CoGPlat: Using Composition to Enable Collaborative e-Government Services

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Abstract. The use of Information and Communication Technologies on the public administration can be considered a reality - many public services delivered by governments to the society are already available through electronic means. Nevertheless, Collaboration, e-Democracy and e-Governance are new ideas that promise, to a certain extent, a revolution on public administration. The main goal of these mechanisms is to increase the transparency and legitimacy of the public administration decisions, what leads to more efcient governments and to a better integration with the society, with other public entities and also with the private sector. This article describes preliminary studies about a running project that has as its main goal the study and proposal of new Collaborative e-Government and e-Governance mechanisms, validated through the modelling and implementation of a platform, which we call *CoGPlat - Collaborative e-Government Platform*.

1 Introduction

The Information and Communication Technologies (ICTs) are being applied vigorously by governmental units at national, regional and local levels around the world [7]. This use of ICTs on public processes and services is often termed e-Government, which has as its most common applications the ones related to the provision of information to the society. Besides that, many services that before were delivered only through traditional means are also being successfully offered through electronic means - in Brazil two examples are the on-line Federal Income Tax declaration system and also the Electronic Police Department (São Paulo's State Government initiative).

A variation on the classic e-Government model appeared recently: Collaborative e-Government. Following this model, new work and cooperation relationships with the private sector and with non-governmental organizations (NGOs) are established in order to deliver a greater variety of services to citizens and to permit a greater participation of the society on the government decisions. This opportunity for governments to redesign services through collaboration has as one of its main facilitators the rapid evolution of the ICTs and the Internet [3].

Although there are many researches related to the classic e-Government model, the application of collaboration mechanisms on the public administration represents a new area of study. The research project we present next consists basically of an e-Government platform (CoGPlat) which supports collaboration among different public

and private organizations and the citizens. This collaboration support will allow both the society and the local organizations to actively participate on the public affairs, respecting the democratic and legal precepts. Aspects like privacy, security and traceability are also considered.

A modelling process based on MDA (*Model Driven Architeture* - Section 2.2) is suggested in order to guarantee platform independence. To validate the model we propose a prototype implementation based on a service-oriented approach (Sect. 2.3) applying Orchestration and Choreography (Sect. 2.4) mechanisms.

This article is organized as follows: Section 2 presents some basic concepts related to this work; Section 3 introduces some researches in the area of e-Government and e-Governance; Section 4 presents an overview of the platform; Finally, Section 5 presents some nal considerations.

2 Concepts

Next we present some concepts and de nitions related to our project.

2.1 e-Government and e-Governance

Electronic Government (or e-Government), as an expression, was coined after the example of Electronic Commerce. In spite of being a recent expression, it designates a eld of activity which is with us for several decades yet. To some extent, e-Government is just a new name for the informatization of the public sector. [5]. The use of ICTs in public administration and in other branches of government (including parliaments and the judiciary) has attained a high level in many countries of the industrialized world.

Nevertheless, the term e-Governance is much more than the simple electronic delivery of services. It is closer to concepts like e-Democracy, offering a greater citizen participation support on the government decisions and acts [1].

While the motivation for traditional e-Government applications is usually the improvement of a speci c service delivery, the motivation for the appliance of e-Governance mechanisms includes [2]:

1. The aim to have the society supporting the government decisions;
2. The possibility to increase the credibility and transparency of the governments;
3. The opportunity to gather, effectively, the private sector, the third sector and the citizens together on the challenges of the public administration.

2.2 Model Driven Architecture

The Model Driven Architecture (MDA) [8] is a new way of writing speci cations and developing applications, based on a platform-independent model (PIM). A complete MDA speci cation consists of a de niti ve platform-independent base UML model, plus one or more platform-speci c models (PSM) and interface de nition sets, each describing how the base model is implemented on a different middleware platform. A complete

MDA application consists of a de niti ve PIM, plus one or more PSMs and complete implementations, one on each platform that the application developer decides to support [9].

MDA development focuses rst on the functionality and behavior of a distributed application or system, undistorted by idiosyncrasies of the technology or technologies in which it will be implemented. MDA divorces implementation details from practical functions. Thus, it is not necessary to repeat the process of modeling an application or system's functionality and behavior each time a new technology comes along. Other architectures are generally tied to a particular technology. With MDA, functionality and behavior are modeled once and only once. Mapping from a PIM through a PSM to the supported MDA platforms can be implemented by tools, easing the task of supporting new or different technologies [9].

2.3   Service-oriented Computing

Service-oriented computing (SOC) is a computing paradigm that considers services as fundamental elements for the development of applications [11]. Services are offered by service providers - organizations that procure the service implementations, supply their service descriptions, and provide related technical and functional support. The application of SOC on the Web is manifested by Web Services - a speci c kind of service that is identi ed by a URI, whose service description and transport utilize open Internet standards. Interactions between Web Services typically occur as SOAP calls carrying XML data content. Interface descriptions of the Web Services are expressed using Web Services De nition Language (WSDL). The Universal Description, Discovery, and Integration (UDDI) standard de nes a protocol for directory services that contain Web service descriptions. UDDI enables Web service clients to locate candidate services and discover their details [11].

2.4   Service Composition

The Web Services are migrating to a new phase, where more robust interactions are supported, characterized by composition. This composition is achieved through mechanisms like orchestration and choreography. They de ne how a set of Web Services interactions can be grouped (composed) in order to execute a determined process.

Orchestration describes how Web Services can interact with each other at the message level, including the business logic and execution order of the interactions. These interactions may span applications and/or organizations, and result in a longlived, transactional, multi-step process models [12].

Choreography tracks the sequence of messages that may involve multiple parties and multiple sources, including customers, suppliers, and partners. Choreography is typically associated with the public message exchanges that occur between multiple Web Services, rather than a speci c business process that is executed by a single party [12].

There is an important distinction between Web Services orchestration and choreography. Orchestration de nes an executable business process that may interact with

both internal and external Web Services (like in a work o w). Usually there is an entity that coordinates globally the composition - the Orchestration Engine. On the other hand, Choreography is more collaborative - only the public message exchanges are considered relevant. Differently from Orchestration, there is not an entity to control de composition globally - each party involved in the process describes the part they play in the interaction [12].

In order to de ne a web service composition (either through orchestration or choreography) the following questions should be considered:

1. Can the interactions happen in any order?
2. If no, which rules govern the sequence of interactions?
3. Is there any relationship between messages sent and/or received?
4. Is there a "beginning" and an "end" on a given sequence of interactions?
5. Can a given sequence of interactions be undone?
6. Is it possible/necessary to draw a global view of all message exchanges?

Two relevant speci cations that model this composition (and try to offer mechanisms to answer these questions) are BPEL4WS [19] and WSCI [20].

2.5 Collaboration

Collaboration can be de ned, from a technological viewpoint, as an agreement between a set of partners (Web Services, for instance) to achieve a common goal on a shared process.

In the context of our work, collaboration can be de ned as *"a reciprocal and voluntary agreement between two or more distinct public sector agencies, or between public and private or nonpro t entities, to deliver government services"* [3]. In general, these relationships involve a formal agreement about roles and responsibilities. The participating organizations share a common objective aimed at the delivery of a public service. They also share tangible and intangible risks, bene ts, and resources [3].

Collaboration, especially in the e-Commerce eld, has been widely discussed and many technological solutions have been proposed to support Collaborative e-Commerce (we could cite, for instance, the Virtual Marketplaces [10,17,18]). We will study these solutions and try to adapt some of them to the context of e-Government and e-Governance.

3 Related Work

In this section we present some researches in the eld of Collaboration and e-Governance related to our project. Due to the recentness of the area, these researches are still on their initial stages and the discussion is held on higher abstraction levels.

3.1 e-Governance Survey

A series of papers published by the *Commonwealth Centre for Electronic Governance* discuss different aspects of e-Governance and e-Government, including the following topics:

1. *Information Management and e-Government* [14];
2. *Knowledge Management and Technology* [16];
3. *The Role of Information in the Emerging Global e-Government, e-Governance and e-Democracy Environments* [15];
4. *e-Government vs. e-Governance: Examining the Differences in a Changing Public Sector Climate* [13].

3.2   New Models of Collaboration for Delivering Government Services

This article [3], published in an e-Government special issue of *Communications of the ACM*, presents a 2 year project held on USA, Canada and Europe. Various case studies were done on different areas of public administration trying to analyze where new collaboration models could be applied. A summary of the studied projects is presented on Table 1.

Table 1. Case Studies

Place	Project	Objetive
USA	*NYS Geographic Information System Coordination Program*	Data sharing and development of expertise
USA	*Access Indiana*	Public access to state government information and transactions
USA	*IRS e- le*	Filing of personal income tax returns
USA	*First gov*	Public access to federal government information
Canada	*Casdastre Quebec*	Real property tax mapping
Canada	*E-Commerce for Occupational Health and Safety Claims*	Claims processing for workers compensation
Canada	*BonjourQuebec.com*	Quebec tourist information and transactions portal
Canada	*Service Ontario Self-Service Kiosks*	Network of kiosks allowing renewal of driving licenses and Social Security cards
Canada	*One-Stop Business Registration*	Unique kiosk allowing electronic ling of all forms required to open a new business
Europe	*Bremen On-Line*	Public access to city information and transactions
Europe	*Hotjob*	Job offers portal

Based on these case studies, some observations regarding collaboration were done:

1. Each collaboration rests on an understood (but often tacit) working philosophy. Collaboration has many meanings and different projects operate on different working assumptions.
2. Collaborative relationships are evolving and dynamic. Each collaboration offers continuous opportunities for feedback and learning.
3. Data-intensive collaborations face issues of data ownership. In all of these collaborations, data is treated as a valuable asset.

4. Multi-organizational collaborations need an institutional framework. Because these initiatives stretch across the boundaries of distinct organizations, they need to establish a new kind of institutional legitimacy.
5. Technology choices affect participation and results.

3.3 eGOIA - Electronic GOvernment Innovation and Access

The European Commission launched a co-operation programme – @LIS ALliance for the Information Society – to accelerate the development of the Information Society in Latin America and to reinforce the partnership between the European Union and Latin America. eGOIA (Electronic Government Innovation and Access) [4,6] is an @LIS project that aims to implement a demonstration system supporting the access of citizens, through the Internet, to integrated public eGovernment services.

The main target of eGOIA is the demonstration of future-oriented public administration services to a broad public. Thereby the vision of the eGOIA project is the provision of a single virtual space supporting the interaction of citizens (independent of social status, gender, race, abilities and age) and the public administration in a simple, future-oriented and cost-effective way.

Technically the project is based on two main paradigms: front-of ce integration and back-of ce integration of e-Government services

4 CoGPlat Overview

The main goal of the **CoGPlat** platform is to support interaction and collaboration among governments, organizations (public, private and nonpro t) and citizens through the appliance of e-Governance and e-Democracy concepts.

The functionalities necessary to achieve this goal are presented next, together with a schema of the platform infrastructure and with a more detailed analysis on the rst functionality being developed - the *Transparent Services*. Also on this section some implementation issues are discussed and an application scenario is presented.

4.1 Platform Functionalities

The platform should be prepared to support the following functionalities:

1. Dynamic Integration and Management of various services delivered to the citizens:
   (a) Transparent Service concept: after a citizen request, *CoGPlat* manages all bureaucratic steps involved on a determined process, simplifying it to the citizen.
   Example: to get an authorization X emitted by the municipality, different entities should be contacted (Fire Department, Planning Secretary, Engineers Council etc) on a determined chronological sequence. This process is usually slow and consists basically of the transport of documents by the citizen from one entity to the other. The *CoGPlat* could help managing all this steps (electronically), making the authorization X process transparent to the citizen.
2. Mechanisms to support society participation on the public administration processes.

3. Mechanisms to guarantee the transparency of the public processes:
   (a) Possibility of inspection/audition of all public processes on a simply and immediately way by any citizen or organization.
4. Con ict resolution support (including support for different regulations).
5. Multilateral negotiation support.
6. Decision-making support. Examples:
   (a) Do the different regulations allow that decision?
   (b) Is their support (legitimacy) from the involved society sectors to that decision?
7. Support for medium- and long-term planning. Examples:
   (a) Are there other entities (municipalities, state government, private companies, NGOs etc) involved with such planning? If yes, what is their position and how can they contribute?

Besides that, scalability and computing platform independence are essential characteristics in order to integrate the platform in the best possible way with the heterogeneity of services already available electronically.

4.2 Infrastructure

Facilities. To implement the functionalities presented, the following managers are introduced:

1. **Transparent Services Manager**: responsible for the dynamic integration of services delivered to the society.
2. **e-Democracy Manager**: supports different participation ways of the society on the government decisions. It helps the other Managers offering legitimacy to the public administration acts, always respecting the local regulation.
3. **Auditing Manager**: makes it possible for the society to exam clearly and directly all public administration acts, increasing government transparency and credibility.
4. **Con ict Mediation Manager**: responsible to help in the resolution of con icts among different entities, especially when different regulations are involved or even when there is no de ned regulation.
5. **Multilateral Negotiation Manager**: important on a negotiation process that involves various parts - it works together with the Con ict Mediation Manager when necessary.
6. **Decision-making Support Manager**: helps determining the political legitimacy, legal and statistical support for decision-making.
7. **Planning Manager**: offers support to medium- and long- term planning, integrating on a collaborative way the entities involved on a determined process.

These managers collaborate with each other to deliver the services supported by the platform. The Fig. 1 presents a general schema of the platform.

Besides the managers, two other facilities are part of the platform. These facilities are responsible to manage the integration with external entities and applications:
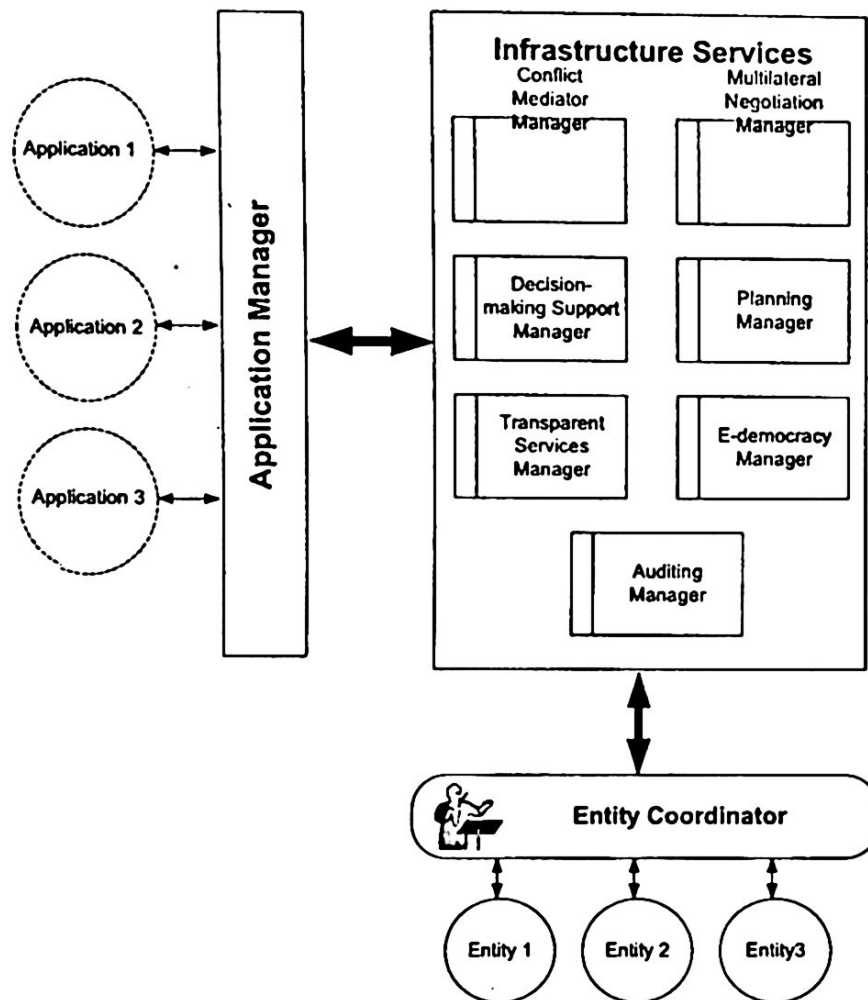
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Fig. 1. *CoGPlat* infrastructure schema

1. **Entity Coordinator**: responsible for the integration of other entities to the plat-
   form. An entity is an organizational unit that participates on the platform environ-
   ment offering and/or using any service. Examples of entities are municipalities,
   public organizations, NGOs, private companies etc. The *Entity Coordinator* is also
   responsible for managing the collaboration (using orchestration and choreography
   of services, for instance).

2. **Application Manager**: catalogs and manages the applications and their dynamic
   integration. An application, in this context, can be de ned as a set of (computing)
   services that interact with other to achieve a common goal. An application can also
   be considered a service and be part of a composition forming another application.

The interactions among the different actors that are part of the platform are being
formalized at the current stage of the project.

4.3 Implementation

A prototype that implements the most important functions of the infrastructure in order to validate is to be implemented next. Besides this prototype, some application examples will also be developed over the platform (Subsection 4.3) showing its potentials.

For the development of the prototype, some issues are being considered:

1. **Heterogeneity:**
    (a) The entities that will participate on the platform have independent and heterogeneous systems.
    (b) The political, legal and cultural aspects of the entities may also have a great diversity.
2. **Privacy and Integrity:** The way CoGPlat will manage the privacy and integrity of the information belonging to governmental systems, entities and citizens is a key factor for the success of the platform.
3. **Traceability:** Besides the transparency and auditing issues already mentioned, the platform prototype must also offer to whom concerns the possibility of following the processes and activities running over it.

Based on a MDA model (which is platform independent), the use of a technology based on the SOC paradigm (like Web Services) to integrate the different services that are going to participate on the CoGPlat environment could be a very appropriate solution to treat some of these issues – the SOC paradigm makes the integration of different applications and entities easier (at service level), preserving the peculiarities of the intra-organizational processes.

Besides that, to compose the services and offer support for collaboration, we propose the use of Orchestration and Choreography. When, for example, the composition is made up by services of an entity that controls others, an orchestration approach is more appropriate. On the other hand, when there is only collaboration among the entities (no administrative links or hierarchy and fully decentralized control), choreography is the most appropriate choice.

Current Stage. The rst facility being developed on the platform is the *Transparent Services Manager*. An MDA model of it (and of all other facilities) will be of great importance to guarantee independence of platform to the speci cation of the CoGPlat. In terms of implementation, the *Transparent Services Manager* is the facility responsible for the integration of services delivered by different governmental entities to citizens dynamically through the application of Orchestration and Choreography of Services. The second facility to be implemented is the *Auditing Manager*, responsible to offer support for traceability to the platform. The E-democracy Manager is the third facility to be implemented due to its importance to the platform.

Application Scenario The rst application to be built over *CoGPlat* will treat collaboration among municipalities. Metropolitan regions face various problems that involve different municipalities: con icts of interest, public transportation issues, scal disagreements, inter-municipal projects, security etc. Collaborative e-Government and e-Governance mechanisms could help a lot on the resolution of those problems.

5   Final Considerations

This article presents preliminary studies about a running project (CoGPlat) that contributes by modelling and developing a service infrastructure based on e-Governance and Collaborative e-Government concepts. Aspects like the support for heterogeneity and traceability are to be among the main contributions of the platform.

A model is being developed using the MDA approach, and a prototype is to be implemented to validate it. Service-oriented Computing and Orchestration/Choreography are applied to facilitate the integration of heterogeneous services delivered by governments and entities to citizens.

Besides that, some example applications (starting with Municipalities and Metropolitan Regions) are going to be developed over the infrastructure to show its potentials.

References

1. Sheryl Barlow, Peter Chen, Janet Chimonyo, Alison Lyon, and Brendan O'Loughlin. E-governance practice and potential in the local government sector. In *Australasian Political Studies Association Conference*, 2003.
2. Steven   Clift.   E-Democracy,   E-Governance   and   Public   Net-Work. http://www.publicus.net/articles/edempublicnetwork.html, September 2003.
3. Sharon Dawes and Lise Préfontaine. Understanding new models of collaboration for delivering government services. *Communications of the ACM*, 46(1):40–42, January 2003.
4. Petra Hoepner. *Electronic Government Innovation and Access - The Basics of eGOIA*. Workshop - 3rd IFIP Conference on E-business, E-commerce and E-government, September 2003.
5. Klaus Lenk and Roland Traunmüller. Electronic government: Where are we heading? In *EGOV 2002 - LNCS*, volume 2456, pages 1–9. Springer-Verlag, 2002.
6. @LIS.   eGOIA   -   Electronic   Government   Innovation   and   Access. http://www.egoia.info/index.html, 2004.
7. Gary Marchionini, Hanan Samet, and Larry Brandt. Digital government. *Communications of the ACM*, 46(1):25–27, January 2003.
8. J. Miller and J. Mukerji. *MDA Guide Version 1.01*. OMG, http://www.omg.org/cgi-bin/apps/doc?omg/03-06-01.pdf, 2003.
9. OMG. *Model Driven Architecture (MDA) FAQ...* http://www.omg.org/mda/faq_mda.htm, 2004.
10. V. Ouzounis. Towards dynamic virtual enterprises. In *1st IFIP I3E Conference*, 2001.
11. M.P. Papazoglou and D. Georgakopoulos. Service-oriented computing. *Communications of the ACM*, 46(10):25–28, October 2003.
12. Chris Peltz. Web services orchestration - a review of emerging technologies, tools, and standards. Technical report, Hewlett Packard, Co., January 2003.
13. Thomas Riley. *e-Government vs. e-Governance: Examining the Differences in a Changing Public Sector Climate*. Commonwealth Centre for Electronic Governance, http://www.electronicgov.net, 2003.
14. Thomas Riley. *Information Management and e-Government*. Commonwealth Centre for Electronic Governance, http://www.electronicgov.net, 2003.
15. Thomas Riley. *The Information Society: The Role of Information in the Emerging Global e-Government, e-Governance and e-Democracy Environments*. Commonwealth Centre for Electronic Governance, http://www.electronicgov.net, 2003.

16. Thomas Riley. *Knowledge Management and Technology*. Commonwealth Centre for Electronic Governance, http://www.electronicgov.net, 2003.

17. Ivo Santos and Edmundo Madeira. Policy-based orchestration and choreography of services on dynamic virtual enterprises. In *3rd IFIP Conference on e-Commerce, e-Business and e-Government*, Research Colloquium, Guarujá, Brazil, September 2003.

18. Ivo Santos and Edmundo Madeira. VM-FLOW: Using Web Services Orchestration and Choreography to implement a Policy-based Virtual Marketplace. In *World Computer Congress 2004 / 4th IFIP Conference on e-Commerce, e-Business and e-Government*, Accepted for Publication, Toulouse, France, August 2004.

19. BEA Systems, IBM, Microsoft, SAP AG, and Siebel Systems. *Business Process Execution Language for Web Services (BPEL4WS) - Version 1.1*. http://www-106.ibm.com/developerworks/webservices/library/ws-bpel/, 2003.

20. BEA Systems, Intalio, SAP, and Sun Microsystems. *Web Service Choreography Interface 1.0*. http://www.sun.com/software/xml/developers/wsci/wsci-spec-10.pdf, 2002.