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ABSTRACT

Many new requirements for the public sector arise from the change of the society and the "Age of Knowledge". Globalisation leads administrations to become more interoperable, irrespective of national borders. To meet these requirements, administrations and IT systems need to become more efficient. One of the main principles in software engineering is reusability. This can be applied on all levels. There is still a lot of potential at the content level. The idea of reusing content is not new but especially in federal structures where central solutions are nearly impossible this is a great challenge. The document describes an approach that allows information to be collected in a decentralised way and makes it available in an interdisciplinary manner and across regional borders. Core Directories will be designed and used as an infrastructural component to make them accessible for multiple applications. In order to share information, data interoperability standards are needed.

Keywords

Core Directories, e-Government, Interoperability, Standardisation, Responsibility Finder, XÖV, UN/CEFACT, Ontology, Semantics, Public Services, Federalism

INTRODUCTION

In order to prepare the public sector for the challenges of the 21st century, administrations and institutions need to operate more efficiently. They must match continuously growing requirements. Besides this, administrations have to restructure themselves due to financial, organisational or strategic reasons.

When using public services a huge effort is often needed just to identify the right contact person. A lot of approaches and initiatives exist today to simplify access to administration. One outstanding initiative in Europe is the European Services Directive [European Parliament and the Council, 2006]. It currently confronts public institutions with various challenges in the field of electronic government. Setting up administration consultants as points of single contact (PSC) for all administrative tasks requires a great amount of customising existing systems. Such points of single contact support the whole life cycle of businesses in the European Union from their establishment until closing. [Von Lucke, J.; Eckert, K.-P.; Breitenstrom, C. (2008)]

These PSC need an extensive knowledge of the structure of the public sector. They need information about public services as well as public administrations and institutions. The determination of legally compliant responsibilities becomes an elementary task. Especially in federal structures the automatic identification of responsibilities turns into a main challenge.

The design of Core Directories provides an opportunity for making information seamlessly accessible in a structured way as well as reusable in different contexts. The combination of four directories allows responsibility finders, one-stop shop approaches or community helplines to determine responsibilities that are legally compliant and distinct.

This document addresses government officials, project managers, software architects, technical consultants and readers interested in standardisation, interoperability and infrastructures.

Objectives

The aim of this document is to present the concept of Core Directories. They can make an important contribution to increasing the effectiveness of public sector processes. When applied as an infrastructural component they provide an interdisciplinary usage of information so they can be reused in different contexts. This increases the quality of information and avoids redundancies.

Additionally, a data interoperability standard provides cross border access to information and allows decentralised maintenance and editing. Hence, important aspects of interoperability and standardisation for e-Government applications will be described. The intention is to understand the process of standardisation as well as the chances and problems that come with it.

The need and usability of Core Directories will be demonstrated with an example. For this purpose, the e-Government application responsibility finder will be introduced. This application uses information from the Core Directories and determines responsibilities that are legally compliant.

Document Structure

This document consists of three parts. The first one covers the basics of interoperability and standardisation. Special attention is paid to the German standardisation for the public sector. This part also focuses on requirements and characteristics of interdisciplinary standards.

The second part describes the concept of Core Directories and their necessity as a central infrastructural component. A generic approach to the design of such Core Directories will be illustrated as well as some important challenges that have to be met during the conceptual stage such as global unique identifiers.

Finally, the third part of this document explains an example application that analyses information from these Core Directories and determines responsibilities. It explains the concept and definition of a data interoperability standard for such directory based responsibility finders. Furthermore, the development of a prototype based on this concept will be shown.

INTEROPERABILITY STANDARDISATION FOR E-GOVERNMENT

Germany and the European Union are good examples of the need for interoperability in e-Government. There are numerous stakeholders, operators, concepts, conditions and regulations as well as legal, social, political, economic and cultural aspects to consider. The results are diversity, complexity and heterogeneity. Moreover, the economies and societies are increasing their mobility and flexibility. These facets can only be handled by organising and structuring. The hierarchy is an established solution for the top-down organisation. Today it has to be added by process and branch oriented networks. To handle the complex systems, different local and functional nodes in the networks have to communicate. Interoperability is the idea of connecting the communication partners in their heterogeneous architecture. [Princeton University Wordnet (2006); IEEE (1990)]

Communication always needs an arranged framework including language used, codes and also semantic markers. To be efficient it is useful to define standards, especially for the exchange of huge amounts of data. Standardisation itself is a long-term collective work and needs to be agreed upon, accepted and used by the majority. With standardisation it is possible to be more complex, establish minimum needs, reduce costs and accelerate work.

Administration needs standards such as this for three reasons: to communicate with businesses (A2B), citizens (A2C) and other government agencies (A2A). Several interoperability standards have been defined in different countries and branches. But in the majority of cases there is no interdisciplinary or cross border concept. Therefore the European Union initiated the Interoperable Delivery of European e-Government Services to public Administrations, Businesses and Citizens (IDABC). They developed the European Interoperability Framework (EIF). Several European countries adopted this framework for their national approaches and established catalogues of applicable standards like the UK, Germany or Greece. [IDABC EIF (2004); UK-GOVTALK (2009); SAGA (2009); Charalabidis Y., Lampathaki F., Askounis D., Stassis A. (2007); Papadakis A., Rantos K, Stasis A. (2008)]

EIF describes recommendations and guidelines for e-Government services. This includes aspects like accessibility, multilingualism, security, privacy, subsidiarity and openness. IDABC defines five levels of interoperability: technical, semantic, organisational, legal interoperability and political context. The technical view is responsible for syntax and transport with the purpose of connecting systems and services. Semantic has to ensure the precise meaning of the exchanged information. Process and coordination of the collaborating administrations belong to organisation. Moreover the cooperating partners need legislative alignment and a compatible vision. This document on Core Directories marks all levels, but focuses on semantic issues. [IDABC EIF (2004); Parasie N., Veit D. (2008)]

GERMAN XÖV-UN/CEFACT

The German administration have organised a national strategy pursued by the federal, state and municipal governments called Germany-Online [Germany Online (2009)]. Its objective is modernisation through innovation, efficiency, technology, integration and communication. The project is coordinated and controlled by business domain specific groups and a centralised coordination effort. They inform a ministerial conference and the group of state secretaries to legitimise the project work for administration. The project working groups have concentrated on relevant projects: infrastructure, standardisation and the four main current business domain projects; motor vehicle, civil status, civil registration and the European Services Directive. Other projects like portals and the responsibility finder support the main projects. The infrastructure group is concerned with the upgrade of networks and governance models for communication infrastructure, technology and security. The semantic aspects are handled by a standardisation group. They are developing basic and business components, semantic models and establishing best practices.

Under the name of XML in the public administration (XÖV) [Germany Online Standardisation (2009)] the group establishes the XML based standards for efficient data exchange and seamless processes. Some projects are, such as the exchange format for the civil registration (XMeld), are well known and widely-used. Moreover, a framework, several guidelines and a repository have been published. The coordination and the XÖV-projects are also working on internationalisation, but the actual key topics are the business domain specific exchange standards. Currently there are some activities on cross domain projects like the responsibility finder, the European Services Directive and the public administration service phone number.

The XÖV components are based on United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) [UNECE (2009)] and additional World Wide Web Consortium (W3C) [W3C (2004)] data types. Core components like name, address or communication are developed from this base. The business domain specific projects create their specific business components with the use of core components. Internal and external codelists are added for classified attributes. The customisation and difference in the usage of the core components increases with a rise number of projects. Therefore cross business domain projects and coordination with the creation of ontologies becomes necessary. This document and the other activities of the research group are trying to establish an easy way to use Core Directories as a semantic infrastructure for different applications and projects.

The development of the components and directories takes the following steps: first the analysis of existing technologies and systems with their concepts and models and the evaluation of needed components and codelists, then the modelling of the new or updated components and codelists using Unified Modelling Language (UML), tools, generators and workshops and lastly the regular standardisation process within XÖV legitimation. The process is iterative and partially supported by XÖV coordination. It currently offers a repository and tool for scheme generation and documentation. Special attention is currently required for the legitimation, communication and coordination with other projects. Therefore, XÖV operates an organisational framework with conferences and managing groups. The technical element with transport and security of data exchange is centrally coordinated by the Online Service Computer Interface (OSCI) group; however this is not in the focus of this document.

Interdisciplinary Standards

On the one hand standards are developed for business topics. On the other hand infrastructure defines possible technologies and their use. A sophisticated and flexible concept is needed for an efficient system landscape and for the combination of business and technology topics. Therefore, service oriented architecture (SOA) and service bus ideas can serve as a basis. SOA offers reuse as well as modular development. Services can be connected to the organisational bus in a flexible manner. Moreover, interfaces and exchange formats become more important, especially when the range of the service bus is expanded to other organisations. This is essential for an integrated e-Government infrastructure. [Von Lucke, J.; Eckert, K.-P.; Breitenstrom, C. (2008)]

Alongside the technical infrastructure, controlling information and directories are needed. An example is the user directory of an organisational system for login functionality and personal information about the user. If this example is expanded across the border of the organisation, basic information on them will be needed. Many projects define this basic information on their own. This is not particularly useful. Core Directories capsulate some of the information and other services or applications can reuse them. Furthermore, if such directories are offered by an authority or trusted organisation they are reliable. Availability and quality can be defined in service levels and the corresponding agreements.

The Core Directories have to be designed in an easy and flexible way. This supports usability, the ability to integrate, openness and multilingual implementation. Simple services can use and combine the Core Directories for functions like responsibility finding or organisational charts. Combining more and more interdisciplinary components makes complex functionality possible. The business domain specific services can then concentrate on their specific functions.

Cross border topics and the use of flexible and simple components as modular elements in a complex topic are important. Therefore, the European Union initiated several programs like the Information and Communication Technologies Policy Support Programme with a large scale pilot including simple procedures online for cross border services (SPOCS). Topics include interoperable delivery, electronic safes, exchange and directories. This makes it possible to realise the first parts of the described interdisciplinary, cross border and multilingual infrastructure. [European Commission (2009)]

Ontologies

Cross border activities have to handle the different cultural, social, political and legal systems. Moreover, federal systems also have to handle these aspects within the borders. This complexity has to be added by the interdisciplinary views on the exchange and directories. A key challenge to communication is speaking about the same topic and having a common shared precise meaning of it. Semantic models need to be defined for this purpose. Data exchange is just the transfer of data, but administration needs communication of information and knowledge. It is only possible to communicate efficiently with descriptions, links and impacts of the data packages and attributes. Therefore, the exchange format has to be enlarged by the above mentioned extensions. Ontologies support linkage and semantic declaration. Nevertheless ontologies are not part of most exchange standardisation projects as they define limits and constraints for it. [SEMIC.EU (2008)]

Accordingly, starting an interdisciplinary project like Core Directories means thinking of possible semantics and ontologies in an international context. This leads, for example, to the design of international usable identifiers and the limitation of specific structured codes. The design needs to be generic, scaleable and flexible. The following projects on the operation and optimisation of the exchange standard have to analyse the differences and to design the structures, codelists and ontologies.

CORE DIRECTORIES FOR E-GOVERNMENT PROCESSES

A directory is a structured collection of information which acts as a point of entry [Von Lucke, J. (2008)]. The concept of directories is well known and used in databases or file systems. In several countries different directory based approaches already exist. Actually they are concentrating on national requirements. From the beginning the concept of Core Directories considers international issues. Therefore a global addressing and multilingual concept is needed.

Directories that contain general interdisciplinary information are named as Core Directories here. In the domain of e-Government these Core Directories hold information on organisations, public services or areas, for example. This document shows a generic approach to the design of Core Directories.

Need for Core Directories

From their characteristic as interdisciplinary usable directories they should be seen as a central infrastructure component. This allows them to reuse the information in multiple applications. One example is a responsibility finder which will be shown later in this document.

A major advantage of this concept is the one-time collection of information where it arises. This avoids redundancy, increases the quality of information and accelerates the development process of new e-Government applications and services.

The structured way of storing information makes it machine readable. It can be used and integrated into automatic processes.

Generic Approach to Design Core Directories

Regarding the design of the directories it is clear that they are all built using the same principle. A generic approach to the design of Core Directories can be deduced from this. Firstly, this makes it easier to understand each directory and secondly, this approach provides better quality control during the conception stage. This preferred way assures that at least all important components are covered.

The generic data model could be used as a blueprint for the design of new Core Directories as shown in figure 1.

Thus, every directory consists of the following components.

Identification

Every object that is stored in a directory needs unique identifiers. In the majority of cases these identifiers exist. But they are more often than not used in a special context or have only regional validity. Globally unique identifiers will be needed for objects that are used in an interdisciplinary manner or across regional borders. The research group created a concept called coordinated distributed allocation of keys, based on common ideas. This will be described later in this document.
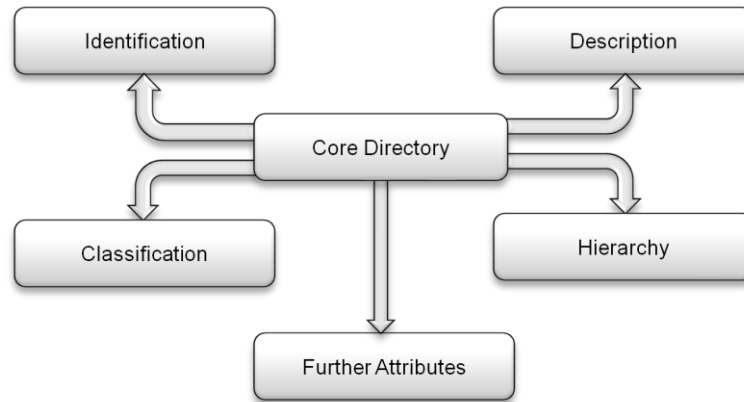
Figure 1. Layout of a Core Directory

Description

Every object can be described with names, short and long descriptions, abbreviations and alternative representations, e.g. logos or images. This could be done in different languages.

Classification

To characterise objects they need to be classified. This will be done using codelists. Codelists are lists containing the possible properties of an object. For example the codelist gender contains the entries male, female and unknown.

Hierarchy

In many contexts an object has a correlation to other objects. These could be superior or subsidiary objects, synonyms or analogous objects. For example, the area Germany is a subsidiary region of the area Europe.

Further Attributes

Further attributes are all attributes that could not be classified in one of the other categories. They could consist of additional information like such as geographic coordinates, for example.

The Key Challenge

Creating interdisciplinary Core Directories involves meeting some challenges. The definition of globally unique keys is necessary in order to identify similar objects and make them interoperable and comparable with each other. As such keys generally do not exist; a concept has to be created to determine how these keys should look.

Generally there are two alternatives. The first one is to define globally unique identifiers at a central point. For this purpose, a coordinating centre is needed that assigns unique keys. The effort for such a coordinating centre is enormous. Also in federal systems the acceptance of a central institution is disputable. Thus, a solution that minimises the effort of a coordination centre and allows a decentralised definition of identifiers is needed.

Hence, a concept of coordinated distributed allocation of identifiers has been developed as it is shown in figure 2.

In this scenario multiple coordinating centres will be installed that define namespaces only. Inside a namespace all keys are unique. The identifier is a combination of the coordinating centre, the namespace and the key inside the namespace. This concept allows the continued use of existing local keys, while the requirements of globally unique keys are still fulfilled. The installation of multiple coordinating centres allows a decentralised definition of globally unique identifiers.
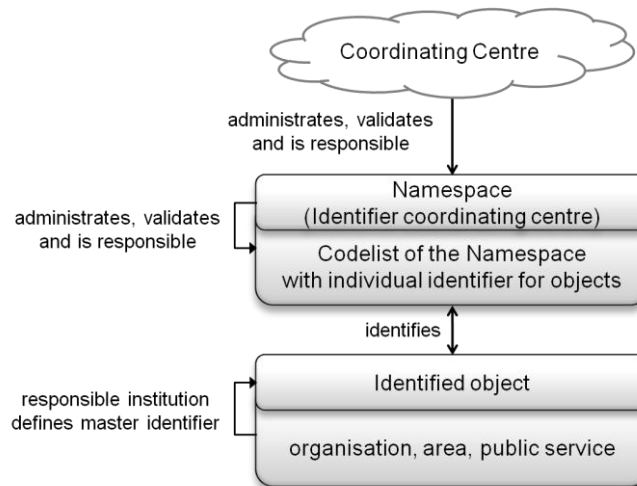
Figure 2. Concept of coordinated distributed allocation of identifiers

EXAMPLE: DIRECTORY BASED RESPONSIBILITY FINDER

A responsibility finder helps citizens, businesses and administrations to find a responsible public institution. In Germany five different approaches currently exist [Klessmann, J. and von Lucke, J. (2008)]:

- Directory based responsibility finder,

- Content management based responsibility finder,

- Wiki based responsibility finder,

- Search engine based responsibility finder,

- Central responsibility finder as a relaying service to the appropriate local responsibility finder.

A directory based responsibility finder determines spheres of responsibility with the help of carefully designed directories and queries formulated by users. For this it needs to have access to at least a public sector service directory, an organisation directory and an area directory [Klessmann, J. and von Lucke, J. (2008); von Lucke, J. (2008); Von Lucke, J.; Eckert, K.-P.; Breitenstrom, C. (2008)].

Four directories are needed to determine responsibilities that are distinct and legally compliant.

Finally, a directory of public sector services which contains all services that are offered by the public sector. It is important to distinguish between technical directories storing Web Service Description Language files (WSDL) (eService directories) and "human-oriented" directories (service catalogue) for example, that hold comprehensive information about agencies and services augmented by search functionalities, glossaries etc. An example of an eService directory is the German Administration Services Directory (DVDV). Moreover, the SPOCS project analyses among other things the combination of catalogues and eService directories. This document only covers public services meaning those in the context of service catalogues.

The second directory is a directory of organisations which holds all necessary information about an organisation (e.g. address, opening hours and forms of communication). This could also include private organisations that are responsible for public services.

The third directory is a directory of areas. This is necessary to determine regional responsibilities.

Finally, a directory of responsibilities combines the three other ones and holds information about the responsibility. It determines a responsibility for specific service in a specific region.

Additionally, an XML based interoperability standard has been worked out to facilitate a network of responsibility finders. Such a network allows cross regional access to information. The partners in this network have to agree on service levels concerning the scope, availability and usage of their content.

Advantages of a Directory Based Approach

Using a directory based approach provides several advantages. On the one hand, the structured way of storing information makes it machine-readable. This allows automatic processes to embed the functions of a responsibility finder. All information can automatically be analysed and evaluated.

On the other hand, a decentralised and distributed maintenance and editing of content is possible. The consistent way of storing information ensures their supraregional usability.

Also, the directory based approach is the only one that allows a distinct determination of responsibilities. This is an important requirement for fully automated processes. Additionally, only a structured way of storing information allows a legally compliant identification of responsibilities. Especially in the European Union this has particular importance with respect to the European Services Directive.

Developing an XML Based Interoperability Standard

In order to provide nationwide and cross border information on responsibilities it is necessary to establish communication and data exchange between different local responsibility finders. Therefore, the research group developed a recommendation for an XML based data interoperability standard based on the concept of Core Directories. This was done using the German XÖV-Framework and has been created in cooperation with stakeholders from the public sector, science and the economy. The concept has been intensively discussed and improved in several workshops. In a couple of month the concept became a matured and standardisable recommendation.

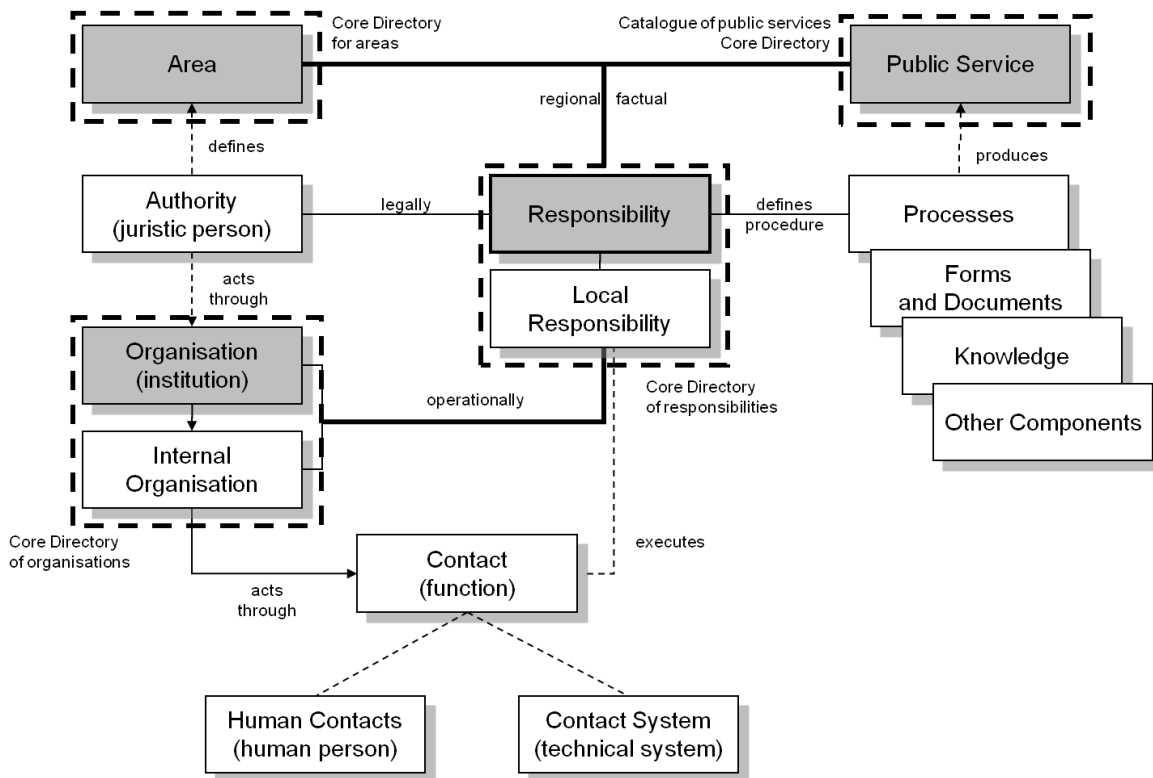Figure 3 shows the data model in its final version.

Figure 3. Data model for a directory based responsibility finder

Regarding Figure 3, responsibility consists of a combination of areas, public services and organisations. Every Core Directory contains information about descriptions of an object as well as its hierarchical relationships, identifiers and classifications.

The Core Directory of areas additionally contains geographic coordinates. That makes it possible to describe areas in as detailed a manner as necessary and furthermore to integrate them into geographic tools. An area describes the regional aspect of a responsibility.

A Core Directory for public services (also known as catalogue of public services) contains information about charges, respites or legal bases. Especially legal bases are very often needed and referenced in public administration processes. That is why it would make sense to store them in a separate Core Directory which can be accessed by different applications. Furthermore, the Core Directory for public services accommodates information about obligatory cooperation such as which documents are necessary. Public services can be part of life events. Further components like processes, forms, documents, etc. are conceptually included and partially structured. However, for the moment there exists no autonomous specification for them. Processes, documents and knowledge are very complex components which need an extensive analysis at first. Other components like charges are less complex and easier manageable. Existing projects already concern some of these further components. In Germany for example, the project XDomea [XDomea (2009)] specified a standardised structure for the interchange of documents. Existing specifications should be reused or referenced to avoid duplicity.

The Core Directory for organisations contains addresses, public hours, communication channel options and an institution's contacts. The internal organisation of an institution can be represented through hierarchy relationships. Contacts are again differentiated between human contacts and contact systems. Contact systems are electronic services provided by an organisation. Human contacts are the employees themselves.

Finally, a Core Directory for responsibilities merges the information. In order to get more detailed information it is possible to store local responsibilities. They represent local characteristics like organising the internal division of responsibilities.

An authority is a juristic person. They define political subdivisions and act through organisations. An authority is a legal construct that accounts a responsibility in law.

Using Prototypes to Validate the Data Model

From the beginning, the research group emphasised the usability and practicability of the developed data model. Therefore, a prototype was developed at the same time as the concept was created. It meets different objectives. First of all, this procedure shall prove the feasibility of the concept. Secondly, the prototype is needed to validate the practicability of the directory structure and with it the suitability of the data model. Furthermore, the prototype will be used to realise interoperability scenarios. Realising the exchange of data with existing responsibility finders is one of the crucial points in the research project. A data exchange format based on the data model could be used to set-up a network of directory based responsibility finders. The intention is to boost the quality of information. A network of directory based responsibility finders provide nationwide and cross border information. Also the use of Core Directories allows consistent long-term structures to be established. Additionally, the prototype can be used as a master or a test system for third party suppliers.
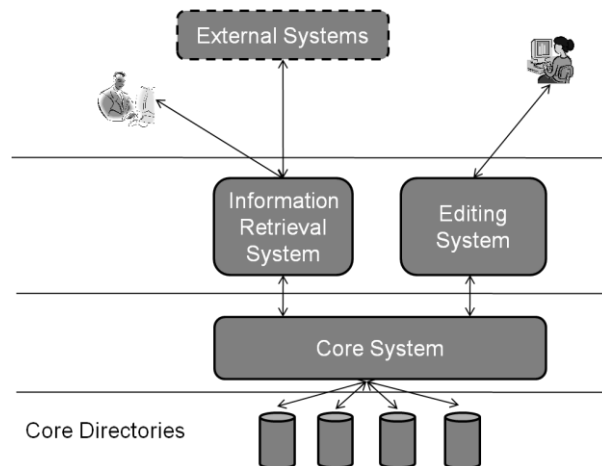
Figure 4 shows the prototype architecture.

Figure 4. Prototype architecture

The prototype consists of a core system which provides elementary functions to access the four directories for public services, organisations, areas and responsibilities. These functions will be used by an information retrieval system as well as an editing system. This approach allows the easy creation of further information retrieval or editing systems without implementing core functionalities again. Based on the core system a mobile tool to determine responsibilities can be developed with minimal effort. In order to get interoperable a web service interface allows communication with external systems.

The prototype is used in different scenarios, e.g. in demonstrators for the realisation of a PSC in the context of the European Services Directive, as well as in one-stop shop approaches developed for the public sector.

SUMMARY AND CONCLUSION

The concept of Core Directories has great potential. The directory based approach provides an opportunity to address the complex structures and processes inside the public sector in an easy and more efficient way. The structured way of storing information allows linkage with automatic processes. A consistent use of this principle might set-up the basis for an overall system of information management. This again, allows a lot of new e-Government applications.

The persistent use of Core Directories as an infrastructural component permits an interdisciplinary access to information. Furthermore, the creation of a data interoperability standard for the directories affords a cross regional or even a cross national use of information. The most important advantage is the one-time collection of information where it arises. This improves quality, lowers the amount of time needed for collecting information and reduces redundancies.

The biggest challenge when sharing information is to find common semantics and ontologies. Especially the latter must be defined with care and accuracy. The success of a standard depends on its usage and acceptance.

The research group will address these challenges and open questions, especially in the context of ontologies in further research projects.

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