A Semantic-Enabled Middleware for Citizen-Centric E-Government Services

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ABSTRACT

Research efforts toward effective e-Government infrastructures have gained momentum, motivated mainly by increasing demands to improve citizen participation in public processes, promote social e-Inclusion, and reduce bureaucracy. One of the biggest challenges is providing effective techniques to handle the inherent heterogeneity of the systems and processes involved, making them interoperable. This paper presents a semantically enriched middleware for citizen-oriented e-Government services (CoGPlat), which facilitates the development and operation of new e-Government applications with higher levels of dynamism. It introduces the use of composition techniques based on semantic descriptions and ontologies. Requirements like autonomy, privacy and traceability are handled by applying policies that govern the interactions among services.

Keywords: CoGPlat, Composition Techniques, e-Government, Interoperable Systems, Ontologies, Public Processes

INTRODUCTION

The demands for the creation of mechanisms to increase the transparency of public administration processes have dramatically increased over the recent years (Watson & Mundy, 2001). They represent a requirement for every government identified since the origins of the modern democracies: Thomas Jefferson once wrote that “whenever the people are well-informed, they can be trusted with their own government” (Jefferson, 1789). According to a UN (United Nations) recent report, the “strategic and meaningful application of Information and Communication Technologies for the purpose of improving the efficiency, transparency, accountability and accessibility of government is possible if the ultimate objective of e-government is to promote social inclusion” (Ahmed, 2006).

In order to fulfill these demands some important technical challenges must be handled. The first one is to promote interoperability, to face the heterogeneity of the information systems throughout the government entities and their partners. A higher level coordination mechanism to mediate and facilitate the interactions among the administrative processes may be required when providing composite inter-
organizational citizen-centric services. Reusability, openness, compliance to the de-facto standards and scalability characteristics are also fundamental aspects that all e-Government platforms should seriously consider. If on one hand the adoption of SOA-based (Service-Oriented Architecture) approaches appears as a solution to the interoperability demands, on the other it introduces further challenges such as how to successfully describe the services, how to compose them as dynamically as possible and also how to mediate (or not) their interactions. Additional concerns include privacy, trust, autonomy and adequate identity management.

These challenges are similar – but go beyond – the ones found in the domain of enterprise applications, especially with respect to transparency, flexibility and interoperability requirements. According to Davies et al. (2007) these differences can be classified into the following categories: regulatory aspects such as privacy protection, eligibility, identity management, anonymity, accessibility, adoption of standards and fast reaction to changes in the legislation; and organizational aspects such as intra- and inter-government collaboration demands, administrative services similarities throughout different agencies (reuse is possible and desirable) and knowledge management (legal, financial etc.).

The specific research objectives of this paper are: a) discuss mechanisms to improve the quality, efficiency and reach of public administration services by promoting technical and semantic interoperability; b) propose techniques to increase the transparency and dynamism of the government administrative processes; c) facilitate citizen participation, through electronic means, on the government decision-making processes; and d) help shift the focus of the public services from the bureaucratic procedures to the citizen. Considering these goals the most important contribution of this paper is the proposal of a semantically enriched middleware for e-Government services called CoGPlat (Citizen-oriented e-Government Platform), a middleware which provides a set of functionalities that simplify the development and operation of citizen-centric applications. This paper also defines new strategies to dynamically compose Semantic Web Services and techniques to increase the transparency of public administration processes. Another important contribution is the introduction of a set of policies to mediate service compositions, providing different levels of autonomy, privacy, traceability and identity management.

CONCEPTS, TECHNOLOGIES AND LITERATURE REVIEW

This section introduces related concepts and technologies, as well as the state of the art on e-government literature.

Interoperability and Services

Interoperability, defined as “the ability of two or more systems or components to exchange information and to use the information that has been exchanged” (IEEE, 1990), is a fundamental requirement in the context of distributed and dynamic applications. A solution adopted by many systems is to follow a Service-Oriented Architecture (SOA) approach, where services running over heterogeneous systems interact and are used as building blocks for the construction of applications (Papazoglou & Georgakopoulos, 2003). A composite service can be regarded as a combination of activities, which may be either atomic or also composite services, invoked in a predefined order and executed as a whole (Fluegge et al., 2006). Two different execution models for composite services are commonly defined: orchestration and choreography. In an orchestration all interactions that are part of the process are described and then executed by an engine, which has control of the overall composition. In contrast, choreographies are more collaborative and less centralized, with only the public message exchanges considered relevant (Peltz, 2003; Ross-Talbot & Bharti, 2005).

The specification, enactment and management of composite e-services are topics studied in the eFlow project (Casati & Shan, 2001). Both adaptative characteristics and also
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