A Web-based Architecture for Government Databases and Services

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Abstract

Collecting social and welfare benefits for disadvantaged citizens requires going through a time-consuming and often demeaning process. The process of providing services usually involves access to a large number of government databases and applications. To tackle this problem, we adopt an ontology-based organization of diverse databases that filters interactions and accelerates information searches. We also wrap existing welfare applications by e-services. This elicits the dynamic discovery of e-services that best meet citizens' needs. In this demo, we present a Web-based prototype that allows the dynamic management and access to a large number of government databases.

1 Introduction

The Web is emerging as the *de facto* medium for promoting all types of economic, political, and social activities. Nowadays, organizations use the Web for publishing data in various information sources (e.g., databases, XML documents) and providing diverse types of applications (e.g., customer relationship management, welfare and social services) [5]. While accessing databases is an essential part of the Web story, all predictions agree that the next chapter in the Web revolution is the deployment and use of Web-based applications [1, 2, 5].

A typical and emerging area that involves access to both databases and applications is *digital government* [4, 7]. In our project, we have teamed up with the *Indiana Family and Social Services Administration* (FSSA). Currently, disadvantaged citizens must collect their benefits within the FSSA by visiting several offices within and outside the towns in which they live. To tackle this problem, we propose to make both FSSA databases and services Web accessible. Indeed, the use of the Web would provide a one-stop social and welfare bureau. Another current problem within the FSSA is the existence of a large number of heterogeneous databases and social services. The case officers generally need to access citizens' information in several databases. They also need to figure out which social services best meet their clients' needs. This process is frustrating for both citizens and case officers. Many citizens drop out of the FSSA programs with a consequential harmful impact on their health and welfare. To deal with this problem, we propose to organize both FSSA databases and applications in a way that facilitates information discovery and ease of use. For that purpose, we organized the different FSSA databases into *distributed ontologies* [3]. We also wrapped each application by an *e-service* [5]. The distributed ontologies filter and reduce the overhead of discovering databases and hence, accelerate information searches. Each ontology focuses on a single common information type. We dynamically group databases into a single collection, generating a conceptual space with a specific content and scope. An *e-service* is a functionality made accessible via the Web by an application provider and accessible by clients. These could be human users or software applications. One of the main benefits of using e-services is to dynamically discover them in a way that best meets users' needs [6].

The aim of this demo is to showcase a prototype that enables access to a large number of government databases and services on the Web. We present a Web-based infrastructure that helps disadvantaged citizens receive benefits, job training, and placement within FSSA. In Section 2, we outline the FSSA's social programs used as a proof-of-concept in our proposed implementation. In Section 3, we describe the proposed architecture. The architecture uses different communication middleware (*CORBA*, *RMI*, and *EJB*) to enable transparent access to the different databases. It also uses *e-speak*, an e-service platform for defining and invoking e-services.

2 Application Domain

We use government welfare and social services as a case of study. For that purpose, we have teamed up with the *Indiana Family and Social Services Administration* (FSSA). The FSSA serves families facing issues associated with low income, mental illness, addiction, mental retardation, disability, aging, and children at risk for healthy development. The FSSA also helps strengthen families' ability to succeed in their communities. This agency is composed of dozens of autonomous departments. Each department consists of a myriad of information systems that provide social services to needy citizens. In our implemented scenario, we focused on three bureaus within the FSSA: the *Families Services*, the *Vocational Rehabilitation Services* (VRS), and the *Blind and Visually Impaired Services* (BVIS). The Families Services provides several types of assistance to needy families, including cash, food, housing, and employment. The VRS supports people with disabilities to prepare for, obtain or retain employment. The BVIS assists blind and visually impaired citizens to achieve vocational and personal independence. In our prototype, we consider several rehabilitation programs offered by the Families Services, VRS, and BVIS (see Table 1).

Bureau	*Rehabilitation Program*	*Function*
Families	Temporary Assistance for Needy Families (TANF)	Provides cash assistance and supportive services to assist the family, helping them achieve economic self-sufficiency
	Food Stamps	This program is designed to raise the nutritional level of low income households by supplementing their available food purchasing dollars with food stamp coupons
	Medicaid	This program finances basic, cost-effective medical services for low-income residents of the State of Indiana
VRS	Job Placement (JP)	Placement of citizens into employment consistent with their disabilities
	Independent Living (IL)	Maximizes the integration of disabled citizens in community leadership, independence, and productivity
BVIS	Family Participation Day (FPD)	Helps the family of a visually impaired citizen develop a realistic outlook toward blindness
	Communication Skills (CS)	Teaches all the communication techniques needed by a visually impaired person (Braille reading and writing, etc.)
	Blind Registry (BR)	Enables the registry of blind people

Table 1: An Overview of FSSA Welfare Programs

3 Implementation

In Figure 1, we present the global architecture of our system for the FSSA case. Each rehabilitation program within the three bureaus (families, VRS, and BVIS) has its own database (Informix or Oracle).

We have also deployed four FSSA applications and wrapped them by corresponding e-services.

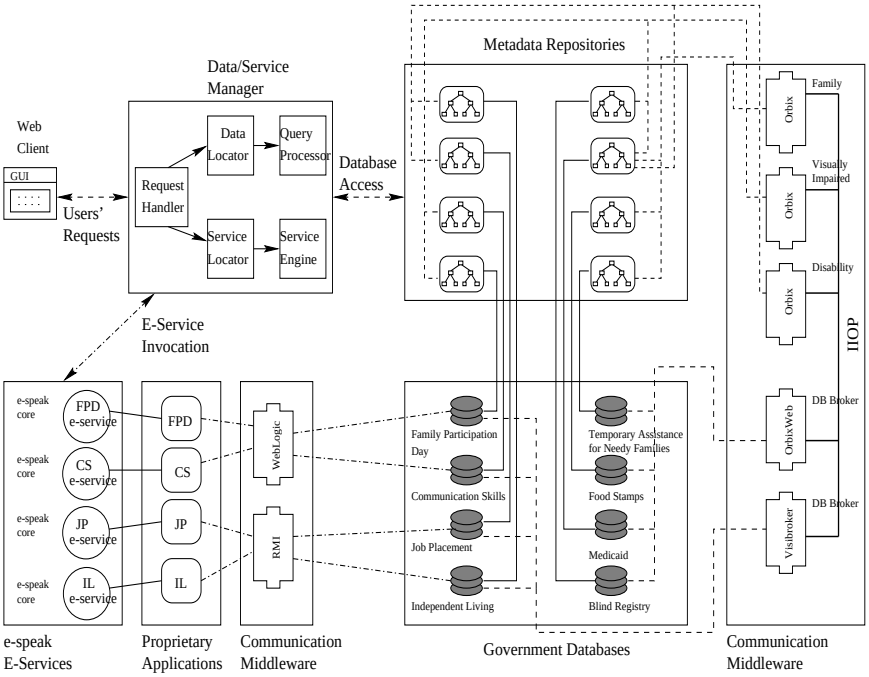

Figure 1: The Global Architecture

Users (i.e., citizens and case officers) access the system through a Web client. Two types of requests are supported: querying FSSA databases and invoking FSSA applications. All requests are received by the *data/service manager*. In a nutshell, the data/service manager receives users' requests, executes these requests, and returns the results back to users. It is composed of five components: the *request handler*, the *data locator*, the *query processor*, the *service locator*, and the *service engine*.

The *request handler* is responsible for routing requests to the *data locator* or the *service locator* depending of the type of these requests. All querying requests are forwarded to the *data locator*. Its role is to educate users about the information space and locate relevant databases. For that purpose, the different FSSA databases are organized into *distributed ontologies*. We identified three ontologies in the current prototype: *family*, *visually impaired*, and *disability*. For example, all FSSA databases dealing with families are member of the *family* ontology. A database can be related to more than one domain of interest and hence be member of more that one ontology.

All necessary information to locate FSSA databases is stored in *metadata repositories*. Each database has a metadata repository attached to it. This repository contains information about all ontologies the underlying database is involved in. It also contains information required to access the database such as the database name and location. The metadata repositories are linked to three different Orbix ORBs (one ORB per ontology). Users can learn about the content of each database by displaying its documentation in HTML/text, audio, or video formats. Once users have located a database of interest, they can submit SQL queries. The *query processor* handles these queries by accessing the appropriate database via JDBC gateways. The different FSSA databases are linked to OrbixWeb and VisiBroker ORBs. Since we are using CORBA 2.0 compliant ORBs, all inter-ORBs communications are handled by the IIOP protocol.

The service locator and engine components deal with application requests. As the number of applications offered within FSSA may be large, helping users to find applications of interest is of prime importance. The role of the *service locator* is to educate users about the application space. To facilitate the discovery of FSSA applications, each application is wrapped by an *e-service*. For that purpose, we have used *e-speak* [8], an e-service platform to define and invoke e-services. One of the main benefits of using e-services is to dynamically discover the available e-services that best meet users' needs [6].

Locating e-services can be performed in two ways. The first way is by specifying the e-service name. This is mainly useful for frequent system users. The second way is to search for e-services based on their properties. These properties are part of vocabulary we have defined for government welfare services. Examples of properties include the service category (e.g., health, housing) and the bureau the service is member of (e.g., VRS). Once users have located the e-service of interest, they can directly interact with the e-service by invoking its operations through the *service engine*. Examples of operations for the JP e-service include searching jobs and setting up interviews. The current prototype includes four e-speak compliant e-services: FPD (Family Participation Day), CS (Communication Skills), JP (Job Placement), and IL (Independent Living). The e-services wrap proprietary applications within FSSA. These applications use two communication middlewares, namely EJB (WebLogic server) and RMI, to implement social and rehabilitation programs.

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