

E-Government: Challenges and Opportunities

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Abstract. We briefly discuss the e-government challenges, both in respect to a four stage model of e-government development, and clustering them according to the technical, economical and social perspective. Semantic interoperability is the next step and fits in the Semantic Web vision. International and Italian context are pushing towards conformance to web standards and interoperability. Emphasis on e-government is a good opportunity for all to knowledge advancements and competitiveness. In the framework of a national call for e-government projects, the Comune di Pisa succeeded in implementing the CiTel project, where cooperation among different partners (administration, industry and research) was a key success factor.

Categories and Subject Descriptors (ACM):

H.3.5 [Online Information Services]: Web-based services
J.1 [ADMINISTRATIVE DATA PROCESSING] – Government
K.4.2 [Social Issues]
K.4.2 [Organizational Impacts]

1 Introduction

E-government is simply defined ([Gordon2002]) as the use of ICT to improve the process of government. In a narrow sense it is sometimes defined as citizen's services, re-engineering with technology, or procurement over the Internet.

Government also engages in marketing and sales via the Internet (e-commerce), which however is not the heart of e-government. The core task of government is governance, the job of regulating society and not just marketing and sales. E-governance is defined as the transformation of (governance) processes (resulting from) the continual and exponential introduction into society of more advanced digital technologies.

E-governance is generally considered as a wider concept than e-government, since it can bring about a change in the way how citizens relate to governments and to each other. The idea of adopting ICTs is to move beyond the passive information-giving to active citizen involvement in the decision-making process. E-governance can bring forth new concepts of citizenship, both in terms of citizen needs and responsibilities. Its objective is to engage, enable and empower the citizen ([UNESCO-Egov]).

Individuals and organizations interacting directly or indirectly with the government are known as the players of e-government. These interactions can be named ([Koloachalam2002]) as Government-to-Government (G2G), Government-to-Business (G2B), Government-to-Employee (G2E), and Government-to-Citizen (G2C).

E-government, which promises to make government more *efficient*, *responsive*, *transparent* and *legitimate*, is a technical, economic and social challenge, where wrong

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Franco Chesi and Maurizio Pallotti contributed to the paper supplying information about the CiTel Project. The section describing CiTel is mainly their contribution. The rest of the paper is by Oreste Signore.

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or short-sighted decisions can waste resources. New projects must take into account existing experiences and investments, show a good return of investment, and implement services usable by a large variety of people.

Recently, the Italian Ministry of Technological Innovation (MIT) advertised a nation wide selection for e-government projects. The CiTel e-government project has come in fourth position in this selection.

In the following we will briefly recall some e-government issues, outlining challenges, future directions and opportunities. Subsequently we will describe the CiTel project, outlining its achievements, technological issues and envisaged future developments.

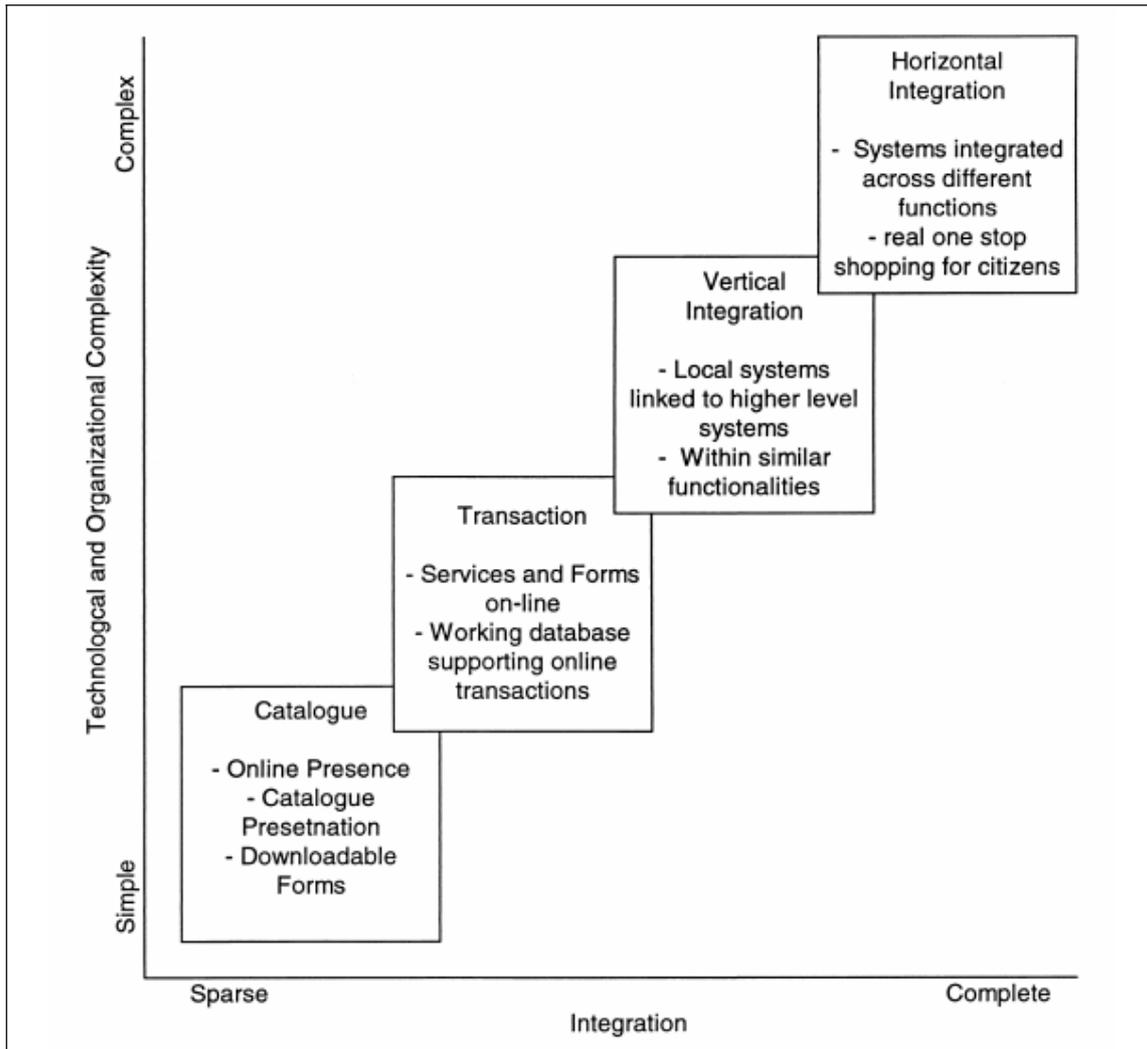


Figure 1 - Dimensions and stages of e-government development (from [Layne2001]).

2 The four stage e-government model

[Layne2001] describes a four stage model to develop a fully functional e-government. Based on technical, organizational and managerial feasibilities, the paper suggests that e-government is an evolutionary phenomenon, and posits four stages of a growth model for e-government: (1) cataloguing, (2) transaction, (3) vertical integration, and (4) horizontal integration. As shown in Figure 1 these four stages are arranged in terms of

complexity and different levels of integration. In this section we will explain these four stages, mainly following the original paper.

The first stage is called “*cataloguing*” because efforts are focused on cataloguing government information and presenting it on the web. In this first stage efforts are focused on establishing an on-line presence for the government.

The second stage, where e-government initiatives will focus on connecting the internal government system to on-line interfaces and allowing citizens to transact with government electronically, can be called “*transaction-based*” e-government. At this stage, e-government efforts consist of putting live database links to on-line interfaces.

However, citizens’ demands and changes in society will push governments to go further as the critical benefits of implementing e-government are actually derived from the integration of underlying processes not only across different levels of government but also different functions of government. Citizens desire to see the government as an integrated information base and contact one point of government to complete any level of governmental transaction. We can refer to this as a “*one-stop shopping*” concept.

This integration may happen in two ways: vertical and horizontal. *Vertical integration* refers to local and central administration connected for different functions or services of government, while *horizontal integration* is defined as integration across different functions and services.

In defining the stages of e-government development, the vertical integration across different levels within similar functionality will be attained before the horizontal integration across different functions, because of their different level of complexity.

This last stage of e-government, *vertically and horizontally integrated*, represents for citizens an ideal situation, in which they have on-line access to ubiquitous government services, with levels of government and functional walls inside government transparent to them.

Stage I: cataloguing. In this first stage governments create an “*administration website*” mostly due to a great deal of pressure from external actors, demanding to get on the “net”. Parts of the government’s non transactional information are put on the site. Main reasons why any government would want to move to this “electronic cataloguing” stage, is that as many citizens are able to access information on services from the private sector from the web, they expect the same access from the government.

In terms of G2C, this stage offers the least amount of functionality for the user. The typical government department home pages at this stage have a description of the department, and some links to other pages. It establishes a departmental “presence” as opposed to providing service access points to the customer.

The next step in this natural progression is to re-organize information by services, by different actions or by different events.

At this stage technological requirements are relatively simple. Nevertheless, there are some challenges on managing these sites. The administrator has to balance different amounts of on-line presence and allocated resources required by different departments. In a political organization this is always a problematic issue. Another important issue is the maintenance of the information. Along with procedural and policy changes, web pages need to be maintained and some data presented on government websites may be temporal. Date and time stamping may be essential at this stage, along with issues of consistency in format and user-interface among different departments.

Privacy will also become an issue at this stage, as it is possible for the government to track on-line activities. While this tracking information is collected toward improving

the website and its offerings, this information may also be sold to external parties. Thus, several policy issues must be decided by the administration in establishing the site.

The reduced scope of the web site under this stage makes organizational challenges limited. The first challenge is assigning responsibility for the overall coordination and planning of services on the administration web site as well as its maintenance.

In many cases at this stage an internal employee, having non-technical job classifications, takes the maintenance responsibility for the site. Over a period of time, this part-time responsibility may create problems of an inappropriate use of resources as the person may come to spend more and more time on site development and maintenance. Having an internal person whose skill at developing web sites is secondary to other skills may limit the ability of the site to meet customer needs.

The second problem is assigning responsibility for the answering of e-mails. Web sites often include an email address for questions from site users. Often these questions may be wide ranging and beyond the ability of the web master. Some procedure must be established to address how these emails will be handled and how quickly.

Stage II: transaction. At this stage, citizens can perform transactions like, for example, renew their licenses and pay fines or taxes on-line. The quantity of these e-transactions increases, and the administration is pushed to build on-line interfaces directly connected to the internally functioning government systems with minimal interaction with government staff. Electronic transactions offer a better hope for improved efficiency for both the customer and the agency than simply “cataloguing information”. This stage presents government on the Internet as an active respondent. It is now a two-way communication, where citizens move from a passive to active role. Citizens transact with government on-line by filling out forms and government responds by providing confirmations, receipts, etc.

The citizen-customer enters through a portal that looks at the service needs of the customer as opposed to requiring the citizens to traverse numerous sites to find the information needed. This one stop on-line help centre will be available through a portal. The issue (cost, time) of integration of legacy systems comes onto the scene. As the information collected by governments may be politically sensitive, installation of appropriate security mechanisms may be an important technical consideration. At the same time, many other policy issues need to be resolved, such as authentication and confidentiality.

Stage III: vertical integration. At this stage, the focus moves toward transformation of government services, rather than automating and digitizing existing processes. Electronic government is not simply a matter of putting existing government services on the Internet, it requires a re-conceptualization of the government service itself. In the long run, the full benefit of e-government will be realized only when organizational changes accompany technological changes.

After on-line transaction services become prevalent and mature, citizens' expectations will increase. Most transaction stage systems are localized and fragmented. A natural progression will be the integration of scattered systems at different levels (vertical) and different functions (horizontal) of government services.

It is expected that vertical integration within the similar functional walls but across different levels of government will happen first, because the gap between levels of government is much less than the difference between different functions. Many administrations interact more closely with their central or local counterparts than with other departments in the same level of government.

Consequently, at stage three central and local systems are expected to connect or, at least, communicate to each other. Vertical integration goes beyond this simple interconnection. If a citizen conducts a transaction with an administration, the transaction information will be upward or downward to the appropriate counterparts. The various levels of systems are connected and talk to each other so that results of transactions from one system can be interchanged with another system.

Physically, this may be integrated as a central database or a connected web of databases communicating with each other.

Perhaps at this stage G2G transactions are more important than G2C ones.

The target of vertical integration is to seamlessly integrate the central and local systems for cross referencing and checking.

Beginning in this third stage, communication and integration-oriented technologies become more important. As the goal is to integrate central and local administrations, a web of remote connections is a technical prerequisite. In this remote connection and virtual transactions, several technological issues emerge: signal authentication, format compatibility of electronic data interchange, exposure level of internal legacy system to outside, etc.

Accordingly, the role played by the government employee changes. In the old traditional off-line government, many government employees are responsible for processing localized governmental transactions. Once systems are integrated and automated, most transactions are automated, and the scope of activities performed by each employee will extend beyond functional department boundaries.

Development of this stage requires various levels of government to allow some flexibility in the development of their databases that meet not only their needs. Administrations have to become less proprietary about their information.

Even though stage three may provide improved efficiencies, privacy and confidentiality issues must be carefully considered. A conceptually centralized database might be viewed with alarm as opposed to increasing efficiencies. Governments must consider the appropriate balance between the privacy of personal information and the right of individuals to access public records.

Stage IV: horizontal integration. The full potential of information technology, from the citizen's perspective, can only be achieved by horizontally integrating government services across different functional units. The limitations of the functional nature of both the public and private sector will become clearer as more public administrators begin to see the vision opened by the Internet. Typically, citizens requiring assistance from governments need more than one service. To overcome this problem, some administrations provide one stop service centres.

The horizontal integration of the stage four will considerably improve those efforts. Databases across different functional areas will communicate with each other and ideally share information, so that information obtained will propagate through all government functions. In addition, citizens could conduct business across a wide variety of requirements. As an example, when a citizen moves his/her home, the basic residence record could be propagated to different functional service branches of government such as the medical assistance and the local election department so that the citizen does not have to fill out a personal record form for each department or administration.

The horizontal integration of government services across different functions of government will facilitate "one stop shopping" for the citizen. Each organization may have to give up some power to move to this stage.

Technically, integration of heterogeneous databases and resolving conflicting system requirements across different functions are major stumbling blocks for any government to reach this stage.

However, it is not only a technical challenge but also a management challenge, as demonstrated by Figure 1. Horizontal integration requires a change in the mindset of government agency directors. When thinking in terms of information needs or transactions, many directors perceive their department as most important and disregard other departments needs. With the support of the Internet, the government processes defined by specialization may not be efficient, effective, or citizen friendly. The concept of governance and management of government staff may be subject to re-evaluation from the perspective of e-government. Functional specialization may not be suitable as a governing structure in e-government.

In many respects, horizontal integration provides more access for other governments and possibly businesses than it does for the citizen. However, it is important that the citizen does not perceive horizontal integration as the beginning of a society in which the electronic data collected is used to glean information about the individual. The individual remains in control because it is the individual who chooses to use or not use the capabilities of a website.

3 Challenges in e-government

As we have seen before, e-government is a big opportunity to bring services to all citizens, but must also consider some challenging issues. We have yet discussed some of them, related to the stages of e-government development. We are going now to consider them grouped by their areas. It will easily seen that these requirements are not orthogonal, and there will be some overlaps. Really, the most significant characteristic of any successful e-government application is its *quality* ([Signore2005]). Let us now give a brief sketch of the various issues.

3.1 Technical issues

Projects will not start “from the scratch”, but will have to consider previous investments resulting in legacy systems. Some of them can be rewritten in new environments, while in some other cases this could be too expensive. Therefore interoperability with existing software and hardware platforms is a key success factor. It is unlikely that available resources can support a full replacement of existing applications. Designers must carefully consider portability and compatibility with future technologies. Finally, some legal aspects, like security and privacy, must be considered, as personal data are processed and stored, and financial transactions must be executed. To cope with such requirements, appropriate technical choices must be done.

Interoperability. System must be interoperable, both as far as the newly developed are concerned, as well with the existing legacy applications. As a consequence it is mandatory to define “open standard” architectures, having well defined interfaces, to avoid heavy maintenance interventions on existing applications, perhaps completed in the recent past.

Privacy. A critical obstacle in implementing e-government is the citizens’ concern on privacy of their life and confidentiality of the personal data they are providing as part of obtaining government services. The guarantee by government will not suffice unless accompanied by technical solutions, transparency of procedures and possibly

independent auditing. Privacy and confidentiality has to be highly valued in establishing and maintaining web sites.

Security. A basic task to fulfil is payment (of fines, taxes, etc.). Transaction security is an obvious requirement.

Multimodal interaction. An e-government application is really effective if user can access it using different devices.

3.2 Economical issues

Economical issues are mainly concerned with return of investments and safeguard of the previous ones. The last point leads again to interoperability considerations and to some other considerations, like cost/benefit analysis and the effectiveness of the resulting application.

Costs. Implementation, operational and evolutionary maintenance costs must be low enough to guarantee a good cost/benefit ratio.

Maintainability. Regulations and device characteristics can vary, and the system must be capable to second the emerging needs. Maintainability is a key success factor for long living systems in a rapidly changing technical e regulatory environment.

Reusability. E-government must be seen as a nation wide plan. Implemented applications, or at least some of their modules, must be reusable by other administrations.

Portability. Independence from hardware/software platforms is a primary requisite for portable applications, to help in possible reuse by other administrations.

3.3 Social issues

Social issues are mainly concerned with the usability by a large variety of people. This implies that the interface must be usable by disabled or elderly people, understandable by low literacy or non native language people, etc.

Accessibility. Any service should be accessible by anybody from anywhere anytime. The concept of e-government is claiming for increased efficiency and effectiveness of government, but these goals will be achieved only if service will be available to one hundred percent of citizens. Even if Internet population is exponentially growing, there is a significant portion of the people who may not be able to access e-government for various reasons. Some users may have physical or cognitive limitations, both permanent as well as temporary. Some others can have limited access to ICT technologies and devices. Therefore, universal access is still a mirage. Similar services must be maintained outside the web, such as physical service facilities and automated telephone response systems. Governments may want to provide Internet access through public terminals as a part of their universal access efforts.

In Italy this aspect is regulated by the 4/2004 law ([Signore2004]).

Usability. Users are often non expert users, or, at least, they may use applications in a sporadic way, and need guidance to find the right way to perform their transactions. Governmental web sites must be usable, to be effective. This aspect has been considered in the technical regulations for the law 4/2004, which provide for a minimum accessibility level (objective/heuristic) and higher quality levels (subjective/empirical).

Acceptance. Successful implementation of e-government requires a reconceptualization of government. As e-government becomes a reality, the public sector organizational structure will change accordingly both internally and externally. The focus of change will be on the system efficiency and the citizens. Internally, the power conflicts over departmental boundaries and control of services will become more apparent as integration progresses. Externally, government processes will be organized for citizens'

convenience instead of the convenience of the government. In other words, the integration should not be driven by efficiency and effectiveness alone.

A relevant issue will be to have all the citizens well aware of the facilities offered by the e-government infrastructure, and have them to trust in it. This task may require appropriate marketing actions and education of less skilled people.

4 Future for interoperability

Semantic interoperability remains a big obstacle in e-government. In fact, as recalled by [Klischewski2003], “lack of interpretation of the meaning of data objects and interfaces in focus is the key obstacle for networked computer applications in administrative processes and services”. Such semantic mismatches are caused by differences in conceptual schemas of cooperating applications, or different structures and granularity of information.

Semantic Web technologies ([SemWeb], [Signore2003b]) are promising to overcome these difficulties. It is very probable that next generation e-government applications will heavily rely on these technologies (RDF, OWL) as they will become more common and mature, to achieve maximum vertical and horizontal integration.

5 Looking at the context

As pointed by [Benamou2004], all case studies confirm that political involvement is essential for the success of e-government projects.

A complete discussion of what is going on in this area is outside the scope of this paper. However we will just recall that at European level an interoperability framework for pan-European eGovernment services ([EIF2004]) has been defined. UK government ([UKegov]) recently released the version 6.1 of the e-Government Interoperability Framework (e-GIF), dictating very detailed specifications with extensive reference to XML technologies.

Recently in Italy, with the Decree (DPCM) 14 February 2002, a first advance of 120 million Euro was directed to the financing of e-government projects presented for evaluation by PA organisms. A system of "co-financing" was provided, where e-government public funds could cover only a part of the total amount of the projects, up to 50%. The rest of the expenses should be financed directly by the project proponents.

This e-government plan issued by the Ministry of Technological Innovation (MIT) aimed to introduce innovation in Public Administration and was offering many opportunities to the ICT actors. A relevant step towards the horizontal integration was the explicit reference to the “events of life” metaphor (see Figure 2) whose support was requested.

Recently (9th January 2004) the Italian Parliament approved a law (4/2004) which is imposing that impaired people should not be discriminated, and must have access to the services supplied using ITC technologies. This act greatly affects Web sites and e-government applications ([Signore2004]).

Starting from January 2006, the Digital Code for Public Administration will be in effect, so accelerating the full support of digital technologies in all activities by citizens, namely certificates, email, teleconferences, reuse of technologies, co-operation, digital transmission of documents, digital signature, etc.

As far as multimodal interaction is concerned, a great attention is devoted to digital terrestrial television ([T-egov]).

eventi della vita

- Avere un figlio**
Prima e dopo la nascita, l'adozione, le agevolazioni per i genitori.
- Studiare**
Ordinamento scolastico, scuole statali e private, opportunità formative.
- Usare un mezzo di trasporto**
Prendere la patente, acquistare un veicolo, in caso di incidente.
- Fare il volontario**
Scrivere un curriculum, formazione, cercare lavoro, sicurezza.
- Avere una casa**
Contributi pubblici per acquisto e affitto, piani urbanistici comunali.
- Pagare le tasse**
Modelli di dichiarazione e versamento, codici e agevolazioni.
- Vivere in salute**
Assistenza, malattie, prevenzione e strutture del Sistema Sanitario.
- Vivere l'ambiente**
Tutela dell'ambiente e del territorio, percorsi naturalistici.
- Vivere tempo libero e cultura**
Musei, siti archeologici, turismo, biblioteche, teatri, cinema.
- Andare in pensione**
Requisiti, nuove regole, tipologie di pensione, Enti previdenziali.
- Avere una famiglia**
Tutela dei bambini, matrimonio e separazione, perdita di un caro.
- Andare all'estero**
Ambasciate e consolati, vaccinazioni e iscrizione di minori sul passaporto.
- Fare sport**
Servizi e strutture, iniziative e sicurezza nella pratica sportiva.
- Fare/subire una denuncia**
Le cose da fare quando si sporge denuncia o quando la si subisce.
- Aiutare gli altri**
Protezione sociale, assistenza ai disabili e alla terza età.

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Figure 2 - The "events of life" metaphor

6 Opportunities

The present emphasis on e-government is a major opportunity for all the actors in the ICT panorama. There are many areas of challenge where government is a demand leader ([Scherlis2003]). These areas include confidentiality, trustworthiness, ubiquity of service, information access and management, human-computer interaction, middleware, security, organisational and social issues, large scale systems, software technology, etc.

There are some interesting points to note about the relationship between e-government innovation and IT research. First, there is a mutual reinforcement between government's role in investing in long term research and acting as a farsighted customer addressing its own long term technology needs. Second, government benefits from collaboration between the two groups which are at the opposite ends of the IT supply chain: government users and IT researchers in developing e-government capabilities. Researchers can directly understand real challenges, while administrations will be aware of emerging and future technologies, having also the opportunity to influence their evolution.

Looking to this issue from a merely technical point of view, it is evident that successful e-government implementations and emerging normative standards from Europe and central governments make an extensive reference to the W3C Recommendations ([W3C-TR]). In fact, applications conformant with the basic W3C goals (universal access, semantic web, web of trust) and design requirements, like interoperability and decentralization, are perfectly in line with the present and future requirements of e-government applications.

In fact ([Signore2003a]), technical interoperability, portability, accessibility are just a consequence of conforming to W3C Recommendations, and any existing application conformant to these standards will conform to emerging regulations with little or no effort.

Therefore, being active actors in developing web technologies can be an excellent opportunity to be competitive in the market. Even more important, moving without taking into account what's going on in the field, can result in a tremendous waste of resources.

7 The CiTel Project

7.1 Generalities and previous experiences

The CiTel project "*Telematic Front office for the citizen*" (Figure 3) was born in the context of the Tuscany Telematic Regional Net, where local administrations since several years operated towards a comprehensive environment for technological innovation and Information Society. The project would not have born in absence of this technical infrastructure, a 8000 km high speed network connecting local administrations and optical fibre Pisa infrastructure.

The municipality of Pisa was very active in proposing innovative projects which received several awards ([Forum2001], [Forum2002]).

In 2002 the CiTel project has been proposed in the framework of the multi-project E-Toscana in the selection advertised by MIT. The project ranked in fourth position in the national selection, and first among the E-Toscana project (area "services for citizens and enterprises"). The total cost of the project has been about 3.36 Millions of Euro (about 1.6 MEUR by Comune di Pisa, 1.1 MEUR investments by private firms, 630 KEUR as Ministry co-financing).

The CiTel project is a good example of successful adoption of standard conformance strategy, with a fruitful cooperation among public administration, private firms and research institutions.



Figure 3 - General overview of CiTel

7.2 Design requirements

CiTel project is oriented to the realization of a telematic service desk to citizens and firms on several channels, both virtual and real.

The municipality of Pisa was mainly looking for:

- enhancement of services;
- increased transparency (citizens should be well aware of what is going on);
- set up of the “Digital Office”;
- development of infrastructures in the regional area;
- optimization and organizational costs saving.

To fulfil these requirements some well defined and concrete objectives have been identified:

- Setting up a unique municipal desk. The service to the users is performed by the front-office, and citizens perceive it as the “unique” office.
- Set up of a call-centre, whose task is offering front-office services as well as supplying first-aid information and accepting claims, as usual.
- Activation of a bi-directional web based communication channel between citizens and administration.
- Allowing payment of a wide variety of services through the web.
- Allowing access to services also through distributed multimedia kiosks.
- Supplying information to citizens using several media, like SMS and e-mail.
- Extending service offering to tourists.

7.3 Achievements

With the realization of the project the citizen can approach the desk for information or services directly by her/his computer, by mobile phone or by telematic kiosks installed in several points of the town, avoiding rears and bureaucratic routes.

These services are intended not only for the citizens of Pisa but also for residents in some neighbouring cities (Calci, San Giuliano Terme, Vecchiano, Volterra, Vicopisano and Cascina). Therefore, presently 7 municipalities (for a total of about 200.000 potential users) are yet having access to these services, and 2 more (San Miniato and Pietrasanta) just joined.

The citizen will be admitted to services after being identified through various levels of credentials, starting from the login and password (low credential) to the Electronic Identity Card (strong credential) and the digital signature.

Citizens not using the more advanced technologies may contact the usual information and service desk and the Call Center by a toll-free number. In this case, the operator will be able to answer in a more complete way than in the past, retrieving the information requested by the citizen through fixed identification codes.

The CiTel telematic desk is thought not only for citizens, firms, Tax Assistance Centers but also for tourists (who can book and pay tickets for exhibitions and museums), students (it is possible, for example, to have access to timetables and class registries).

As a first step, we tested the real desk for the first services on line: acknowledgment system, automatic routing to the proper office without knowing the final destination, estimation of citizen satisfaction, access to own files, delivery of requests and fiscal statements checking the own position and calculating the money due, sending of SMS to citizens about events they are interested in.

Connecting to the website (<http://www.e.pisa.it/>) citizens can obtain the major part of the services included in the e-government project for the seven cities of the Civic Net of Pisa. Among the services, we will recall: payments on-line, account statements for firms, building declarations and application, state and payments of cases, applications for the limited traffic area, state and payments of the fines, access to the own data, self-declarations on line, changes of residence, applications for schools, school meals and school bus, applications for the occupation of public ground; payments of the “lux perpetua”, booking and tickets for museums, class registries in the schools of Pisa.

Citizens can access with a unique acknowledgment system and make payments using the same mode for every involved local authority.

The virtual front-office activates a bidirectional communication channel allowing citizens to make applications and express their own satisfaction without moving themselves and without knowing the office of competence.

7.4 Technological issues

We want point out that on the technological level the project uses an efficient, modular platform of services. The fundamental architectural component of the system is the Base Framework, proposed by Regulus. It consists of all the components common to the services to the citizens and of the management and control applications used by the operators:

- Authentication and Authorization Management,
- Menu Management,
- LOG Management,
- Notifications Management,
- Orders Management,

- On line Payments Management,
- User Session Management

This framework can be tailored to specific needs, depending on the context of the application environment adopted by the local administration selected by the user, making available local data.

It interacts with CIG-Citizen Identification Gateway, which is the CiTel security system. CIG is an Authentication Server independent from the other components of CiTel, and can be used by several, even external, applications.

The Base Framework has been implemented in open source environment using standard technologies, both as architecture (Linux, Apache Web server, TOMCAT, etc.) as well as development and management platforms (SUN J2SE/J2EE platform, Struts framework, AXIS, standard XML/SOAP interfaces as required by the Web-Services model, etc.). As DBMS, Oracle has been selected.

The CIG security system can contemporarily handle several different credential typologies (User/Password, Digital X.509 certificate, CIE¹, CNS², etc.). Authentication is based on the *challenge-response* mechanism, according to the governmental specifications for *strong authentication*.

Services have been structured separating various logical levels:

- *Presentation (User Interface)* in designing the Web interface W3C-WAI Recommendations have been taken into account, to achieve accessibility. The presentation is XHTML 1.0 Transitional valid, making use of Cascade Style Sheets (CSS), designed to modify the look of pages and the way different areas in the page are arranged and filled.
- *Application Logic (Management of the Service)*: implements and controls user's operations sequence, interacting with the infrastructure modules of the web portal.
- *Integration with the Back Office (Data Management)*. A fundamental goal in CiTel was to avoid duplication of application data in its database. The implemented integration architecture allows to keep application data in the back offices of the participating administrations. When citizens need to operate on them, they are retrieved from their source, used and eventually updated back in their place.

CiTel services have standard interfaces towards back offices of the various administrations, therefore every service can operate on specific data stored on the administration the user has selected.

The interface between services and back office systems has been realized through the Web Services model, developed according to WSDL and XML/SOAP standards, and according to the indications supplied by the authorities of e-government. It is open to the standards of the cooperation plan established in Tuscany that includes Pisa as participant.

The planning effort with Cedaf lied in realizing a Front Office which uses own information as well as info acquired by web services to obtain a right level of cooperation between the various local authorities: so it is possible to improve efficiency and quality of service to citizens and firms.

The 3 levels structure allows improving a multi-channel fruition of services and integration with back-office services.

¹ CIE: Carta di Identità Elettronica (Electronic Identity Card)

² CNS: Carta Nazionale dei Servizi (National Services Card)

It is worth to point that issues related to the standardization of interfaces between Web Services and back office applications, aimed to an easier reuse of the projects by different administrations, are concern of a specific activity involving AssInform and some e-government projects, including CiTel. Additional effort is required to the administrations, to plan all the activities required to make directly accessible to citizens correct, verified and consistent data, with the appropriate levels of security.

7.5 Reuse

The reutilization plan is an important issue. For this purpose a cooperation has been activated between the Agencies acting as coordinators of e-government plans. It is established the reutilization of all the products, documents and applications realized in the project. All the Agencies that apply may obtain the technical documents produced in the planning and analysis phases.

Some Local Agencies, namely Livorno, Lucca, Pietrasanta, Carrara, already participated in our analysis and reutilization, attending the project advancement meetings. We tried to take advantage ourselves by their professional skills. Presently, two e-government projects are going to reuse the base framework and two municipalities (Pietrasanta and San Miniato) started to reuse CiTel modules to supply services to their citizens. Seven self-consistent modules are going to participate in a call issued by CNIPA (National Centre for Informatics in the Public Administration), to build a national catalogue of reusable solutions.

Contribution of partners, involved Agencies, Ministry of Technological Innovation, was very valuable to keep the schedule.

7.6 Other issues

An integrated e-government plan has to face some problems, related to legacy applications, acceptance by involved administrations and personnel skills.

To overcome these difficulties appropriate initiatives were taken. People belonging to the seven administrations involved in the project where educated about e-government issues, digital signature, technical and management issues, to gain the skill needed for a successful acceptance, implementation and operation of the plan.

Another key point was the participation to the analysis phase, to set up services aware of the needs of the participating administrations.

To make the project operational the Pisa Municipality modified its internal organisation and in 2003 presented an awarded project ([Forum2004]).

7.7 Future work

Presently CiTel is in the delicate phase of starting the use of the services by citizens and firms. Accessibility or e-learning modules for every service cannot by themselves guarantee that these services are actually and effectively used. The actual estimation about the use is possible only when a lot of services will be activated. We will heavily use the customer satisfaction analysis to assess the quality of service. CiTel will obviously evolve in increasing the number of services available trough the web interface.

In addition, it is already planned to modify its infrastructure and some services to make use of television channel, probably the most popular and widespread technology in Italy. In this aim an evolutionary project, T-CiTel, has been already presented. It has been one of the 29 projects in Italy which got funding in the framework of a contest for digital terrestrial television transmissions, managed by the Ministry for Innovation and Technologies. The main task is to bridge the digital divide, supplying selective and

personalized information to all the people who are not using more sophisticated technologies.

Even if the user interface of CiTel has been developed taking into account the W3C Recommendations, and especially the WAI Guidelines ([WCAG1.0]), an additional effort will be required to make CiTel conformant to the Italian regulation for accessibility of public sites, which is very strict ([Signore2004]).

In the short period, CiTel is participating to a new contest, aimed at the “reuse of solutions” issued by CNIPA (MIT).

8 Conclusion

E-government presents several technical, economical and social challenges that will surface as the e-government development moves from the initial “cataloguing” stage toward full vertical and horizontal integration.

Semantic interoperability is the next step, and will get advantages from the scientific effort put in this research area.

Regulations and guidelines, both at European as well as national level move towards a solid and reliable technical framework, mainly based on the Web technologies. E-government requirements fit well in the W3C long term goals like web of trust and universal access. In implementing e-government solutions conformance to the W3C Recommendations is an important issue towards improving quality, reducing costs, and saving previous investments. Even more important is to actively participate in the definition of the Web technologies.

Governmental nation wide initiatives are essential to trigger new projects and investments, but it is necessary to invest in research and development to attain a suitable level of quality and competitiveness.

Facing the e-government challenges, CiTel resulted in a successful experience (award at [Formez2004] and winner at [Paaperta]). Main points are the conformance to an open standard architecture and compliance with W3C Recommendations, which resulted in saving of investments, high interoperability and flexibility towards new technological framework.

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