Providing Pan-European Public Services through an Interoperability Architecture

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Abstract: The enlargement of the European Union will lead to a higher number of cross-national curriculum vitas of European citizens. Thus, the complexity of public administration interaction across Europe will rise. To ensure that this interaction does not become a barrier to European citizens' mobility, public administrations need to support E-Government in an informational, communicational and transactional stage, but above all in an integration stage. The interaction of processes from public services needs to be integrated in an interoperable infrastructure. Such a solution was developed in the EU project "InfoCitizen" on a conceptual and technical level. The solution was proven to be working in scenario simulating a real curriculum vitae of a mobile European citizen.

1 E-Government: The third stage

The modernization of government services is one of the major objectives of the European Union. The eEurope 2005 Action Plan therefore proposes a set of actions, especially the creation and the establishment of interactive and interoperable public services [1].

Using E-Government offers new possibilities to public administrations (PA) of governments, regions and municipalities to bring public services to citizens and businesses in a more comfortable manner. For instance information technologies allow the electronic inter-connection of public administrations [3].

However, the multitude of individual initiatives has led to massive solutions not compatible with each other. In the long term harmonisation will enable easy interconnection and interaction between European public administrations (EPAs). Entire programs of public initiatives are dedicated to the effort of harmonisation. While these programs contribute to an electronic harmonisation an intermediate midterm solution for interoperability between public administrations is required to make the interconnection between EPAs possible.

The project "InfoCitizen", funded by the European Commission under the 5th Research Framework Program, developed an architecture for interoperability between EPAs. The specification and execution of interoperability was not limited to system integration, but covered the whole lifecycle of interactions of organisations, public services, business processes and of course application systems. InfoCitizen started in September 2001 for the duration of 24 months with the participation of eleven organisations coming from five different EU-countries.

2 Integrated public services

E-Government is considered as support of public service processes through Information Technology (IT) [2]. There are many possibilities to enhance public services by improved information exchange. Through Internet or Intranets, multiple forms of decision making, business processing or simple communication will change the interaction with public administrations [4]. Nevertheless, the degree of support for E-Government in public administrations strongly depends on its realization, mainly measured by the four stages Information, Communication, Transaction and Integration. However even today, the number of governments providing transactional features is very low and thus they underperform in the most valuable stage of Integration:

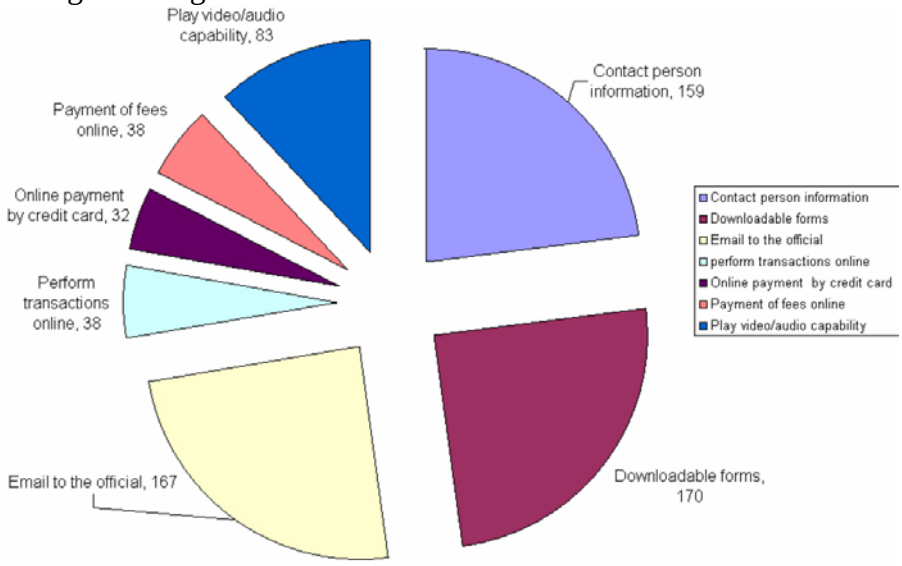

Figure 1 No. of countries providing interactive and transactional features [5]

The gap is even more significant when looking at the cross-country dimension. Transnational public services in Europe, i.e. those that cross the borders of the member states, are poorly, if at all, developed [6]. Therefore, pan-European interoperability between EPAs has to be fostered. Thus, there is the need for integration of citizens and businesses into public administration processes as well as the integration of different public services. The citizens and businesses can influence the execution of public services without having to know the way public services work and are processed. Consequently, full electronic support is required, covering all public services and the according processes.

The InfoCitizen Project aimed at improving the process interoperability – both at the organisational and system levels – for facilitating structured information exchange and sharing amongst European Public Administrations. It achieved this by

1. designing and establishing a common, open and extensible European information architecture, the InfoCitizen European Architecture, that specifies organization-, process- and system interoperability, applicable for all EPAs and that has been tested in representative public administration segments among the participating EU countries,
2. developing a distributed, decentralized, internet-based framework of standard-software components, the InfoCitizen Framework solution, building on emerging technologies (e. g. software agents, middleware, xml, Web Services) and acting as a pan-European IT interoperability infrastructure for EPAs, that support the InfoCitizen European Architecture created.
3. deploying it in a demonstration network of administrative sites, while also a pan-European integration exercise has been set up.

3 Methodology

In order to realise true pan-European public service integration the processes need to be integrated [7] without changes to the local services and their frameworks themselves. Regulations and laws define the way services have to be provided. Solely small changes in the process interfaces will enable integration without the need to change the process itself. This is the only way to integrate services through integration of processes in the medium-term and does not hinder future long-term harmonisation.

Looking at the relation between single public administrative organisational units, e.g., departments or public authorities, it becomes apparent that they are only little or not at all integrated. A single standalone process (e.g., wedding) directly triggers several other processes (e.g., marriage certificate, civil status, etc.), though. The interaction between the PAs is almost invariably accomplished using paper-based transports like postal mail or the citizen himself. Thus, this can lead to a loss or a inconsistency of information and documents. Apart from that, this way implies a loss of time and resources for the citizen.

The approach of integrated and transparent public services is to adapt the initiation of a process in such manner that the customer only has to request the service he/she directly needs and that all other related public services are automatically triggered transparently.
Integrated means that a public service process is capable to start another related public service process, which is needed to provide the public service initially required by the customer.
Transparent means that a public service process step which is not essential to the customer is decoupled from him/her and thus it is no longer his duty to carry out the process.

Public services related to an initial public service, regardless if it is preliminary or downstream to it, can be characterised according to the classic supply-demand scheme. A process requires information (demander) and another process can provide the required information (supplier). An initial service can be supplier or demander accordingly:

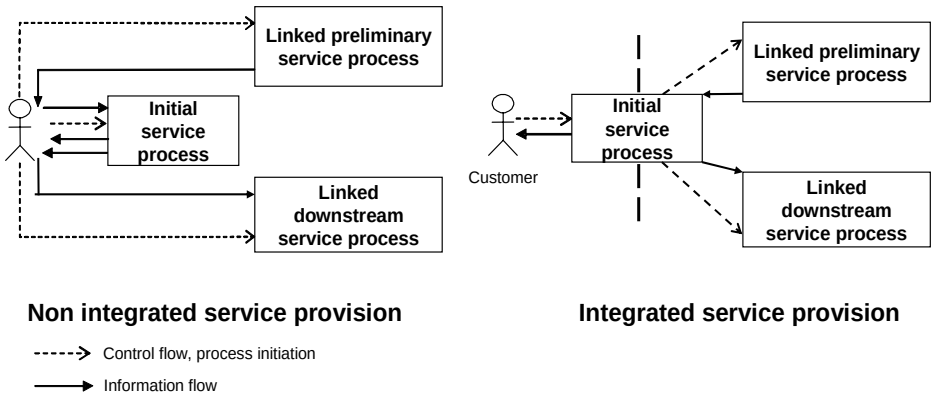

Figure 2: Non-integrated and integrated public services

1. If an initial service acts as a demander, it requires information from other services. Since the knowledge on the required information only appears when the service is re-quested, the initial service must dynamically request the information. Therefore the ser-vice uses a pull-strategy.
2. In the role of a supplier the initial service has the potential to forward information. That information was created during the processing and can be forwarded to related downstream public service processes. As the downstream public services do not keep track of the changes made by the initial service, it is up to the initial service to proactivly bring the information to the downstream services. This is called the push-strategy.

The first major outcome of the InfoCitizen Project, a generic interoperability information architecture, called the InfoCitizen European Architecture, supports these strategies. It

describes the relations and specifications for information exchange between EPAs, i.e., the inter-PA interaction. The major requirements that were addressed with this architecture are the support and description of the two key goals of the user needs, namely [8]:
transparent public service provision to the European citizen,
multi-agent / multi-country setting of public service provision.

The InfoCitizen European Architecture will conduct electronic transactions in multi-agent settings/multi-country settings in a manner transparent to the European citizen. The structure of the InfoCitizen European Architecture has been developed according to the phases of the implementation process and is composed of three "partial architectures", each of them designed in order to solve a specific problem space at its level:

1. *Conceptual architecture* – defining the business processes, information objects and basic interoperability mechanisms by abstract models. To cover all different aspects that need to be described, it was necessary to use a set of different, originally incompatible modelling languages and methodologies (UML, ARIS, AUML, FIPA and the SAP reference models) and to adapt them both to satisfy the requirements of complete specifications and to convert them into a coherent overall methodology.
2. *Technical architecture* – this is a technology-independent description of the ICT; this description includes as little design decisions as possible and attempts to avoid any restrictions imposed by implementation technologies. The technical architecture follows the logic of the conceptual architecture in terms of service provision processes, service interaction and data structures, i.e. it is the "translation" of the conceptual architecture in a technical environment [9].
3. *System architecture* – a description of the system "as-to-be-built" referring to its actual components as imposed by the selected technologies and incorporating design decisions regarding centralization/distribution, information representation formalisms, and other issues. The system architecture provides guidelines for the implementation of the final prototype and imposes the technology to be used.

4 InfoCitizen Framework Technology

In order to guarantee a wide adaptability and to avoid monolithic software constructs, the project decided to develop an open framework comprising four generic and fundamental software components linked via Web Service technology. The distinction of different component roles was introduced in the technical architecture and was realised in a concrete setting in the system architecture. The main differentiation is made in central and distributed parts of the framework. The InfoCitizen framework is composed of the Service Supply Components, each on top of a corresponding legacy system at a local installation, the unique Services Repository, the Interoperable Agent and finally the Front End System. Figure 3 shows the structure of the InfoCitizen Software Framework.

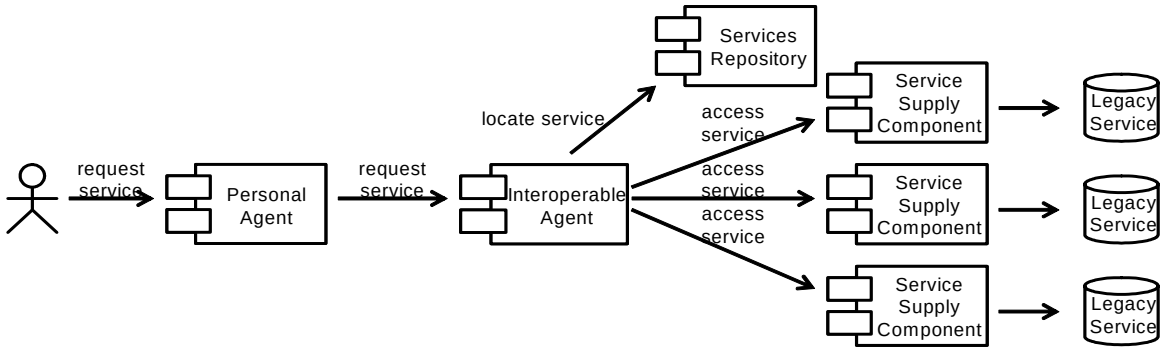

Figure 3 : InfoCitizen System Architecture

4.1 Service Supply Component Framework (SSCF)

The Service Supply Component Framework specifies how to develop components (Services Supply Components) that enclose PA systems and provide their services to the InfoCitizen Interoperability Platform. A Service Supply Component instance is a particular Web Service, compliant to the WSDL standard with SOAP1.1 binding on HTTP. A SSC can be developed with any programming language and deployed on any platform supporting the SOAP and WSDL standards. However particular support is provided to develop Java based SSCs. An SSC Deployment Tool (SDT) is given to assist the administrator in all SSCs life-time operations: from their creation and customisation to their deployment and installation. Three generic and customisable SSCs are given both to exemplify the development of SSCs and to permit accessing a large number of legacy systems. The JDBC-SCC allows a software agent (developed with Java, Visual Basic, C or any other language that supports SOAP) to access every JDBC compliant database. The JCA-SCC allows a software agent to access any software system that is compliant with the Java Connector Architecture (JCA) v. 2.0 through the Common Client Interface. This standard has been specified from the Java Community to allow vendors to make their products accessible from any J2EE compliant platform. The CDL-SSC enables access to PA documents stored in a legacy database through the Common Document Language defined by ICEA. This allows defining a map-ping between the XML model of PA documents (described through the Common Document Language) and any relational schemata of a legacy databases.

4.2 InfoCitizen Interoperability Platform (IIP)

The InfoCitizen Interoperability Platform (IIP, also referred to as ICIP) is the middleware that resides between the user Front-end and the Service Supply Components (SSC). It plans, controls and executes the information exchange. Using the emerging agent-technology enables the platform to efficiently search for, retrieve and distribute documents. By this EPAs are connected to the InfoCitizen platform to interact with each other, hence to be integrated. This is achieved by a combination of an Interoperable Agent and a Services Repository.

The core consists in an agent-based interoperability platform supporting distributed computing using the communications capability of agents. It simplifies the implementation of multi-agent systems through a middleware. The communication between machines is supported using standard SOAP. The agent platform can be distributed across machines and configuration, which can even be changed at run-time. It is controlled via a remote general user interface. Four main modules comprise the platform:

Interoperable Agent: the central element within the IIP; its mission is to combine a set of atomic services provided by Service Supply Components into high-level operations per-formed as transactions. It can be accessed from the outside using both synchronous and asynchronous SOAP interfaces.

Services Repository: the database of InfoCitizen service description; it includes information for services, locations, extraction services, documents and document types. The service in-formation is decentrally set up and updated by the EPA responsible for this specific service. When searching for an appropriate service, the Interoperability agent queries and analyses the data of the services repository and finally locates the specific service.[10]

Repository Admin: web front-end for repository data administration. Allows the usual operations for business object definitions: list, add, delete, and modify.

Extraction Service: defines a mapping between data in two different documents. It is used to copy data back and forth from and between different inputs and outputs.

4.3 InfoCitizen Front-End System (IFES)

The front-End System satisfies user needs regarding usability and process support. Based on internet-technologies, it is a multi-lingual customisable information portal solution that interfaces between the user and the InfoCitizen platform.

The primary objective of the Front-End System is to hide the underlying intricate infra-structure from the end user, who perceives it in a black box manner. At the same time it co-operates seamlessly with the Interoperable Agent that runs the length and breadth of the whole distributed information system. Moreover, the Front-End System provides a different range of functionalities and options in proportion with the rights of users of different categories. Furthermore it is fully customisable in terms of language and graphical representation morphology, so the installation and development of local up to national platforms for local public administration authorities can be done in an easy, user-friendly, fast and productive manner.

4.4 InfoCitizen Common Document Language

The description of information exchanged through the InfoCitizen system is one of the most crucial aspects of designing an interoperability architecture. At the moment, the information representation in the different EPAs is very heterogeneous, so there is a need for standardised information exchange. All documents that might be exchanged by participating EPAs should follow a sort of common language that is understood by the network peers. The generic document concept used in the Dublin Core Model builds the basic concept for the Common Document Language. It structures data and meta-data of all documents exchanged and establishes the general rules for document exchange. On the technical level, it is necessary to define the syntax and the semantics of the common document language using a data dictionary in order to derive an XML-scheme for the system level specification.

The Common Document Language described within the technical architecture provides a technology independent design for the generalised InfoCitizen document. This standardised language is an extendable basis for the handling of exchanged information between EPAs. To realise the standardisation of the transferred data on the level of the system architecture, a technology must be chosen, that is widely accepted as a standard but at the same time is capable of dealing with the domain under consideration. XML can fulfil these requirements, because on the one hand, it is accepted and on the other hand, it is extensible to match the particular needs in PAs. On the basis of XML-schemes three basic document types – certificates, applications and notifications – were defined. They contain simple and complex types marked as mandatory or optional. These document specifications are stored in the repository of the IIP.

5 Four-country Interoperability Demonstration

In order to evaluate the potentials of this development, it was necessary to apply the concepts and to deploy the technology within real environments. Thus, it was aimed to substantiate the conceptual and architectural aspects of pan-European E-Government interoperability within a demonstrator, namely the InfoCitizen showcases. Moreover, this enabled the verification of the practical capabilities of the proposed solution. The pan-European demonstration is based on a complex and real-life scenario and covers four European municipalities and prefectures from Germany, Spain, Italy and Greece. It defines, presents and evaluates the essential interoperability that the InfoCitizen Framework should provide to support A2A collaboration. The scenario has been constructed as a macro-process that consists of simpler processes. The purpose of the composition of the scenario is to cover a large amount of cases and to verify and evaluate the interoperability of the system. The final goal is the scenario to lead to a pan-European Scenario that would include cultural and legislative particularities of the EU

countries in order for the final framework to meet the real need of the PA organisations that will constitute the InfoCitizen PA organisation network.

The deployment and customising of the generic components of the Software Frame-work enabled practical experiences of the InfoCitizen solution on real use-cases. The scenario has provided an appropriate test-bed to check the viability of the InfoCitizen model with real PAs. In brief the pan-European scenario evolves the following PA organisations that are responsible for providing public services either directly for an EU citizen or for an-other EPA: In the whole scenario the *Municipality of Schmelz (Germany)* has to provide four different services. Schmelz will provide certificates of residence, deliver birth certificates, provide civil status certificates and certify citizen's citizenship as a German. A special problem was recognised during the detailed requirements analysis: Birth certificates are kept as paper documents without a persistent electronic representation in Schmelz. Therefore an asynchronous mode was introduced in InfoCitizen to handle partially or fully paper-based documents (offline-data-support).

The demonstrator in the *Municipality of Tres Cantos (Spain)* implements an interoperable census service. The service implies a workflow relating to the census process (registration/ deregistration of a citizen in/from the census registry), which uses some other services offered by other municipalities, with the objective of requesting from the citizen the least amount of paper documentation possible and to minimize the citizens' presence in the administration.

The Italian Showcase of the *Municipality of Colleferro (Italy)* aims to apply the InfoCitizen platform to automate and integrate fundamental services provided by the Municipality of Colleferro at a pan-European level: Change of residence from other countries to Colleferro and the Marriage in Colleferro between Italian and foreign people. Moreover, the Municipality is also involved to provide information required by services initiated by other PAs, for example issuing the birth certificate of a citizen.

The *Prefecture of Thessaloniki (Greece)* showcase is based on the adoption application process. The process of applying for an adoption is rather complex and requires a large set of documents that can be issued from different PA organisations. InfoCitizen aims to facilitate this process in order to retrieve all the documents necessary to submit the application.

6 Results and Business Benefits

The InfoCitizen solution provides the possibility for each EPA to offer their services electronically in the InfoCitizen Network. It can manage and use its services (e.g. delivery of birth or residence certificates) with the same front-end with which it can request electronic services from and provide their services to other public administrations within the network. Any public administration can be interconnected interoperable to public administrations, be they within the same municipality, the same region, the same country, or across Europe.

One of the main results is the extensibility and easiness of integration. With the use of the above mentioned technologies there is no need for the employees of the EPAs to be firm in depth with the details of the solution by the use of common internet tools.

Currently, efforts are being made to bring the InfoCitizen solution to the market. The demonstrator can be - and is being – developed into a product. Thanks to the extensibility of the solution the system can be implemented progressively. Nevertheless, the more EPAs join the InfoCitizen Network, the higher the overall benefit. Thus, large scale promotion needs to be done on a European level.

The technologies chosen- more specifically the platform independent and the web ser-vice technologies- were suitable to develop a solution according to the above mentioned objectives and to achieve the latter. Furthermore, the experience of the project showed that extensibility and the support of partially paper-based processes are mandatory requirements for the

implementation of a pan-European interoperable infrastructure. Finally, the result of the project is the need for easy implementation and well documented environment components.

EPA customers – citizens or businesses – profit from the integration of service delivery with InfoCitizen. There is no longer the need for the customer to go from one public administration to the other and to carry out the transportation of documents. One public ser-vice is delivered and immediately executed where it is requested. Preliminary and down-stream public services are executed automatically in the back office leading to transparency for the citizens and businesses.

EPAs profit from the participation to the InfoCitizen Network due to a reduction of service execution costs. Fewer breaches between Medias increase the speed and quality of service provision.

7 Conclusions

The InfoCitizen System solves the issue of interconnecting EPAs with interoperability. It overcomes the previous hurdle of harmonisation. Not making it useless, but rather empowering it with a set of solutions allowing a progressive integration of public administration legacy systems and thus, the integrative provision of public services.

Further research can be done for the integration of business services to the public ser-vices provided by the InfoCitizen Network. It would make the use of the InfoCitizen solution even more attractive. A multi-channel portal directly accessible to citizens and businesses and its related research issues could also be deepened.

Although integrated and transparent public services are only a milestone on the participation level of E-Government, it yet shows the potentials and possibilities that are related to it. The open and extensible framework proposed by the InfoCitizen project, to network public administrations on a pan-European level, will reduce administrative borders in Europe.

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