E–Government Interoperability

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INTRODUCTION

The rise of the Internet has structurally changed not only the business area, but also governments and administrative authorities. The usage of information and communication technologies (ICT) influenced the organizational behavior and the daily work of public administrations. In parallel, a new management paradigm has grown in governments and administrations: The New Public Management (NPM) aims to a new orientation on the impact of public activities and on the benefit of public services for its customers, namely citizens and businesses (Barzelay, 2001). It puts the administration and its activities in the triangular relationship between politics, administration and citizens (Osborne & Gaebler, 1992). Within this "ecosphere", decentralized steering models (Reichard, 2002) as well as market mechanisms are introduced and emphasized (Pollitt & Bouckaert, 2000).

Both factors, ICT and NPM, have resulted in the electronic (E-) Government. E-Government is the support of public service processes through ICT. It affects all areas of governmental work and acting. For this article, we focus on the production and distribution of public services (Reinermann, 2002). However, even in this limited area, the implementations vary from case to case. In order to rate the effects and benefits of E-Government, that strongly depend on the interaction abilities already usable, a measurement is needed. Currently, the realization degree indicator is commonly used for this purpose. Table 1 summarizes the commonly used categories of realization steps for E-Government:

BACKGROUND

Integration requires a seamless and customer-oriented integration of public services across organizational borders and through different application systems (Wimmer & Traunmueller, 2002). This results in the need for public administrations to open themselves towards other authorities as well as to their customers, namely citizens and businesses and to actively collaborate with them. The area E-Government Interoperability covers strategies, organizational concepts and information technology to link administrative business processes and to interconnect application systems.

Conceptual and technical E-Government Interoperability infrastructures are considered as prerequisite for the creation of advanced public services and the distributed processing of multi-agency business processes (Werth & Zangl, 2004). Conceptual solutions mainly cover Enterprise Architectures and reference models for specific use in public authorities. In this context, Enterprise Architectures are representing the public authority in terms of organisation and operations (e.g. processes, behaviour, activities, information, decision and object flows, resources and organisation units, system infrastructure and architectures), in order to reach some finalities. Finalities here indicate the creation of explicit facts and knowledge that add value to the enterprise or can be shared by business applications and users for the sake of improving the performance of the organization (Interop, 2003). Especially, operations require the management of the public services as the external view (Glassee, Van Engers, & Jacobs, 2003) and of the business processes as the internal implementation (Seel, Guengoez & Thomas, 2004). Furthermore, reference process models represent the unifying abstraction of a variety of process models in different authorities. They can be used in multiple administrative scenarios to support the realization of services described by these reference models (Martin, Seel, Kaffai & Thomas, 2004).

However, these concepts also demand on capable and effective interoperational infrastructures for public administrations to operate (Fernandez, 2002). Furthermore, they foster "the transition from the current paradigm of highly fragmented, isolated applications and islands of functionality to a situation promoting consolidation to an integrated, collaborative and secure architecture" (Werth, 2003). Most approaches specify components for different tasks within the infrastructures, usually "definition/configuration", "discovery", "connection", "processing" and "monitoring/administration". First approaches base on workflow management architectures (Reinermann, 1997). The resulting technical infrastructures cover most or all of those components and organize them either in a centralistic or distributed way. In centralistic architectures, there is only one instance of a component that controls the activities. Distributed environments miss this single control instance in favour of self-organizing and –controlling techniques. Both approaches may be adequate for integration scenarios depending on the structure of the orga-

Table 1. Stage-wise realization model of e-government

I. *Information (enhanced)* – This first stage is the easiest to implement. It comprises electronic availability and provision of thematically structured information. This represents an unidirectional communication relationship between public administrations and their customers. A website is a typical example for this stage.

II. *Communication (interactive)* – extends the information stage by a feedback channel. Hence a bidirectional communication is established. Common technologies are e-mail, chats and forums.

III. *Transaction (transactional)* – The transaction stage describes the online availability of public services, i.e. it becomes possible for a citizen to trigger online a legally binding public service. It can also include electronic payment and all relevant phases of a transaction.

IV. *Integration (networked)* – This highest stage of realization, only rarely used, describes the integration of the customer himself into public administration processes as well as the collaboration of public services. The customer can influence the execution of public services without having the knowledge about the way of working and processing of the respective services. At this stage, full electronic support is required, covering all public services and the according processes.

The attributes in brackets state the presence measurement expressions of the United Nations (cf. United Nations, 2003).

nizational system to be integrated. In centralistic environments, (e.g. hierarchical ordered authorities) centralistic technical architectures are mainly suitable, whereas in decentralized organizational networks (e.g. in federative states), distributed architectures will fit the best.

A suitable approach to decompose E-Government Interoperability is given by three layers, as shown in Table 2.

APPROACHES AND TECHNOLOGIES

Currently, two major research streams address this topic from different directions and with diverging intentions:

The *Front-end interoperability* approach is user-centric and tries to realize an easy and direct access to exposed public services. It focuses on a consistent presentation and thematic structuring, based on the interests of the citizen. Mainly the attempt is to group those public services that are assumed relevant for a specific situation of a citizen's life (schooling, full age, building a house, retirement, etc.) or a business event (founding, location, economic simulation, etc) (Reinermann, 2002). This concept is called "live event oriented" for citizens resp. and "business episode oriented" for companies (Vintar & Lebel, 2002). To realize this concept, Internet-based portal technologies access services located at different authorities, without regarding institutional boundaries (Klischewski, 2001). Such integrated portals result in one-stop-shop E-Government solutions. They enable the triggering of single services or groups of them via one interaction step using the normal web browser (Tambouris, 2001).

The scope of the *Back-end interoperability* approach is the cross-organizational business process. The intension is to link business processes and their executing application systems. Therefore, it corresponds to the area of Enterprise Application Integration (Linthicum, 1999). On the backend side of service processing, adequate public services have to be identified, discovered and accessed. Implementing infrastructures mostly rely on middleware (Pasic, Diez & Espinosa, 2002) or agent tecnnologies (Carvalho, Moreira & Sa-Soares, 2003). Middleware is mostly used for data replication, transformation and transportation. Thus, single messages representing data items are passing through the applications following a specific rule set. This technology realizes simple data integration. Using agent technologies, the integration can be augmented to the functional level. Here, autonomous software components (agents) try to form a predefined behavior by calling functions (methods) of other agents. Emerging developments on Service-Oriented Architectures (SOA) and Web Services foster a new dimension of back-end interoperability, due to open standards and interfaces. By exposing encapsulated functionalities by self-describing Web Services, a public authority is enabled to use business functionalities that are processed by other authorities. Hence, it becomes