Developing Generic Shared Services for e-Government

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Abstract: Currently e-Government initiatives have a highly fragmented nature and are hardly coordinated. An architectural approach aimed at reusing components as shared services can support government agencies in the implementation of their e-Government initiatives. In this paper we describe research aimed at identifying and prioritising the importance of generic services that can be shared among public agencies. Generic shared services are identified and prioritised by technical experts and government representatives using a group support system session. This has resulted in an action plan to implement the services and use them as part of future e-Government projects.

Keywords: Architecture, group support system, e-Government, shared services, data centres, shared service centre

1. Introduction

The Internet offers a tremendous opportunity for governments to better deliver its services and interact with its many constituents, citizens, businesses and other government organizations (Chen 2002). Politicians pay an overwhelming attention to more customer-oriented services provisions. The current economic climate is, however, forcing government agencies to focus on the efficient implementation and operation of their information systems. Politicians and managers of public organizations have become increasingly dissatisfied with the returns obtained from their investments in information and communication technology (ICT). Development and maintenance costs are rising too rapidly and technology seems to be changing so quickly that one single organization can hardly keep up with all the latest developments. Inevitably the costs of e-Government initiatives have become the prime concern of public management and collaboration between government agencies has become a necessity for cost-effective services provision.

The reality of today is the emergence of 'islands' of government that are frequently unable to interoperate due to fragmentation resulting from uncoordinated efforts at all levels of public administration (European Commission 2003). This shows that there is a need to coordinate joint efforts on all levels of public administration. Initiatives to address this need do not learn or only partly profit from the experiences gained in similar projects and do not reuse services that are already developed. The attention of public managers is shifting from innovation to cost efficient operations using shared service or data centres (Leganza 2003). Within the Netherlands, this has sporadically resulted in collaboration between small municipalities aimed at avoiding duplication of efforts and to establish one shared back-office. Services cannot be provided at lows cost and implemented at a local level only, as budget and expertise are limited. Small organizations cannot develop all the desired services and cannot have all kinds of expertise needed in house. By sharing services and expertise among organizations, a larger number of services can become available.

With the advent of web services technology it becomes technologically feasible to create components deployed as web services that are modular, easy to access, well described, implementation-independent and interoperable (Fremantle et al. 2002). Service-oriented paradigms are becoming more important in today's design of information systems. Once developed to support one particular business process, the service can be reused in various other business processes. Moreover, new business processes can be constructed within a shorter time frame by using the pre-developed components.

Shared services can be developed by unbundling and centralizing activities. Shared services are often bundled in independent legal entities, call shared

service centre. They are usually geographically separated from the service requester through the application of information and communication technology. A *shared service* is a generic service that is jointly developed by public agencies and can be used many times in different business processes of various government agencies. Shared services can be developed using web-services technology, however, by not means this should be considered as a prerequisite. The use of shared services requires an architectural approach through which services can be gradually incorporated in the already existing architecture. In this way investments in legacy systems can be leveraged. An architecture should provide the flexibility to include common services and functionality provided by legacy systems, which cannot be replaced easily and would otherwise restrict further development.

To date most of the research has focussed on the extend to which public agencies present information via the Internet and on the types of access necessary. The goal of this paper is to identify and prioritise the importance of generic services that can be shared among agencies. We do this by first discussing the background and thereafter discussing service-oriented architectures. In section four we present a group session aimed at identifying shared services. In the section thereafter we discuss the assessment of the shared services identified in section four. In the last section we discuss some shortcoming of the approach and further research.

2. Background

Businesses and citizens have to operate within a regulatory regime of a government that includes frequent and mandatory dealing with that government. In the Netherlands, there is no such thing as a one-stop shop for all business and citizens. Constituents have to deal with a fragmented landscape of government organizations that sometimes are even hard to locate. Public administration can be characterized by independent agencies having all kinds of heterogeneous information systems and providing various kinds of services. The government agencies are free to design their own architecture and to choose appropriate software vendors.

The current situation is such that each governmental organization has developed its own information systems rather in isolation, and that for each product or service a separate information systems exists. The information systems are often monolithic packages. No generic architecture is available that enables communication between front-office and back-office applications, between back-office applications or with systems outside the own organization. Functionality like identification and authorization can be found in each of these information systems. Functionality is not reused within one organization, let alone between organizations.

Figure 1: The fragmented field of public agencies

Within a virtual business counter the Dutch Municipalities, Taxes and Chamber of Commerce have to cooperate to offer a one stop-shop to businesses. Although the

Dutch tax organization is geographically divided in districts, this organization is uniformly automated as shown on the left side of figure 1. The services they offer are well-defined and the level of automation is high. The chamber of commerce consists of 21 autonomous organizations that hardly share any information systems as shown in the middle of figure 1. The services offered to businesses can vary per district and are often not well standardized and structured. The most striking example of the fragmented landscape can be found when looking at the Dutch municipalities as shown on the right hand of figure 1. There are about 500 municipalities each providing about 290 services to citizens. The services are well standardized and uniformly described, although municipalities might have customized the services to match the local conditions. Each municipality is free to buy or design their own information systems and in the past for information systems were used to support each product. In the worst case this could have resulted into 500 * 290 information systems. No overview exists of the systems used by the municipalities.

With the rise of the Internet most of the government agencies have initiated some kind of web-based project. The current initiatives in the Netherlands often reflect the history of the organizations and only a small portion of the high ambitions of having 70% of the services online are realized. The services provided can be positioned in the two lowest phases of Layne and Lee (2001), the catalogues and transaction phase, Overall, projects have created a web-presence containing product information, there are some downloadable forms and for a limited number of services it is possible to conduct online transactions.

Governments' history with independent agencies and their sometimes overlapping functions and objectives has resulted in a slow progress. Each agency typically has a number of legacy systems and some web-based projects that make use of different technical architectures and support different business processes. Legacy systems run the agency's key mission-critical applications and agencies have often invested a vast amount of resources to develop and maintain these systems. Some large legacy systems have been designed over years and they form the very basis of an agency. Often it is even not possible to replace operative legacy systems with a uniform solution at once. Developing new systems from scratch requires much time and money, is prone to failure and does not leverage investments in legacy systems. Consequently, it is critical to incorporate legacy systems in future architectures. Incorporating the existing applications as information or functional components can leverage investments in legacy systems.

The existence of isolated, highly fragmented and unrelated computerized applications that overlap in function and content within one public organization has resulted in 'isolated islands of technology' while information systems were viewed as being internal to the public organizations. The ICT-architecture has been vertically organized around agencies, and departments within the agencies, and does not share or hardly shares any common horizontal functionality. The public administration consists of stove piped organizations with no history of working together. There is no such thing as a department of architecture department that is responsibility for all systems under development. The role of central level initiatives has been a minor one, whereas the information managers within agencies have guided development.

By sharing administrative processes across agencies it is expected that a significant increase in efficiency and enhanced services delivery can be created. The ministry for Government Reform and Kingdom Relations of the Netherlands aim is to reduce the citizens' and business' bureaucratic obligations and burdens by 25% (Graaf 2003). That reduction will largely be brought about through reducing unnecessary regulation and by far better use of ICT. A first step is the creation of a service-oriented architecture providing a set of basic services that can be used by agencies in their business processes.

3. Service-oriented architecture

The term architecture has become increasingly over-used and denotes a wide variety of uses (Perks and Beveridge 2003). From a structural approach coordination theory can guide the

definition of architecture. Coordination is often defined as the management of dependencies between activities (Malone and Crowston 1994). From a coordination point of view, *architecture* is the description of a set of components and the relationships between them on various levels including business, process, functionality, application and technical infrastructure level (Armour et al. 1999). From a rational perspective the design of an architecture is usually seen as a set of trade-offs between available resources, e.g. money, personnel, time, and functional and technical requirements related to the architecture such as scalability, capacity response time, security and availability (Koushik and Joodi 2000). An architecture contains architecture description languages, common architectural patterns, trade-offs methods, service-oriented or component-based frameworks and technologies. An example is the IEEE 1471; a standard describing a framework for architecting.

From a more business process reengineering view an architecture aims to bridge the gap between business and ICT departments and between conceptual and implementation design by defining a systems composition from various viewpoints. In this conception architecture is not only a technical artefact but also a phenomenon having strong organizational connotations (Perks and Beveridge 2003). An architecture typically establishes a shared vision. It often incorporates a blueprint of the existing and desired design and an overall plan regarding the realization of parts. Stakeholders can use architectures to make decisions concerning system development strategies.

Architecture is an abstraction of the systems under study and can guide the development of these systems. A repository of experiences, components and services can support this process. A goal of architecture is often to reuse experiences and resources like services and components. The use of an architecture can have the following advantages.

1. Decreasing the complexity of the systems. A complex system can be analyzed by looking at the parts having a lower complexity than the whole system;
2. Increasing the reusability of and the connectivity between parts. Both experiences as well as components can be reused. When a service or component is developed by one agency other agencies can reuse this component or service;
3. Reducing errors and mistakes. As experiences with various architectures are stored, making the same mistakes over and over again can be avoided.

Currently, pleas have been made for more open, flexible architectures constructed of relatively small components that can be accessed using web services technology (Fan et al. 2000). Service-oriented architectures can leverage investments in legacy systems running the enterprise's key business-critical applications (Arsanjani 2002). The concept of modularity in service-oriented architectures has thje following three advantages (Baldwin and Clark 2000).

1. It increases the range of manageable complexity;
2. It allows different parts of a large system to be worked on concurrently;
3. It accommodates uncertainty.

The principle of modularity can be applied to the various architecture levels. For our purposes we focus on a set of services provided by software components on the application level.

Services can be shared by the various government agencies to avoid the development of similar functionality over and over again. Functionally of one system can be shared and provided to all the other agencies involved. Shared services have large potential for a variety of other public and commercial applications. Shared use can make IT infrastructure management and application exploitation and use more efficient. Sharing of services introduces new opportunities for, especially small, government organizations to (1) outsource non-core activities, (2) dimension the capacity of their ICT infrastructures efficiently and (3) to access and use ICT resources currently out-of-reach.

Services can either be coarse- or fine-grained and be used at different levels of information systems development. Fine-grained services are small-sized capturing source-code. Coarse-grained components are large encapsulating complete business

functions or complex systems. Current methods address services usually in a fine-grained connotation and provide little or no support for mapping business architectures to component-based software architectures (Arsanjani 2002). The services we are interested are coarse-grained and will be derived using the knowledge of ICT-experts and government representatives in the following sections.

4. Identifying shared services

One of the main issues in designing service-oriented architectures is the identification of services, including granularity and boundary definition. This is a highly intuitive process, which can have ambiguous outcomes and needs the input of expertise in the field of (1) technology, to ensure that services are technical viable and can be implemented, (2) business process, to ensure that generic services that are identified can be used in various business processes and (3) architecture, to ensure that the new services can be integrated in the existing architecture. This process requires the involvement of people that have the knowledge to take these factors into account. Apart from mobilizing the tactical knowledge of people in an effective way, the involvement of government representatives also creates the necessary commitment for making sure that the shared services will be used in new development projects. The execution of plans often depends on the support of central and regional public organizations.

The process of identifying and selecting services can be supported using a group support system (GSS). A GSS is suitable to deal with complex, unstructured problems and actors having incompatible interests, diverging areas of knowledge and multiple backgrounds (Herik en Vreede 2000). GSSs can be used to provide support during meetings in which groups share, structure, and evaluate ideas. Participants in a GSS meeting contribute by inputting their ideas, reactions or votes to PCs that are connected through a network. GSSs are used to send new ideas to all participants, to provide visualization of data, to calculate vote results, and so on. GSSs are aimed at making group meetings and group decision-making more effective.

A *Group Support System* is a computer based information system, which combines computing, communication and decision support technologies to facilitative collaborative work (DeSanctis and Gallupe 1987). The GSS provides parallel communication, anonymity, and group memory. GSS enhances participation of users as they can contribute freely without fear of evaluation of conformance pressure (Davison 2000). The advantage of using a GSS is that the employees within an organization can anonymously provide their own opinions about the matching mechanisms while having less or no pressure to conform to the organizations' policy and all comments are stored. In the GSS at Delft University of Technology all participants have a computer terminal at their disposal and there is also a large screen to communicate and discuss ideas and results as schematically shown in figure 2.

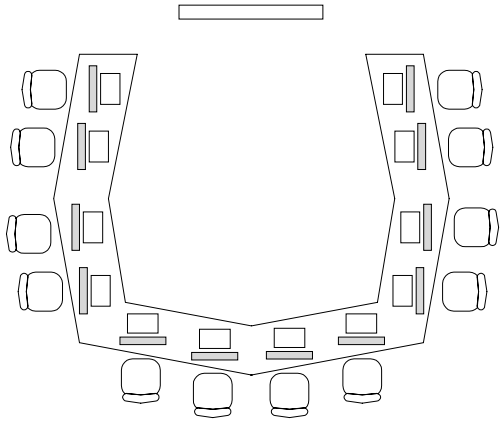

Figure 2: Group session overview

Technical experts, information architects and business process experts from various layers of government participated in a GSS to identify generic services and to prioritize these services in order to come to an implementation plan. The session participants were coming from all levels of public administration including ministries, provinces and municipalities. In the first step of the session, a large number of ideas about possible services was generated. During the second step these services were elaborated and described in more detail. This long list was organized and reduced to the following 10 services having a generic nature and the potential to become a shared service.

1. Basic communication service: This service is responsible for ensuring a secure and reliable transport of data between government agencies, businesses and citizens;

2. Message exchange (generic) service: This service uses the basic communication facilities to transport and log messages from one system to another system. Message logging is necessary to ensure tracing of messages in case of indistinctness or dispute between organizations;
3. Identification and authentication service: Both the transmitting and the receiving party should be identified and authenticated. Identification can be implemented on various levels; on the simplest level by using a user name and password, and on more complicated levels by advanced technology like a chip cards or biometrical methods;
4. Directory (yellow pages) service: This directory service consists of references to the location of source data. When somebody searches the chamber of commerce information, this directory refers to information systems of the chamber of commerce having the requested information available;
5. Authentic registration: This principle of authentic registration states the organization who gathers the information at the sources, is responsible for keeping information up-to-date and for distributing the information to other organizations;
6. Channel integration: This facility is aimed at providing a uniform and consistent service provisioning among various channels. Information about the interaction in one channel is shared and used with the other channels;
7. Library service: Electronic documents are often not stored, however, storage is needed to ensure longevity and accessibility. This service aims at uniformly storing and making documents accessible in such a way that long-lasting availability and authentication of the document source is ensured;
8. Message exchange (specific) service: Aims at the syntactically or semantically integration of messages within particular domains like taxes or social welfare;
9. Authorization service: This service should provide access to only authorized persons;
10. Business process integration: A set of services aimed at the coordination of processes across various organizations. The use of this service should result in a virtual organization having one uniform face to the outside world.

The message exchange service is split up into a generic exchange function for data, like name and address information, and a domain specific exchange function for exchanging of data within a domain, like criminal records and details of permits. This is a typical example showing that the determination of the granularity of a service is a struggle, in this case between the economies of scale of a generic solution versus the customisation and applicably of individual solutions.

5. Assessing shared services

Shared services should help organizations to solve their own specific integration problems and provide economies of scale by sharing the standardized services among many participants. The session participants were asked to rank the shared services based on five criteria. The criteria were ranked on a three points scale, ranging from -1 to +1 and denoted as -, 0 and +. The results of this voting exercise per criteria and the total score are shown in table 2.

Table 2: Assessment of shared services

	Reusability	**Technological urgency**	**Organizational impact**	**Technological impact**	**Availability Technology**	**Total score**
Basic communication	+	+	+	+	+	5
Message exchange (generic)	+	0	0	0	+	3.5
Identification and authentication	+	0	0	0	+	3.5
Directory (yellow pages)	+	-	0	0	+	3

	Reusability	Technological urgency	Organizational impact	Technological impact	Availability Technology	Total score
Authentic Registration	+	-	0	0	0	2.5
Channel integration	+	-	-	0	+	2.5
Libraries	+	-	0	-	0	2
Message exchange (specific)	0	-	-	-	+	1.5
Authorization	+	-	-	-	0	1.5
Business process integration	0	-	-	-	0	1

The first criterion deals with the number of government agencies that might potentially use the service. Technological urgency is about the necessity of having this service to execute the other services. Basic communication is necessary for all the other services, and message exchange and identification and authentication services are necessary for operating the other 7 services. After ranking the services an in-depth discussion about the arguments for the ranking took place. The organizational impact criterion is about the efforts necessary for a government agency to make use of this service. For example channel integration requires a long-term negotiation, standardization and business engineering process. Technological impact deals with the efforts necessary to integrate the service into the existing architecture of government agencies, i.e. how much work is required to change the information systems and integrate the service. The last criterion, availability of technology, is about the readiness of the technology to implement the service and the maturity and associated risks of the technology.

As a follow up of this session, an action plan has been written for the implementation of the generic, shared services (Dool at al. 2003). This action plan introduces a shared service centre for the provisioning and maintenance of shared services. A shared service center is a kind of outsourcing arrangement to one centralized party, where all parties are operating within or belong to one large private or public organization. The introduction of a SSC is a critical decision on a strategic level. It implies a long-term decision between the SSC and clients with considerable complexity and risks. Further activities are aimed at developing a complete architecture.

6. Conclusions and further research

There is no over-arching framework, or reference architecture available guiding e-Government initiatives in The Netherlands. Each new initiative does not learn from or only partly profits from the services that are already developed in other projects. The use of shared services requires an architectural approach through which services can be gradually incorporated in the already existing architecture.

The identification of shared services is a highly intuitive process, which might yield ambiguous outcomes. In this research the tactical knowledge of people is mobilized by using a group support system. Technical experts, information architects and business process experts from various layers of government participated in a GSS to identify generic services and to prioritize these services in order to come to an action plan. The participants identified ten basic services that can be shared among public agencies and assessed them on a number of criteria. These services are the basis of a generic service-oriented architecture for the Dutch government.

The identification and implementation of shared services that can be used by many agencies is only a first, small step on the road towards an integrated government. The transition to e-Government offers many opportunities but also major challenges. Well-designed and smoothly functioning services can enable e-Government. Future research should support the development of an architecture consisting of generic *and* specific services. This architecture should be assessed regularly due to architectural drift.

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