with news coming from webzine about Italian Public Administration bodies and related themes, while the last one collects real-time news from national and international newspapers.

8. Future and related works

The benefit of using a tool with high integrating capabilities does not only come from the possibility of integrating current and well-known information sources, but it lies in a single user interface for any type of content. In fact, the main objective of the Multichannel Hub is the possibility of adding new and unforeseen information sources.

After the development of "Torino Espresso", which represents the first demonstrative application of the Hub in a real context, we would like in the future to integrate this project with some other prototypes. So in this part of the paper, we will present some prototypes realized by CSP - ICT Innovation for the City of Turin in the last year. The integration has the purpose of showing the interrelationship among different digital products and of suggesting possible improvements too. This integration aims also to use these projects as case studies to compare and estimate the potentialities and limits of the Multichannel Hub.

XML format permits data transfer from one application to another independently from the software architecture of each project. In fact the Hub prototype just needs to receive the HTTP address for XML data import, without any constraints as regards extraction and publishing methods.

According to a technological perspective, the Multichannel Hub is able to integrate different external sources such as: ASP/IIS/SQL-Server (Interactive Map), CMS in PHP/MySQL (Tourist web site) and JSP (Search Engine).

8.1 Interactive Map for the City of Turin

This project, called Interactive Map for the City of Turin, is focused on the development of an interactive system for the production and publication of geographic information about the City of Turin.
The system architecture is based on MapWorld engine (http://www.mapworld.it). Through the complete management carried out by the server, the engine directly imports GIS cartographic data from external sources, sending a small amount of bytes to the client.
So in real time the application can manage the visualization of information on the map, exploiting the minimum system requirements of the client (Browser Internet Explorer 6 and Macromedia Flash Player 6).
Moreover its web-based back-end, that simplifies data entry and edit processes, allows for easy contents management and organization in the database. This authoring system enables editorial staff without specific skills to manage diversified content, integrating vector data, tourist and cultural information linked to the different Points of Interest distributed on the map.
The Interactive Map proposes several tourist itineraries, which represent the point of integration between the Interactive Map and the Multichannel Hub.
Thanks to usable data entry forms and scripts able to communicate with the Point of Interest database, the integration system extracts and structures information in XML format, while XSL transformations integrate this information in the Hub.

8.2 Tourist web site of the City of Turin

CSP realized an open source content management system (CMS) for the tourist web site of the City of Turin. The web site is based on an open source CMS, called Mambo (www.mamboserver.com); it is written in PHP and it uses MySQL as the database management system. This applicative configuration guarantees the right functioning of the CMS on several server platforms, such as Unix, Linux and Windows.

An example of integration between the Multichannel Hub and the tourist web site is the export of news in RSS format from the web site to the Hub. In particular, the web site is divided into sections and sub-sections: each category can be exported in order to refine the selection of contents to be imported by the Hub.

The integration is quite easy and immediate, as it is based on queries to the database and on the construction of XML files in RSS format, accessible by other external applications.
The tourism project provides also integration with the Interactive Map of the City of Turin.

8.3 Search Engine for the City of Turin web site

In 2003 CSP – ICT Innovation in collaboration with CELI (http://www.celi.it/) provided the City of Turin with a search engine prototype with advanced functions for information research in large documental bases, such as the web sites network of Turin.
This project produced a research tool characterized by the following features:

- integration of the morphological analysis in the indexing system (firstly for Italian, then for other languages);
- development of a thesaurus or a synonyms dictionary specific for the Public Administration of Turin domain;
- development of a proper nouns dictionary specific for the Public Administration of Turin domain;
- integration of the search engine with systems for information access, adaptable according to user profiles.

Data extraction and management are structured using XML format while the database queries produce results in RSS/RDF format, used by the Multichannel Hub too. So users can be updated about their searches just putting the URL results of their queries in a RSS reader.

9. Conclusions

The developed prototype achieved some important results as concerns technological and applied innovation, especially in the Italian government context.
In short, the results can be summarized as trial and evaluation of:

- flexibility and interoperability of semantic web;
- opportunities offered by web resources and web services;
- multichannel publishing processes;
- integration strategies among different information providers, in terms of content, technology and editorial rules;
- interaction and interface design for non-conventional devices (PDA, smartphones and Digital Terrestrial Television,…);
- multichannel access to public services for disadvantaged users (senior and disabled users);
- a survey methodology focused on the knowledge of user information needs in unusual contexts of fruition (mobile device, Digital Terrestrial Television,…).

This prototype provides a good example in the Italian context, aiming to develop new integrated services in order to promote communication between citizens and Governments in the innovation process.
If Public Administration bodies are developing a model of “connected services” among both different units of the same organization and several local agencies, the quality of the exercised functions has to be based on user satisfaction. This fact represents a radical change in the Governments culture and relationship management, now focused on the increasing of citizens and organizations awareness as well as resources and technologies adjustment.

In fact, the aim of this kind of innovative m-government project is to give citizens the opportunity to take part in the decisional process, sharing on-line transactions and information with Governments. So Information and Communication Technologies turn out to be a good support for the improvement of public

services quality, besides a way of involving citizens in the innovation trials carried out by Public Administration bodies.

Acknowledgments

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