A WORKFLOW BASED APPROACH FOR E-ADMINISTRATION PROCESSES

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Keywords: e-Government, e-governance, e-administration, inter-organizational workflow, process.

Abstract: The use of ICT (s) led to the reengineering of business processes in e-commerce area favoring thus, continued orientation to the client. The same idea seems to be renewed in the area of governance. E-administration appears at the center of any e-governance project. In fact, it covers the entire administrative processes (considered as business processes) whose mission is to serve citizens or businesses. On the other hand, the workflow based approach is appropriate for process modelisation particularly, in the case of well structured processes and whose steps are clearly defined. In this context, we propose a solution for modeling e-administration processes, based on workflow concepts and technologies at different levels highlighting, intra and inter-organizational interactions in the system. The solution is illustrated by a case study relative to the "voting process" (electoral process).

1 INTRODUCTION

Technologies have always been an important factor influencing changes in human organizations, particularly in their working way. Beyond the business where the use of ICT(s) led to the reengineering of business processes favoring continued guidance to the client (customer), the same idea seems to be renewed in the area of governance. With the emergence of new concepts such as internationalization and globalization, a new vision of the governance processes is born.

Nowadays, the quality of work has become a major concern of businesses (entreprises) and administrations. One of the definitions most commonly cited in the literature is based on the equation (St-Amant, Renard, 2005):

e-governance = e-government + e-democracy

If the volet of e-democracy still evokes a lot of questions and controversies, e-government seems to be more within reach because it is essentially based on e-administration. This latter is a set of administrative processes (considered as business processes) whose mission is to serve citizens or businesses. These services can be part of a relationship "Government to Citizen" (G to C), "Government to Business (B to G) or "Government to Government "(G to G).

The automation of administrative processes is not new (St-Amant, Renard, 2005), (El-Djamali & al., 2004), (Parrado, 2002), the added value in this case is supposed to be a better performance at work and a greater satisfaction of the citizen (Van Bastelaer & al., 2004). However, in most cases, this has been possible only through a global or a partial review of the process models governing such organizations. For process modeling, a workflow based approach is favoured, particularly when the considered processes are well structured and whose steps are clearly defined. Therefore, we propose a solution based on workflow (concepts and technologies) at different levels for designing and implementing e-administration processes. The interaction "citizen-administration" is provided via a portal site, representing the Front Office level.

The intra-organizational and inter-organizational interactions are performed respectively, by using traditional workflows and inter-organizational workflows, these are the Middle Office and the Back Office levels.

The rest of this paper is structured as follows: Section 2 describes some related works established in the workflow and the e-governance domains.

Section 3 presents some definitions of key concepts manipulated in this work.

Section 4 describes the workflow meta-model on which our solution is based, and outlines the main steps of the designing approach.

Section 5 reviews a case study relative to the management of the voting process (electoral process), it particularly concerns the phase "Purification of the Election File". In the same section, a general architecture of our solution is presented.

Section 6 shows some implementation results.

2 RELATED WORKS

The areas of e-governance and e-administration constitute currently an intense axis of reflection and research, highlighting the use of ICT(s) for improving the quality of services and benefits provided to individuals and/or organizations (St-Amant, Renard, 2005), (Belmihoub, 2004), (Michel, 2004). Many researchers focus on strategies, development and implementation of e-government solutions (Siau & Long, 2005b), (Chen & al., 2006) and (Shirish & al., 2007). Authors in (Siau & Long, 2005b), synthesize the main existing e-government stage models and propose a new stage model providing a synthesized conceptual framework.

On the other hand, the workflow technology is considered as the favorite tool of BPR (Business Process Reengineering). It enables the modeling and automation of business processes. Its use extends increasingly to cover inter-organizational exchanges, particularly in the area of e-commerce. Many works in this area, describe different architectures enabling several forms of cooperation among organizations (Chebbi & al., 2006), (Van der Aalst, 1999).

Our idea is based on extending the workflow models to support business processes related to e-administration area. For this, we propose an infrastructure allowing static and dynamic modeling of intra-organizational and inter-organizational aspects. Some works as (Corradini & al., 2007) address the problem by proposing a methodological framework for implementing business rules to support inter-organizational interactions at the application level. (Beer & al., 2005) propose a distributed architecture that supports interoperability of workflow systems for e-government.

3 DEFINITIONS

This section outlines some definitions of key concepts handled in this paper:

- **Workflow**

A workflow is an automation of all or part of a business process in which information flows from one activity to another (respectively, one participant to another) according to a set of predefined rules

- **Inter-organizational Workflow**

Regarded as an extension of traditional workflow, inter-organizational workflow can be defined as a manager of activities, envisaging the cooperation between several processes (of different organizations) which are distributed, autonomous and possibly heterogeneous.

- **e-Administration Process**

We call e-administration process, any procedure in the public domain which aims to enhance efficient delivery of services to citizens, businesses or other administrations.

- **Sub-process**

A sub-process is a step in the overall process, requiring inputs and producing results (outputs). We mean that a sub-process is any internal procedure which takes part in the achievement of the overall process.

- **Actors of e-Administration Process**

Actors in a e-administration process are individuals holding one or more roles, and interacting with each other to provide services to citizens, businesses or other administrations. The following figure illustrates the interaction of actors in e-government context where e-administration constitutes the nucleus.
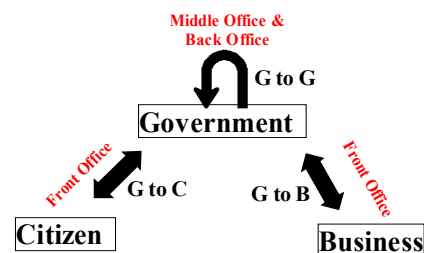

Figure 3.1: Model of e-Government.

The *Front Office* is the interface available to a citizen or a company for remote access to the information provided by an administration.

The *Back Office* concerns the processing of digital local data in a given administration.

The *Middle Office* represents virtual links among administrations.

- **Organization**

An organization is an autonomous structure on the decision-making, having its own business processes and managing its own sources of information. For example, a "city hall" or a "ministry" are organizations.

- **Organizational Unit**

An organizational unit is a structure in an organization whose mission is to provide services to citizens. For example, The "civil status service" in a "city hall" provides services materialized by delivering administrative documents such as a "birth certificate", a "marriage certificate", etc..

- **Service**

A service is any benefit produced by an administration (or an organizational unit) for the citizen and materialized by administrative documents in paper form or electronically.

4 THE EVOLUTION MODEL OF E-ADMINISTRATION

According to (St-Amant, Renard, 2005), the evolution model of e-administration covers five phases as illustrated in figure 4.1:
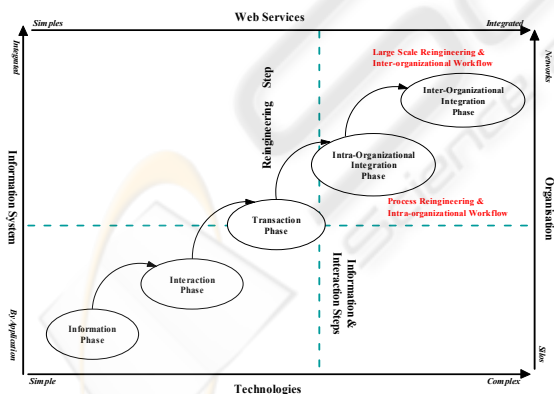

Figure 4.1: Phases of e-administration Evolution.

The process of evolution and integration involves five phases, which are: "Information", "Interaction", "Transaction", "intra-organizational-Integration" and "inter-organizational Integration".

These phases include two important stages: the stage of *information and interaction* and the stage of

business processes reengineering. Transition from the first to the second stage is ensured by the "*Transaction*" phase. For the second stage, we advocate the use of workflow technologies, especially for processes which can be included in this context.

In order to better capture the key concepts of workflow modeling, we propose a meta-model adapted to the e-administration. Indeed, the needs of organizations to adapt to their environment changes require taking into account changes in the process models themselves. The meta-model based approach appears to be most suited to this (Saikali, 2000). In the case of e-administration processes, the need for models adaptability can occur particularly in the context of a relationship "B to G" because of frequent changes in the juridical and the economic contexts.

5 WORKFLOW META-MODEL FOR E-ADMINISTRATION

5.1 The Meta-model

The meta-model (see figure 5.1) highlights the main concepts of workflow defined by the WFMC[1] standard such as: actor, role, process, sub-process, artefact, etc.. It is extended to the administration concepts such as: organization, organizational unit, service, administrative document, form, etc.

The meta-model covers three aspects: organizational aspect, process aspect and informational aspect which are detailed in figures 5.2, 5.3 and 5.

5.1.1 The Process Aspect

The global workflow process is an inter-organizational process, composed of several intra-organizational processes. Each of them is splited into sub-processes which are triggered by internal or external events and/or the satisfaction of logical expressions.

The class diagram of figure 5.2 shows a description of the most important properties in the "process aspect" of the workflow meta-model:
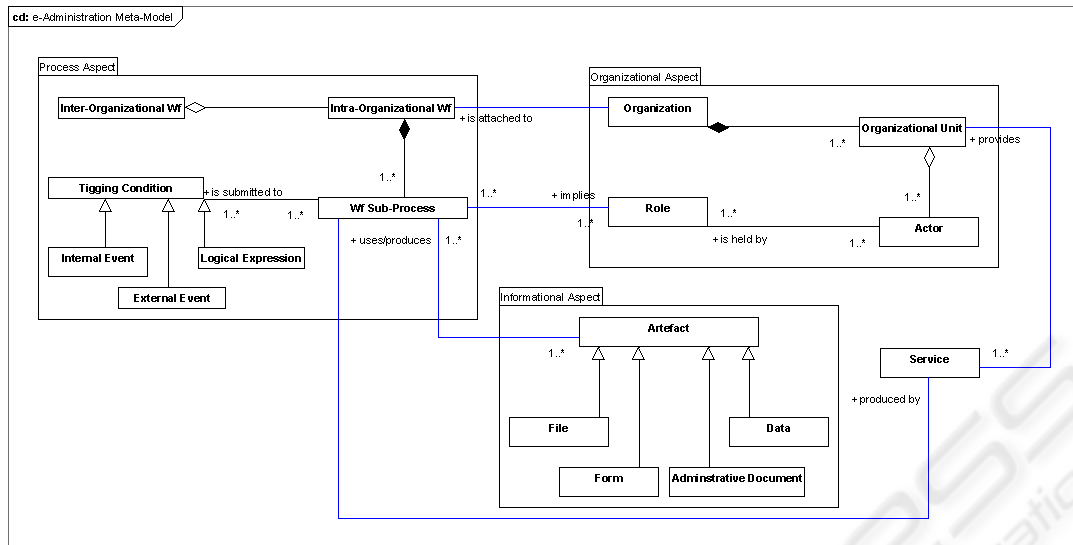
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[1] Workflow Managment Coalition : www.wfmc.org

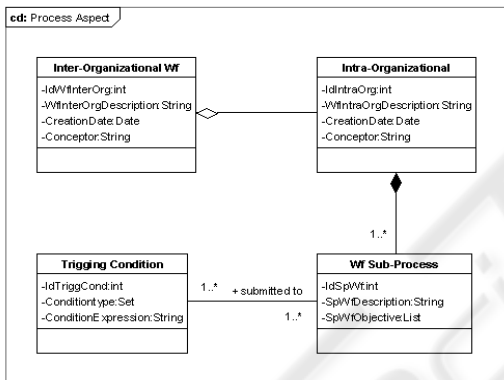Figure 5.1: Workflow Meta-model for the e-administration.

Figure 5.2: Process Aspect of the meta-model.

This part of code in Java describes the imple-mentation of the class "Inter-Organizationnel Wf":

```
//Description of the class
//« Inter_Organizational_Wf »
public class Inter_Organizational_Wf {
    private int IdWfInterOrg;
    private String WfInterOrgDescription;
    private Date CreationDate;
    private String Conceptor;
//Declaration of agragation links with
// class « Wf Intra-Organizational »
public java.util.Collection
Intra_Organizational_wf = new
java.util.TreeSet();
}
```

Listing 5.1: Class «Inter-organizational Wf ».

5.1.2 The Informational Aspect

As shown in Figure 5.3, the informational aspect is defined by a generic class "Artefact" representing all media documents necessary for the performance of administrative procedures. This class may specialize in "files", "forms", "administrative documents" or "data".
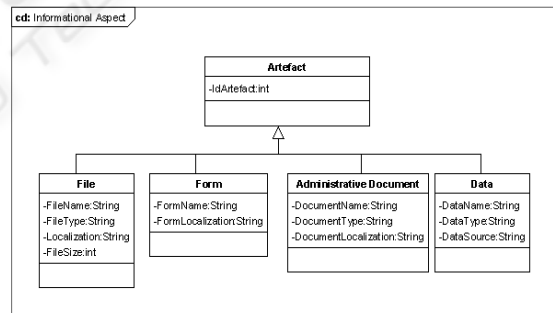

Figure 5.3: Informational aspect of the meta-model.

5.1.3 The Organizational Aspect

This aspect represents on one hand, the organizational units composing the full organization and on the other hand, the affectation of human resources (actors) in these structures. An actor who is part of an organizational unit performs a set of functions according to the roles assigned to him.
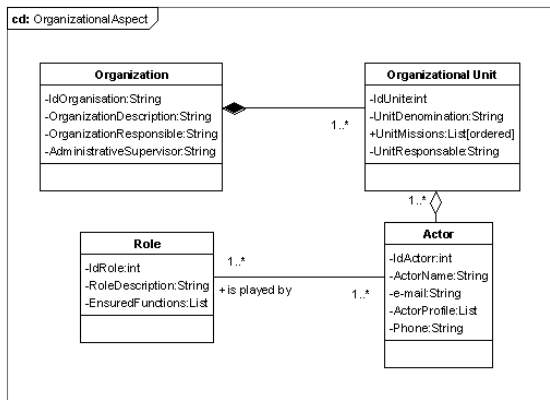
Figure 5.4: Organizational aspect of the meta-model.

5.1.4 The Class "Service"

The class "Service" represents the final product provided by an organizational unit as a result of the execution of a sub-process. The beneficiary of the service can be either an organizational unit or a citizen.
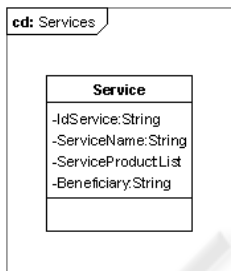

Figure 5.5: Class « Service ».

```
public class Service {
//Declaration of a class « service »
//properties
private String IdService;
private String ServiceName;
private java.util.List ServiceProduct;
private String Beneficiary;

//Declaration of agregation links

Public OrganizationalAspect.
Organizational_Unit provides;

public Process_Aspect.WF_Sub_Process
WF_Sub_Process
 }
```

Listing 5.2: Classe « Service ».

The meta-model previously described serves as a framework for modeling e-administration processes. For example, the "electoral process" is a typical process of e-governance including a typical process of e-administration which concerns the treatment of

the "electoral file", this process will be presented in section 6.

6 CASE STUDY: MANAGEMENT OF THE ELECTORAL PROCESS

Many researchs such as (Cetinkaya, Cetinkaya, 2007) (Wilson & al., 2006) were interested in the "voting process" in the context of e-governance.

6.1 The Project Description

This project is a part of the efforts provided by the government for integrating information and communication technologies within administration services. The aim is to improve the quality of services offered by administrations, by going towards more efficient e-administration processes.

Although, the "electoral process" is not just a simple process of e-administration as it relates to the e-governance and the e-democracy domains. In our case, we focus on administrative aspects of this process, which can be broken down into three main phases as shown in figure 6.1:
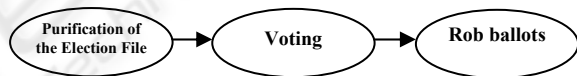

Figure 6.1: Phases of the "electoral process".

The first phase is a process of e-administration because it consists of many procedures for the revision of the "electoral file". This process runs regularly at a given period of the year or unusually for a ballot.

The main objective of this phase is to obtain an "electoral file" updated and purified. This will be done by providing to citizens, services online such as "requesting inscription", "requesting transfer", "requesting update", etc..

6.2 Conception of the Process "Purification of the Electoral File"

6.2.1 The Development Process

The following summarizes the main steps of the development process using UML diagrams.
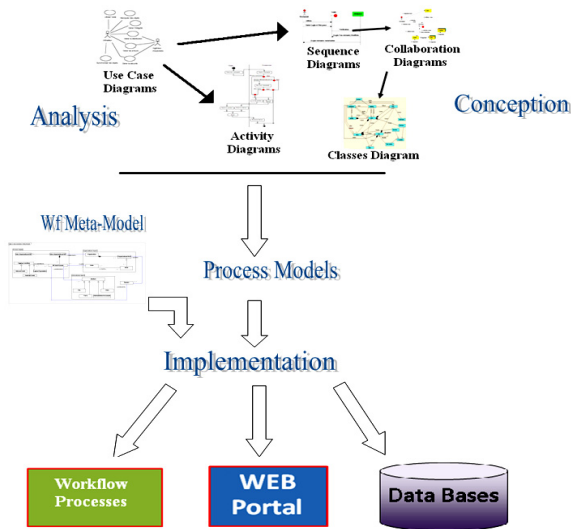
Figure 6.2: Phases of the development Process.

The development process is guided by the use cases and is intended to cover the main static and dynamic aspects of the system. It is summed up in the following points:

- Collecting informations and analyzing needs: identifying the actors and their roles, organizational structures involved and the services to be provided.
- Describing the functionalities of the system by the use cases diagrams.
- Building sequence diagrams highlighting aspects of interaction and synchronization in the system, and collaboration diagrams identifying actors and objects in cooperation.
- Building the overall class diagram representing all entities of the system.
- Describing the dynamic aspects of intra and inter-organizational workflow processes using the activity diagrams.

6.2.2 Analysis and Design

- **Problem Analysis**

The problem analysis allowed the identification of all organisms involved in the process of preparation of voter lists. The following table summarizes these organisms, the organizational units composing them and the roles they hold:

Organizations previously listed can be categorized into four classes according to their missions : "collecting information" organism, "partial consolidation" organism, "global consolidation" organism and "validation" organism.

Table 6.1: Roles provided by organizations.

Organization	Organization Roles	Organizational unit involved
Ministry of the Interior and local communities	Global consolidation of voter lists	General direction of elections
Ministry of Foreign Affairs	Information collect	Embassy, consulate
wilaya[2]	Partial consolidation of voter lists	Administrative service of election
		Computer science service
APC[3] (City hall)	Information collect and Partial validation	Election service
		Municipal Administrative Commission
		"Civil status" Service

Each structure (organizational unit) contains a set of actors, each one holding a role in the administration. For example, table 6.2 shows a description of actors in the "election" service of an APC.

Table 6.2: Actors in the "election" service.

Actor	Role	Function
Actor1	Administrative Agent	Handling inscription requests.
Actor2	Administrative Agent	Handling radiation requests.
Actor3	Responsible	Supervising the revision procedure of the voter lists.

- **Description of the Use Cases**

Actors of the system access to the services provided via a portal site. The use case diagrams of figures 6.3 and 6.4 shows respectively, all the services offered to citizens, and all the functionalities offered to officers (agents) of the "collecting information" organism (for example an APC), enabling them to respond to citizens requests.

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[2] Algerian territory is divided into several "wilaya", each wilaya is divided into several "daira", and each daira into several "APC".

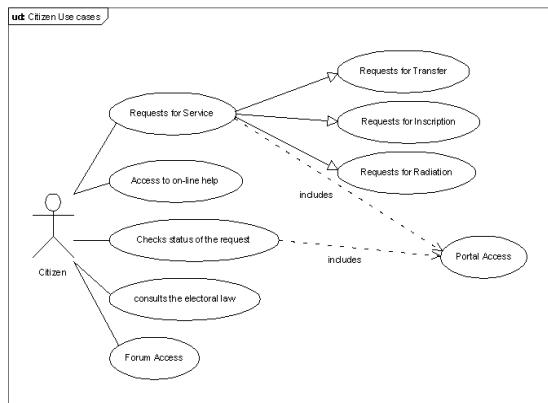[3] Assemblée Populaire Communale (in french) or Communal People's Assembly.

Figure 6.3: Use Case diagram "Services provided to the citizen".
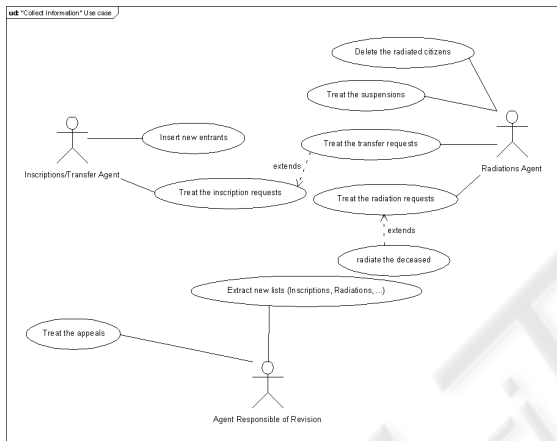

Figure 6.4: Use case diagram "Collecting information".

The sequence diagram bellow explicits the scenario "requesting a service" triggered by a citizen:
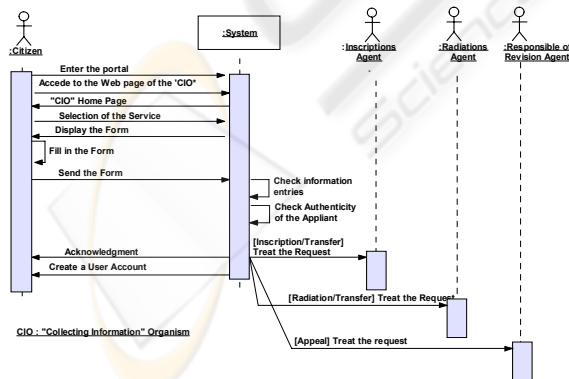

Figure 6.5: Sequence diagram "Requesting a service".

The figure 6.6 presents details of the interactions between the system objects involved in the scenario "Requesting a service":
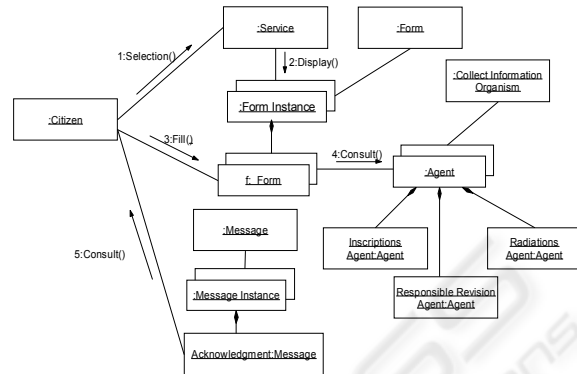

Figure 6.6: Collaboration diagram "Requesting a service".

The overall class diagram is represented by figure 6.7.

▪ **Description of the Workflow Aspects**

The workflow of the procedure "purification of the electoral file" is a strongly coupled inter-organizational workflow, as organizations in cooperation are known ("collecting information" organism, "validation" organism and "consolidation" organism). In addition, the cooperation between these organisms is well structured, since the revision procedure spread over a predetermined period, the validation process follows the consolidation process which follows the process of collecting information.

The process of "epuration of the electoral file" responds to the form of interoperability "chained execution" (Van der Aalst, 1999), (Chebbi & al., 2006). It is divided into distinct processes: the "collecting information" process, the "validation" process and the "global/partial consolidation" process. They run sequentially in the order of their previous citation.

The figure 6.8 shows the activity diagram describing the process of "treating a transfer request":
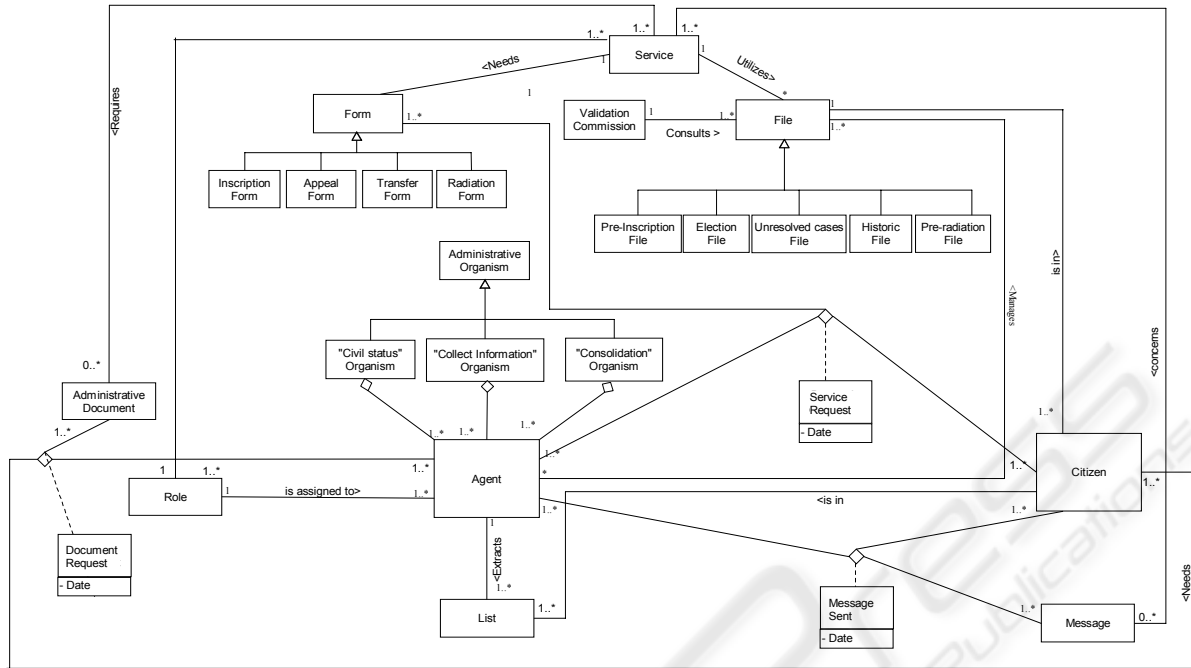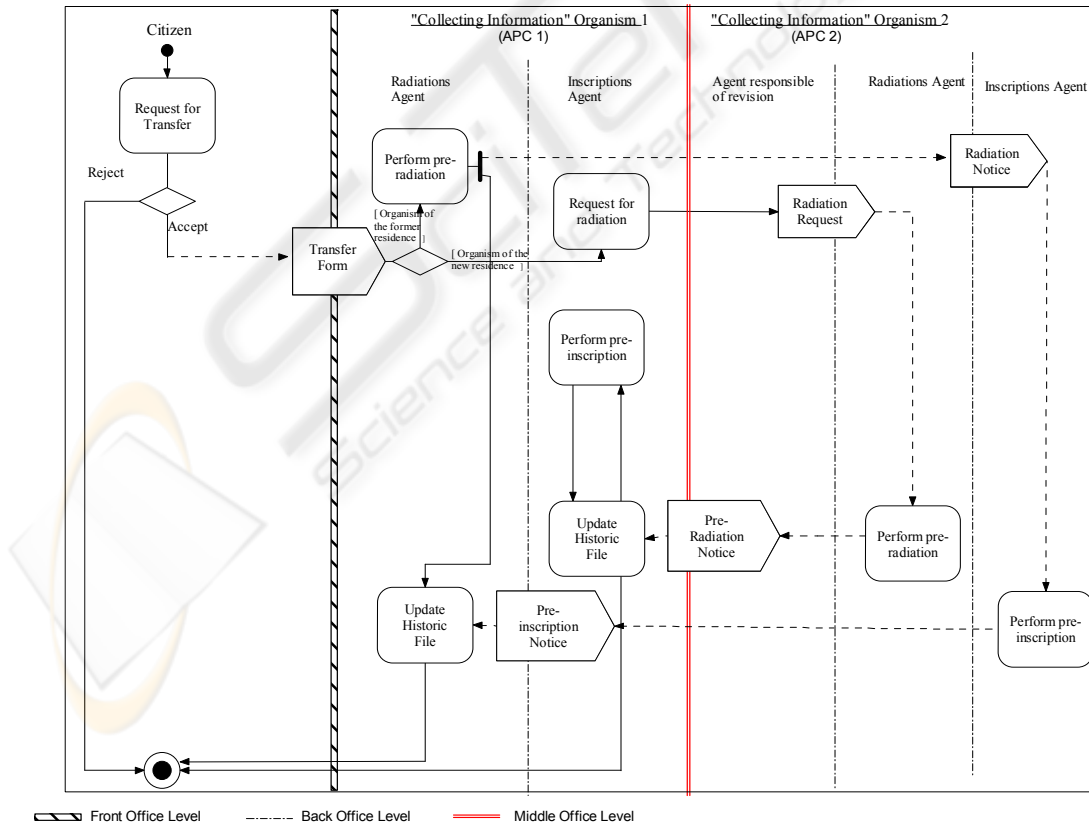
Figure 6.7: Class diagram.

Figure 6.8: Activity diagram "treating a transfer request".

6.3 General Architecture of the Solution

The implementation of solutions to the breadth of e-governance depends on several factors including the physical infrastructure in terms of network equipments and communication. Also, on the degree of automation of the administrative procedures in organizations. So, the architecture proposed in figure 6.9 concerns rather more functional aspects.
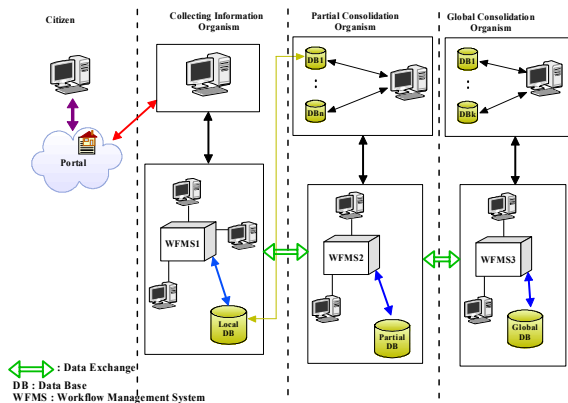

Figure 6.9: General architecture.

7 FIRST RESULTS

The application was achieved in Windows XP Server. For implementing workflow processes, we have used Oracle Workflow. It integrates a set of main components like: the "Oracle Workflow Builder" for process modeling, the "Workflow Engine" for process instances execution and the Oracle DBMS to manage databases.

As programming languages, we have used the language for script "JSP" at the server side and the langage "JavaScript" at the client side.

Here is an example of a workflow process built using Oracle Workflow Builder:

Figure 7.1: Design of the Workflow Process "pre_inscription".

In what follows, we will present some interfaces showing some implemented functionalities of the system.

▪ **The Front Office Side**

The portal site is available as a web site as shown in the following figure:
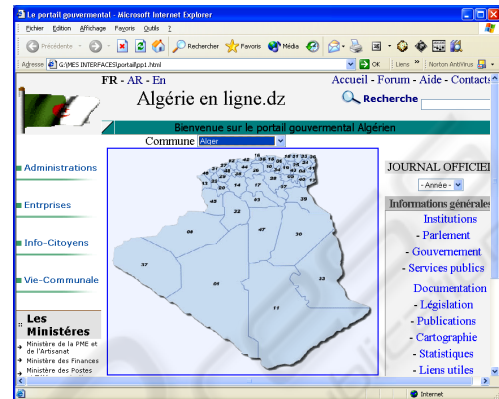

Figure 7.2: The Algerian governmental portal site.

A citizen requesting for a service, must select the APC (municipality) of his residence. Immediately, the portal site of the APC appears:

Figure 7.3: The Website of an APC.

The citizen who wish to apply for a transfer, for example, must click on the relevant service (see figure 7.3) and obtains the following form:
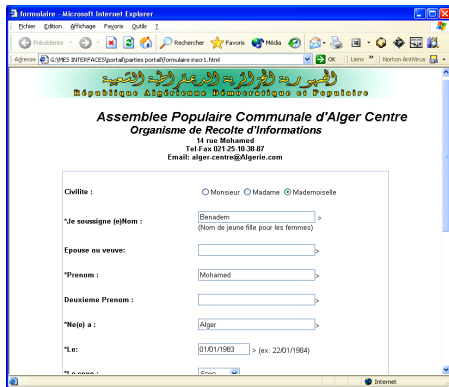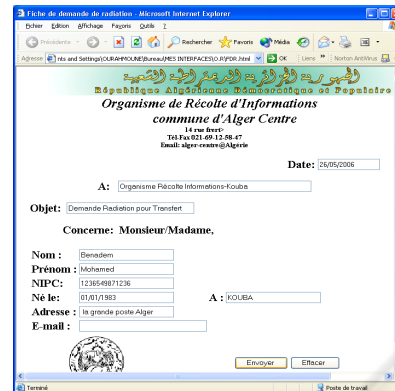
Figure 7.4: "Requesting a transfer" form.

▪ **The Middle Office and the Back Office Sides**

At this level, the administrative staff have a set of workflow applications enabling them the treatment of citizens requests. Any officer selects the APC, in order to access to the corresponding website.

At the appropriate time, the officer in charge of transfer requests, for example, will process the application for transfer through the appropriate functionality as shown in figure 7.6:

Figure 7.5: Functionalities available at APC.

As described in the activity diagram of Figure 6.8, the transfer procedure is carried out in two phases, which are: the removal (radiation) of the former residence and the registration (inscription) in the new one. This will involve the execution of intra-organizational (BackOffice) and Inter-interorganizational (MiddleOffice) workflow processes.

For each transfer request, the agent sends a request for radiation (figure 7.6) from the former residence of the citizen.

Figure 7.6: Request for radiation.

Upon receipt of the request for radiation, the officer in charge of radiation performs the pre-radiation and then informs the applicant for the service that the operation was carried out.

8 CONCLUSIONS AND FUTURE WORKS

In this work, we have proposed a conceptual and a technical infrastructure based on workflow, for modeling and implementating e-administration processes.

Our solution is based on a workflow process meta-model, which we are extended with concepts related to e-administration domain, such as "organization", "organizational unit", "service", "administrative document". The proposed solution supports intra and inter-organizational aspects for the processes. The meta-model based approach offers the advantage of flexibility in terms of models and their instances, allowing then for the organizations easier adaptability to changes imposed by the environment.

The concepts presented in the paper are illustrated by a case study relative to the "purification electoral file"in a "voting process". This process involves actors and processes at different levels of the governmental hierarchy, this justifies the use of intra and inter-organizational workflows. Having captured the main elements to design, we use the established workflow meta-model to create all the procedures associated to the "epuration of the electoral file", highlighting the FrontOffice, the BackOffice and the MiddleOffice levels in the e-administration processes.

The FrontOffice level is implemented using the technology of portals. This can be extended to the

two other levels (MiddleOffice and BackOffice) in order to palliate to the geographical distribution of the organizations or the organizational units, and the diversity of the used platforms.

For implementing our case study, we have used Oracle 10g tools.

As future works, we plan to study the deployability of such a solution by simulation, because of the complexity and the criticality of e-administration processes. We also intend to give a "web services" orientation to this work.

ACKNOWLEDGEMENTS

We would like to thank the Ministry of Telecommunications for its cooperation.

We also thank our students Leila MAICHE and OURAHMOUNE Amel for taking part in the realization of this project.

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