T. GÖVSA M.S. Thesis 2009

INTEROPERABILITY AND E-GOVERNMENT SERVICES: AN EXAMPLE

TUTKU GÖVSA

IŞIK UNIVERSITY
2009

INTEROPERABILITY AND E-GOVERNMENT SERVICES: AN EXAMPLE

TUTKU GÖVSA

M.S Computer Science, Işık University, 2009

Submitted to the Graduate School of Science and Engineering
in partial fulfillment of the requirements for the degree of
Master of Science
in
Computer Science

IŞIK UNIVERSITY
2009

IŞIK UNIVERSITY

GRADUATE SCHOOL OF SCIENCE AND ENGINEERING

INTEROPERABILITY AND E-GOVERNMENT SERVICES: AN EXAMPLE

TUTKU GÖVSA

APPROVED BY:

Prof. Selahattin KURU (Bahçeşehir University) _____
(Thesis Supervisor)

Assoc.Prof. Seyhun Altunbay (Işık University) _____

Assist.Prof. Mustafa Taner Eskil (Işık University) _____

APPROVAL DATE:

INTEROPERABILITY AND E-GOVERNMENT SERVICES: AN EXAMPLE

Abstract

Interoperability is a key concept to the understanding of the changes in progress in e-government. These changes are made gradually and with a phased implementation. The thesis aims to define the interoperability and its usage in e-government services by focusing on core web service technologies and their standardization works upon e-government services. Successful examples and standardization works done were examined and used in order to support my thesis' definitions with examples. Technical aspects of interoperability is detailed and presented to complete the information given in the thesis. This thesis presents one of the applicable examples which are just to give the idea of this thesis.

BİRLİKTE ÇALIŞMA VE E-DEVLET SERVİSLERİ : BİR ÖRNEK

Özet

Bu tez sistem ve servislerin birlikte çalışmaları ve bu teknolojilerin e-devlet uygulamalarında nasıl kullanıldığını anlatmaktadır. Birlikte çalışmanın e-devlet uygulamaları için oluşturduğu önem detaylıca anlatılmaktadır. Birlikte çalışan sistemlerin hangi teknolojileri kullandıkları ve bu teknolojileri kullanırken oluşturdukları kalıpların hangi oranda başarılı olduğu incelenmiştir. Birlikte çalışan sistemleri kurarken teknolojik olarak işlemlerin temelinde yatan şema ve teknolojik lisanların detayları da konuya detay kazandırmak amaçlı verilmiştir. Tüm birlikle çalışma şartlarını yerine getiren sistemlerde yaşanan zorluklar ve kurulmayaçalışılan yapılardan da özet olarak bahsedilmiştir. E-devlet uygulamaların avrupadan ve türkiyeden örneklerine yer verilmiş ve bu örneklerin hangi servisler ile e-devlet oldukları bildirilmiştir. Öğrenilen ve örneklenen bilgilerin eşliğinde, birlikte çalışma ve e-devlet konusunu tamamlayan bir uygulama geliştirilmiştir.

Acknowledgements

There are many people who helped to make my years at the graduate school most valuable. First, I thank Prof. Dr. Selahattin KURU, my thesis supervisor. Having the opportunity to work with his during my master thesis was intellectually rewarding and fulfilling. I also would like to thank for his accaptance and patiance for me. I thank him for his insightful suggestions and expertise.

Many thanks to Department Secretary Ms. Dikmen, who patiently answered my questions and problems on word processing. My special thanks go to Francois Nadeau and Zafer Erenel whose friendship I deeply value.

The last words of thanks go to my family. I thank my parents, my son Tunç, my 2 years old daughter for their patience and encouragement. Lastly I thank my wife Fatoş , she was always nice to me, for her endless support through this long journey.

Table of Contents

Abstract ii

Özet iii

Acknowledgements iv

Table of Contents v

List of Tables vii

List of Figures viii

List of Abbreviations ix

1 Introduction 1

2 E-government Services 3

2.1 Outline and Classification ……. 3

2.2 Types of E-egovenrment Websites ……. 5

2.3 Examples from Europe and World ……. 8

2.4 Examples from Turkey ……. 12

3 Interoperability Technologies 16

3.1 Overview ……. 16

3.2 Interoperability Levels ……..……..……... 17

3.2.1 Technical Interoperability ……. 17

3.2.2 Semantic Interoperability..…….. 17

3.2.3 Organizational Interoperability ……..…….. 19

3.3 SOA for Interoperability ……..…… 20

3.4 XML for Interoperability……..…… 26

4 Interoperability in E-government Services 28

4.1 European Interoperability Framework ……..……. 31

5 An Example 34

5.1 Service Definitions……. 34

5.2 Design and Implementation Details ……..……..……... 34

5.3 ScreenShots……..……. 43

6 Conclusion and Recommendations for Future Work **47**

6.1 Conclusion .....……. 47

6.2 Recommendations for Future Work ……..……..……... 47

References **49**

References Not Cited **51**

Appendix A: CD Containing Thessis Text and Source Code of Example **52**

Vita **53**

List of Tables

Table 2.1 E-Government Evolution 9

Table 2.2 E-Government Examples in Europe 10

Table 2.3 E-Government Examples from Turkey.....14

Table 5.1 CITYPORTAL_PEOPLE table definition 35

Table 5.2 MERNIS_MERNIS table definition.....36

Table 5.3 MERNIS_USER table definition.....36

List of Figures

Figure 4.1 PEGS Infrastructure 30

Figure 5.1 Project Workflow Diagram 37

Figure 5.2 Mernis Web Service Name Space Details 39

Figure 5.3 Mernis Web Service Definition 40

Figure 5.4 First Page 43

Figure 5.5 Security Check Page 44

Figure 5.6 Successful Authorization Page 45

Figure 5.7 Applicant Info Page 45

Figure 5.8 Water/Electric Installation Requests Web Page 46

List of Abbreviations

BP	Basic Profile
DTDs	XML 1.0 document type definitions
EIF	European Interoperability Framework
HTTP	Hypertext Transfer Protocol
ICT	Information and Communication Technologies
IDA	Interchange of Data between Administrations
IDABC	Interoperable Delivery of European eGovernment Services to Public Administrations, Businesses and Citizens.
J2EE	Java 2 Platform, Enterprise Edition
MERNIS	Central Census Information System
MSAs	Member State Administrations
PEGS	Pan-European e-Government services
S/MIME	Secure / Multipurpose Internet Mail Extensions
SGML	Standard Generalized Markup Language
SOA	Service-oriented architecture
SOAP	Simple Object Access Protocol
SSL	Secure Sockets Layer protocol
TAC	Telematics between Administrations Committee
TCP/IP	Transmission Control Protocol/ Internet Protocol
TLS	Transport Layer Security protocol
UDDI	Universal Description Discovery and Integration
W3C	World Wide Web Consortium
WSDL	Web Services Description Language
WS-I	Web Services Interoperability Organization
XML	Extensible Markup Language
XSLT	XML Style sheet Language Transforms

Chapter 1
Introduction

In this thesis, we will try to define the interoperability and its usage in e-government services by focusing on core web service technologies and their standardization works upon e-government services.

We will use best practices helping our exampling and defining work done under the `e-government Interoperability` topic.

We develop an application based on integrating two e-government services. The application is a utility service contract application. It involves accessing and authenticating service from an e-government portal. The outline for the thesis is as follow following the intro chapter we give, overview of e-government services.

We try to enlarge our knowledge about interoperability in technical ways. Because of that, Technology of Interoperability is the main problem to be solved; we investigate all the interoperability techniques in detail. Then we discuss e-government interoperability services. Usage of interoperability in e-government services is the most important aspect because it stands in the core place in order to combine all of the services which created by their governments.

After that, we give the example application showing the sample usage of an interoperable e-government services which we simulate an advanced system similar to one of the most successful e-government services MERNIS (Central Census Information System) [1] from Turkish Government.

Finally we conclude and summarize all the explaining chapters giving what are used and which were explained in this project. At the end of the conclusion part, we

assume some future works to be done in order to gain some of the new e-government service types.

Chapter 2
E-Government Services

E-government aims to utilize Information and Communication Technologies (ICT) to improve public administrations' efficiency and effectiveness in order to encourage growth. If successfully implemented, e-Government services can cut down the time spent to use government services. Anyone who has waited in lines at government buildings can appreciate this service.

By establishing links between government departments, companies, and citizens, e-government makes public services usable and providing duty to fulfill the requirements of businesses and citizens better[2]. Consequently, individuals and companies save big amount of time to spend as they see utilizable services, rather than waiting in lines to utilize various government services.

Providing accurate e-government system is not just a technical issue. The e-government objective can be achieved only through a combination of technology, organizational restructuring and new skills. It is also important to note that e-government solutions should not introduce new difficulties to the single market. For example, national electronic identities must remain interoperable to prevent the appearance of new handicaps for individuals and international companies.

2.1 Outline and Classification

Four main customer types generate the E-Government services' target group: citizens, the business community, government employees and government agencies. E-Government's goal is to transform government agencies and other government services into more convenient, pleasant, clear, economical and useful services.

An e-government system gives individuals the ability to submit a request for government services and receive that particular service via a computerized medium, such as the Internet. The government service can be made available through one office instead of multiple offices, depending on the service in question. With an e-government system, in some cases it would also be possible to make a transaction without having to personally communicate with a government employee.

Below are the four types of e-government services:

- Government-to-Citizen (G2C)
- Government-to-Business (G2B)
- Government-to-Employee (G2E)
- Government-to-Government (G2G)

G2C

G2C services consist of distributing information to the public and assisting with services such as license renewals, ordering official documents for occasions such as birth/death/marriage, income tax filing. G2C also aims to help citizens on services such as education, health care, hospital information, public libraries, etc.

G2B

G2B services consist of duties between government and businesses, such as the distribution of policies, memos, rules and regulations. Businesses and governments can utilize G2B to find current business information, download applications, renew business licenses, register businesses, receive payments and pay taxes. G2B services can also help with business development, especially that of small and medium sized companies (SME). E-government systems function on the basic assumption that reducing the difficulties of the application procedures would make the approval process for SME requests much easier, which ensures promoting business development.

From an advanced perspective, G2B involves services such as e-procurement, which provides online government-supplier exchanges to allow the government to buy goods and services. E-procurement websites generally permit competent and registered users to browse for the buyers or sellers of these goods and services. On some of these websites, buyers or sellers can determine the prices and invite bids. E-procurement is useful in facilitating the bidding process and also allows smaller businesses to bid for extensive government procurement projects. Since e-procurement systems leave no need for auctioneer, they also reduce costs, including the operating costs of the purchasing agents.

G2E

G2E services include G2C services along with specific services targeted only towards government employees, including the regulation of development and training for human resources such as online education portals. G2E services enhance the efficiency of bureaucratic functions.

G2G

G2G services occur at two distinct levels: local/domestic and international. G2G services denote operations between the central/national and local governments, as well as departmental operations and operations between related agencies and offices. G2G services also enable operations between different governments and can be profitable in the international relations and diplomacy protocols.

2.2 Types of e-Government Websites

The big amount of e-government applications can be presented to the citizens through various types of web sites and portals. Classification of e-Government websites will ease to understand the usage of e-Government web communities [3].

Below are the seven types of e-government websites:

- National Entry Points: Gateways or Portals
- Citizen- or Business-Centric Portals

- Ministry-level Websites
- Parliamentary Websites
- Judicial Branch Websites
- Portals for Provincial, Local and Municipal Governments
- Personal Websites for Elected Officials

National Entry Points: Gateways or Portals

National entry portals are the roads which have to be followed to find required services of a government. They are usually called as gateways or web portals as a combination of services and contents. Priority of those kinds of portals is guiding the users to allow them find the most suitable services, web sites, documents or web links to research more on demand. National entry portals should be well designed and high-tech usable to ease users' navigation.

National portal are designed to be the face of a country to the world in the first instance. Being a face of state to the public is the second aim of those gateways. When we think about government's transparency, national portals are the best ways of visibly presenting the nation's approach. Eventually, National entry points slightly may have a penetration on government reputation and credibility, citizen dependence and public reaction to e-Government. National gateways have high security standards and privacy control mechanisms; they are very operative on sector content quality and technical versatility.

National portals have technical and administrative complicity although they are required to be straightforward and simple for the average citizen to use. "Getting multiple government agencies to be able to work together the many aspects of user friendliness like presentation standards, authentication, data quality, access rights, is a major challenge" [3]. In order to prevent operational ineffectiveness, content and portal design topics are becoming more important issues of web portals.

Citizen / Business Centric Portals

Citizen / Business centric portals are very famous and popular in changing and developing countries all around the world. Portal contents and deliveries are directly combination of citizen and businesses' requirements. The main aim of these portals is to give one portal to the businesses and citizens whom will no longer need spent times in government departments, ministries and offices. Portals give full of services or prerequisites of combination of services. Portal's simplicity and organized content is one of the e-Government portals main issues.

Content organization and indexing of portals are another organized way of presenting information. Consolidating substances from different government departments and offices into a single frontend, forms from different bureaus, one for law regulations, and one for online payments to a variation of agencies can be given as an example which is done in US government.

Ministry-level Websites

Ministries, municipalities and offices usually create their own web sites. Since number of ministry level web sites rising and being away from simplicity, they probably lose focus on providing user-centric achievement of learning and services.

Parliamentary Websites

These are the web pages of public concern about the government decision giving the information to the person concerned which is the main different of this e-Government web site type. The content include former proposed legislation and published projects legislative process, committees and members, the council calendar and hearings and debate transcripts and other materials to circulate information about parliament. Members of parliament may write down notes and vote any election of parliament using frontend of parliament.

Judicial Branch Websites

The country's judicial system and the general state of opinion about the cases are going online to inform the public. As an example, The Supreme Court of India [4] publishes case status, calendar, application forms, and cause list search online.

Provincial, Local and Municipal Websites and Portals

Provincial, local and municipal governments are providing customized and localized government duties. As an example, a system may provide citizens the ability to be informed about how their local governments are structured. Those web sites also give access to information on municipal officials. Another important side of specialized web site is that citizens can see current projects, can track on public funds and payments, and also gather information on procedures for obtaining a birth certificate, construction permit, and other documents about regulations in many provinces.

Personal Sites for Elected Officials

This type of e-Government web sites is more focused on developing their own web sites in order to communicate with their auditions in a secure manner via email or electronic authentication. As we mentioned previously, members of parliaments have their personal home pages which they use to interact themselves to citizens publishing personal projects, email address, contact information online. Varieties of web pages are owned by president and ministers globally.

2.3 Examples from Europe and World

The present e-government services are available online in Europe function as separate services that the user uses only in specific cases. However, it is important to keep in mind that multiple services from the same or different organizations may be necessary in some instances. Furthermore, in special circumstances, services from international organization might become necessary.

Services generally start a chain reaction in government organizations and this chain reaction might not always be visible to the citizens/individuals whom use the service. Even when all the services are available online, individuals and government organizations still find that they still need to know more about the service provided. This does not only result in a waste of time, but also increases the costs. Consequently, e-government services should be as much similar as to traditional government services to eliminate this problem.

Table 2.1 shows the integrated e-government service:

Table 2.1 E-Government Evolution

Process	Steps	Evolution	Level
↓	Initiation	• Seems like a good idea • Pilot implementations	Government Online
	Contagion	• Widespread adoption of the technology • Driven by business and new technology opportunities • Decentralization of strategy and resources	
	Control	• Re-focus on cost, efficiency and quality • Re-centralization of some strategy and control	E-government
	Interoperability	• Stand-alone solutions no longer adequate • Move to standardized infrastructure • Re-focus on integration to enable holistic responses	
	Data Management	• Integrated management of data • Borderless services	

There are multiple e-government services available in Europe and throughout the world. Table 2.2 contains examples from practices in Europe. For more detailed information, please check the respective websites.

Table 2.2 E-Government Examples from Europe [5]

Type of Service	**e-service in Operation**
Income taxes: declaration, notification of assessment	Advertising and disposing of seized property on the internet (Spain)
	Bremen On-line Services (Germany)
	Carta d'Identitá Elettronica - Electronic ID Card in Parma (Italy)
	Federal Portal - For Citizens and Business (Belgium)
Job search services by labour offices	3IP (3 Islands Partnership, Islay, Jura and Colonsay) (UK)
	AMS - Swedish National Labour Market Board (Sweden)
	AOC services between Catalan administrations, citizens and companies (Spain)
Social security contributions (e.g. unemployment benefits, family allowances, medical costs, student grants, etc)	Federal Portal - For Citizens and Business (Belgium)
	Italian Citizen Portal - Italia.gov.it (Italy)
	LIN - Icelandic Student Loan Fund (Iceland)
	Open Digital Government, North Jutland (Denmark)
Personal documents (passport and driver's license)	Digital Signature and Electronic Identity Card, Livorno (Italy)
	e-Enabling Life Event Data (Ireland)
	HELP - Virtual Guide to Austrian Authorities and Institutions (Austria)
Car registration (new, used & imported cars)	Auto e-Counter car registration (Italy)
	ROS - Revenue On-Line Service (Ireland)
	Salzburg *e-government* Portal (Austria)
Application for building permission	ENTERPRISE 51 single office for business support (Italy)
	MISS - Multi-Channel Integrated Service System, Barcelona (Spain)
	Open Digital Government, North Jutland (Denmark)
Declaration to the police (e.g. in case of theft)	HELP - Virtual Guide to Austrian Authorities and Institutions (Austria)
	Platform Service-Public Local – public sector data interexchange (France)
Public libraries (availability of catalogues, search tools), enrolment in higher education/university and other education and training related services	BRN - Das Bayerisches Realschulnetz (Germany)
	The Learning Centre, Colchester (UK)
	Handiplace (France)
	MISS - Multi-Channel Integrated Service System, Barcelona (Spain)
Is just a symbolCertificates (birth, marriage, death, adoption, etc)	e-Enabling Life Event Data (Ireland)
	Platform Service-Public Local – public sector data interexchange (France)
	REACH - messaging infrastructure for intra-governmental co-operation (Ireland)
	Digital Signature and Electronic Identity Card, Livorno (Italy)
Announcement of moving	Open Digital Government, North Jutland (Denmark)

(change of address)	Bremen On-line Services (Germany)
	Carta d'Identitá Elettronica - Electronic ID Card in Parma (Italy)
Transport-related services	Primar Stavanger, electronic navigation for sea transport (Norway)
	SOMCET-Net - Transport Optimization for eBusiness (Romania)
	Salzburg *e-government* Portal (Austria)
Elderly related services, disabled related services	Italian Citizen Portal - Italia.gov.it (Italy)
	Regional Network of Piedmont Schools (Italy)
	SuliNet Public Education and HIK University Students (Hungary)
Services related to elections, plebiscites and referenda and services related to the policy development and decision-making process	election.com Ltd - eVoting in Sheffield (UK)
	eVentspils – citizens' news, discussion and voting, Kurzeme region (Latvia)
	e-Vote: Vote for the EU YOU Want (Greece)
Other services for citizens	APLAWS (Accessible Local Authority Websites) (UK)
	Belgian social security (Belgium)
	BRN - Das Bayerisches Realschulnetz (Germany)

Despite the numerous services already implemented, interoperability and integration remain as key concerns in European e-government services.

There are many successful projects, both finished and ongoing, regarding e-government services in Europe. Some examples are:

EGOV – BUS (www.egov-bus.org) - aims to integrate and increase number of research and standards in the area of process and content management for government and cross-government systems. Egov-bus also aims to have "capability of creating advanced applications of electronic signature enhancing acceptance of the technology and establishing trusted system validity for e-Government applications, web services, processes and platforms" [6]. Decrease on combination cost of many e-Government projects is the key effect of this project.

Ontogov(http://www.ist-world.org/ProjectDetails.aspx?ProjectId=f0b608ec90854d40be7eaca3abcef863) - aims to come up with a new, advanced, standard ontology for the service lifecycle of e-governments. The ontology concerns various stages from definition and design

processes to the execution and reconfiguration of the services. The ontology also aims to generate a modified platform to allow public administrations to act like their workings of owned e-government services.

ICTE-PAN (http://www.eurodyn.com/default/page-view_category/catid-16/id-40/type-press.html) – aims to enhance public administration operations through finding new and original methods to model public administration functions. Another objective of ICTE-PAN (Intelligent Collaboration and Transaction Environments in Public Administration Networks) is generating ways to turn these models into design arrangements to allow e-governments to computerize and recreate complicated bureaucratic procedures.

SMARTGOV[7](http://smartgov.e-gov.gr/index.php?category=description&langid=eng) - aims to determine and generate a storage area to facilitate governmental transactions and examine different methods for the public sector as well as various, related social issues.

PISA (http://www.cbpweb.nl/downloads_artikelen/art_jbo_2001_pisa.pdf) – aims to assist the European Directive 95/46/EC and 97/66/EC to protect personal data through combining Software, Internet and E-commerce.

2.4 Examples from Turkey

Turkey has a fairly advanced E-government system in terms of making data and services available. In other words, the E-government examples in Turkey have been efficient in knowledge sharing and providing their services to the citizens [8]. However, there have not been too many studies on potential usability problems because of various levels users' skills and understanding of the system. A quick examination of the e-government websites in Turkey shows that the experienced problems of these sites are related to menu and content design, inactive links and link titles, and inoperative search boxes. The design and content of government websites plays a very important role in their functionality and efficiency as well as their duration.

E-government websites in Turkey mostly operate on an ad-hoc based system. Despite the significant development and growth achieved in Turkish e-government websites, interoperability still remains a major issue. The MERNIS project [9] is the most significant attempt which aims to resolve the difficulties of establishing interoperability. MERNIS is an initiative of the Ministry of Interior Affairs and the project has been circulating TC Identification Numbers online since March 12, 2001. The project allows government officials to store identification numbers online and has enabled 70 thousand citizens to find out their identification numbers online.

The MERNIS Project will constitute the basis of Turkey's online information systems [10]. It will ease valuable infrastructure studies, mainly affecting the information systems of other projects being launched in Turkey.

The MERNIS Project also involves submitting the ID numbers to the Presidency of the Turkish Republic, the Constitutional Court and to the Police Organization within a diskette. The Project will become even more useful when ID numbers become mandatory in all Turkish institutions. In current situation, the ID numbers are added to Turkish ID cards only when the individual needs to change his/her card or when the individual is being issued a card for the first time. Moreover, all other government departments and offices use ID numbers via online systems or on their pre-printed application forms to track citizen with a unique number. Turkish government started ID CARD renewal project before local elections to clean up ID cards without ID numbers not written on it. Citizens whom still did not renew their ID cards and wish to find out their ID numbers can visit http://tckimlik.nvi.gov.tr and search their unique ID number.

MERNIS stands for Central Public Registration Administration System Project. MERNIS will make information technology available for accepting applications through government. It will enable central population data stock formation by getting data from each database of the headquarter district population. The project will also provide services for accepting submissions for ID numbers from each Turkish citizen. By generating this architecture, Mernis system will support the information trade between the public and private sectors. Consequently, MERNIS will be the most reliable population statistics for Turkey. Population records of about 100

million people, living and dead, which are currently archived by the register of births, will be stored technologically through the MERNIS Population Project.

MERNIS gained speed in 2000 and has now reached its last stages. It constitutes the infrastructure of Turkey's National Information System. The MERNIS project aims to organize the register of births and advance its infrastructure enough to gain absolute control over the organization of the register. It is achieved; this goal allows the register of births to be stored in a secure manner. It is now to calculate the available population information by the help of address registration population system. The Project will treat the data in the register of births as statistical information and use it to gather population and family statistics. By giving unique ID numbers to each citizen, potential problems concerning name similarity will be eliminated and information trade between public institutions will also be accelerated. The Project will also improve the efficiency of studies on new identity cards. Recently, in order to make Turkish ID cards more secure and available online usage, related departments are working on embedding a smart chip on identity cards.

Table 2.3 contains a list of the most popular E-government services from Turkey.

Table 2.3 E-Government Examples from Turkey

E-Government Office (service)	Service Definition	Service Link
Turkish e-government	e-Government of turkey providing organized e-Government services and web sites for citizens. Portal has e-sign and m-sign options for the integrated web sites.	www.turkiye.gov.tr
Ankara city portal	Ankara city portal giving combination of services for citizens and companies.	www.ankara.bel.tr
Personal documents: passport and driver's license	Information and online application facilities are available for 38 out of 81 provinces.	http://www.egm.gov.tr
Vehicle Tax Office	Your Vehicle's tax amount can be reported by your plate id, Tax ID, registration date.	https://intvd.gib.gov.tr/internetvd/index.jsp
Social Security Office Worked Years' Reports	You can query your monthly payment to SSK. You also see when you will be retired by SSK. You also can see the dept amount if you have.	http://www.sgk.gov.tr
IGDAŞ Internet office	You can query your İGDAŞ dept by your service and apartment number.	http://www.igdas.com.tr/Dynamic/AboneDurumSorgulama.igd?MI=2&CMI=374&MCI=303
ISKI Internet office	You can query your ISKI dept by your service number. You should be registered to the web site in order to do that.	http://su.iski.gov.tr/pls/int2/INT11.uye_sifre
Income taxes: declaration, notification of assessment	You can do all of your transaction about corporate tax office	https://vedop.mb-ggm.gov.tr/internetvd/login.jsp
Kadıköy Municipality E-Government	Registration and Permission Applications	http://yeni.kadikoy.bel.tr/altsayfa.jsp?pid=353
Income taxes: declaration, notification of assessment	"You have no tax depth" paper can be taken online	http://www.gib.gov.tr/dilekce/Borc_Yok_Yaz_Alm_Dil.html
Income taxes: declaration, notification of assessment	Tax plate application can be doe online	https://intvd.gib.gov.tr/internetvd/index.jsp
Türk Telecom Bill Amount and Payment	You can get your telecom line dept amount and also pay that. You are required to be signed in to do online transactions.	http://www.turktelekom.com.tr/tt/portal/OnlineServisler/

Chapter 3
Interoperability Technologies

This chapter will examine the technologies and criteria used in establishing e-government interoperability.

3.1 Overview

Establishment of interoperability will link different systems, operations, data, and functionalities together internationally and nationally. Interoperability can also be understood as exchanging of information with the enterprise sector [11]. It generates data flow between organizations, extending beyond organizations to administrations, enterprises and/or citizens. Below are three important modes of interoperability:

- Technical interoperability is a collection of technical aspects such as connecting computer systems, open interfaces, data and protocols by also including telecommunications behind the systems.
- Semantic interoperability more focuses on the meaning of exchanged data between the applications and systems. Different data and information should be shared with an understandable manner which is a main role of semantic interoperability.
- Organizational interoperability proposes business operations according to the organizational objectives by using information architecture. Organizational interoperability also means setting connection between different business processes.

3.2 Interoperability Levels:

Interoperability has three levels:

- Technical interoperability
- Semantic interoperability
- Organizational interoperability

Interoperability levels are detailed below.

3.2.1 Technical Interoperability

Interoperability looks like it is enough by itself even though information systems did not achieve the same level of interoperability in telecommunication and postal systems. Interoperability recently accelerated itself by the new internet technologies which are mostly functioning universally as accepted standards. The Internet presents a good example of technical interoperability. The Internet allows computers and information sources from around the world to exchange information through a universally comprehensible format. For example, emails are exchanged through following universal protocols such as TCP/IP (Transmission Control Protocol/ Internet Protocol), HTTP (Hypertext Transfer Protocol) and S/MIME (Secure / Multipurpose Internet Mail Extensions).

3.2.2 Semantic Interoperability

XML (the Extensible Markup Language) is a unique language which separate content from presentation. This characteristics allows the provided data be selected, reformatted, restructured easier. Due to this feature, the Extensible Markup Language is the new way on data exchanged over the internet. On the other hand, XML does not solve all the problems of semantic interoperability. XML models and data meanings can be different from each other that may cause problems in incorporations resources. Semantic interoperability aims that any data be translatable and made accessible to systems which may be different from each other.

Semantic interoperability is very useful comparing to keyword-based matching method which has many problems in it. Users do not find any results or have so many records which are not related to the search made by the user in these keyword-matching methods. One of the causes of this problem is that there are words which have one meaning or there is a word which has multiple meaning. If semantic interoperability exists in the definition of web pages, this terminology will guide the users to find answers to the questions of his/her specific needs. Precise results on the queries will be provided.

Semantic interoperability can also assist intelligent internet agents. Changes in the web page format can negatively affect these agents. Changes in presentation would not affect these agents if the pages were in XML, even though a change in data representation may seriously damage them. Consider the element <GOOD>. If it were changed to <PERGOOD>, these agents could break. The following example could give a better idea about the problems arising from the lack of semantic interoperability in these agents. A travel-planning agent would need information from various sites such as airline, hotel, rental Car Company, weather, and tourist sites, most of which will be using different methods to present their data. The travel-planning agent would then have to translate the differences in data representation into a common language which will be more understandable by program.. As a result, it is obvious that semantic interoperability makes such agents less sensitive to changes and differences in language and allows these agents to automatically process information from various sources.

The Internet is functional because it provides universally agreed standards for data representation. However, there is a difference between presenting information and exchanging or combining information with different information resources, processing the information gathered in a comprehensible and sensible manner [12]. For this next step, there has to be an agreement on more complex issues regarding information context. Semantic interoperability works on establishing this agreement on issues such as methods of discovering, presenting and attaching a context to available information. Through this agreement, web applications would be able to share and process information despite differences in their designs.

The aim of semantic interoperability is to make information immediately understandable which makes particular information available to be used by other applications. Currently, the Internet only allows information resources to be connected and to be shared immediately.

Semantic interoperability can be applied to e-government systems. A possible example would be the access of one Member State's information resource by another Member State's computer application to authenticate the taxation status of an enterprise. Another example would be validating the social welfare status of one of the citizens of the other Member State [13]. If semantic interoperability were achieved, this would be as simple as checking the status of enterprises and citizens belonging to the investigating Member State. In this case, semantic interoperability would eliminate the need for foreknowledge about the other administration's use of information. Another example that proves the efficiency of semantic interoperability would be the semantic and technical interoperability of geographic information, which would ease environmental monitoring and coordination of disaster relief by promoting trans-border and intra-agency teamwork.

3.2.3 Organizational Interoperability

Systems are supposed to be generated with structures which may be a hierarchical organizational structure. Hierarchical structures are commonly used in old fashioned organizations where most commonly paper-based information systems are implemented. Paper-based information systems consist of closed, vertical, personalized information systems. They are unable to share information across different department within the organization. These issues bring organizational problems in term of automating current flows and re-using of current information.

The traditional hierarchical systems have limited capabilities while trying to enlarge the scope of their businesses to include suppliers, partners and customers. Supply chain management systems are mainly focused on that topic. The objective of interoperability in this case is to enable business between different organizations with different internal operations. Successful implementations provide more interoperable

systems which increase business profits in terms of sharing information and organizational operations. [14].

Organizational interoperability concerns itself with the organizational issues outlined above. It is a precise part of interoperability in general. Organizational interoperability allows people to do business over the Internet no matter where they are or where they work. Those systems also operate by itself without human intervention. This type of e-business solutions are supposed to use benefits of organizational interoperability to be accomplished.

Interoperability helps organizations in the public and private sectors to share and re-use information internally and externally to achieve their common goals.

3.3 SOA for interoperability

Interoperability is pretty easy to have if guidelines of Web Service Interoperability Organization (WS-I) could be used. WS-I have Basic Profile (BP) 1.0, 1.1,1.2 and 2.0 recently. Basic Profile Working Group of WS-I is currently working on version 1.1 and 2.0 to make those profile applicable to interoperable web services. Basic profile [15] mainly describes how to utilize Web Services regulations together to establish interoperable Web Services, covering technologies on four areas:

- Messaging
- Description
- Discovery
- Security

Basic Profiles lists limitations and explanations useful for the utilization of base regulations and gives information about how to use these specifications together.

Simple Object Access Protocol (SOAP) 1.2

SOAP utilizes an XML based object protocol, meaning all of its encoding is in XML, in order to enable a decentralized flow and exchange of information. An envelope

containing the required framework to describe the contents of a message and how to manage this content, a series of encoding rules necessary to communicate application-defined data categories, and a convention that signifies procedure calls and responses comprise the SOAP.

SOAP is a protocol for distributed applications and for communications of web services by using remote procedure call model. It utilizes an XML based object protocol which mean all of its encoding is in XML. Although it is pretty new for distributed applications, by its base and using XML language it has the first priority as a most suitable protocol for web services. Flexibility of XML also affects SAOP positively in terms of simplicity and platform independence. SOAP operates XML for message protocol and HTTP for transfer protocol.

SOAP's main aim is to give guide to the other machines about what they should do. When we examine SOAP in terms of interoperability, its ability to make scripted web applications to operate among the systems outside makes is popular. An example would be linking desktop tools to highly advanced document management and internal systems and applications found on servers.

Web Services Description Language (WSDL) 1.1

Like SOAP, WSDL utilizes an XML-based language to detail models that outline Web services. It provides information while we need on communication to a web service. It also publishes information about web service methods and functions in XML format. World Wide Web Consortium (W3C) has not recommended Version 1.1 of WSDL, Version 2.0 is now in recommendation list of W3C.

The WSDL document of a web service has 4 major elements. First one is type which provides the knowledge about data types used in this service. Next element is the message which details the messages of the applications. Messages can have one or more parts which may be assumed as parameters or return values of functions as in traditional programming languages. Classes and combinations of functions are detailed in the port part as third element. All operations performed by the web service is explained in this element at full length. Binding element is the last one. It

details message format and protocol which are used in every single port of a web service. Name and type parts are combined together to create this single bindings element. WSDL is able to describe the public interface for the use of the web service.

A common use of the WSDL also includes the SOAP and XML Schema. It is used in combination with SOAP and XML Schema to make web services available over the Internet. WSDL enables client programs connecting to the specific web service to determine the scope of operations available on the server. It also provides web service details using its four major elements in XML Schema format. At this point, the client uses SOAP to call one of the operations embedded in the WSDL.

Universal Description Discovery and Integration (UDDI) 2.0

UDDI (Universal Description, Discovery and Integration) is not as essential for web services as are XML, SOAP, or WSDL, but it is still highly useful for web services in J2EE as their primary component. UDDI's purpose is to describe standards for publishing and finding web services online. It has member mechanism to provide best matches of required services by the members. It functions as a storage area that contains an inflexible data structure to describe companies and their web services. UDDI came up with being a 'yellow pages' of web services to increase profit and save time of finding best suitable web services for an enterprise.

XML 1.0 (Second Edition)

XML, Extensible Markup Language, is an application profile, which can also be described as a restricted SGML, Standard Generalized Markup Language [ISO 8879]. XML documents are structured to function as conforming SGML documents.

XML was designed to store and transport data mainly focuses on data structures. XML shows itself more on carrying information between systems or application. A program, which is able to read text file and aware of XML language, can also read XML file. One purpose of XML documents is to hold parsed and unparsed data in storage units called entities. XML is system and platform independent in a way of storing data which makes sharing data between applications much easier.

XML is not a functioning language; it is pure explanation of data structures in a tagged explanation which will be seen in chapter five while explaining MERNIS web service.(Figure 5.3)

XML Schema Part 1: Structures

The importance of structures is that they explain the XML Schema definition language, which provides the means to describe the structure of XML 1.0 documents and limit their contents. Structures can also be used for the XML Namespace Facility. The schema language (embodied in the XML 1.0) using namespaces has an important function in the reconstruction of the XML 1.0 document type definitions' (DTDs) options. This specification depends on XML Schema Part 2: Data types, which are outlined below.

XML Schema Part 2: Data Types

Part 2 of XML Schema language regulations involves data types. Part 2 basically outlines the capabilities needed for defining which data types should be used in XML Schemas and in other XML specifications. XML 1.0 includes data type language, which offers a structure which exists in DTDs to understand more about data types on elements and characteristics.

RFC2246: The Transport Layer Security Protocol Version 1.0

A descendant of the Secure Sockets Layer protocol (SSL), TLS enables secure communications on the Internet for operations such as e-mail, faxing and other similar data transfers. Despite some basic differences, the protocols of SSL 3.0 and TLS 1.0 are essentially the same. TLS is located on the OSI model's Application Layer. OSI model's application is very useful and highly needed to debug and troubleshoot encryption problems in the TLS.

RFC2459: Internet X.509 Public Key Infrastructure Certificate and CRL Profile

This section is simply intended as a basic overview of the Internet X.509 Public Key Infrastructure Certificate and CRL Profile. There will be additional information and details on the format and semantics of Internet name forms, such as IP addresses, in relation to the X.509 v3 certificate formats. Standard certificate extensions and one new Internet related addition are described, while a required set of certificate extensions is listed. Furthermore, the X.509 v2 CRL format, an algorithm for X.509 certificate path validation is described and a required extension set is defined. Additional information is given out regarding the description of public keys and digital signatures in X.509 certificates for common Internet public key encryption algorithms (i.e., RSA, DSA, and Diffie-Hellman). ASN.1 modules. Other examples can be found in the appendices.

RFC2616: HyperText Transfer Protocol 1.1

The Hypertext Transfer Protocol (HTTP) is a generic, stateless, application-level protocol for distributed, partner, hypermedia information systems. However, it is multifunctional and its services extend beyond hypertexts, including its capacity to be used as part of name servers and distributed object management systems. It works using request/response methodology. Its request methods, error codes and headers can be extended for these purposes. Its unique and negotiated data representation makes transferring data available between systems

HTTP is best known for its close connection to the Internet. The World-Wide Web global information initiative has been utilizing the Hypertext Transfer Protocol since 1990. This specification is an update to RFC 2068 and defines the "HTTP/1.1" protocol.

RFC2818: HTTP over TLS Transport Layer Security

Secure Sockets Layer (SSL) and its successor Transport Layer Security (TLS) both function as cryptographic protocols. They enable secure communications on the

Internet for operations need to be secure like web browsing, e-mail, faxing, instant messaging and other similar data transfers. Despite some basic differences, the protocols of SSL 3.0 and TLS 1.0 are essentially the same. This section uses the term "TLS" to denote both protocols, unless clarified otherwise.

The Secure Sockets Layer Protocol Version 3.0

The TLS Protocol essentially aims to enable privacy and data integrity between communicating applications. It contains two layers including the TLS Record Protocol and the TLS Handshake Protocol. The TLS Record Protocol functions at the lowest level, used with other well known transport protocols such as TCP. The TLS Record Protocol's purpose is to provide secure connections. Secure connections denote two things:

- The connection is private and symmetric cryptography is used for data encryption (e.g., DES [DES], RC4 [RC4], etc.) Each connection has a specific key for symmetric encryption, which is based on a secret determined by another protocol such as the TLS Handshake Protocol. It is possible to use the Record Protocol without encryption.
- The connection is reliable. A keyed MAC is utilized for the message integrity check included in message transport. MAC computations occur through secure hash functions (SHA, MD5, etc.) The MAC is not absolutely essential to the operation of the Record Protocol, but it is useful when another protocol is using the Record Protocol as a transport for determining security parameters.

The TLS Record Protocol summarizes other higher-level protocols, such as the TLS Handshake Protocol. The TLS Handshake Protocol enables the server and the client to validate each other and to determine an encryption algorithm as well as cryptographic keys before the first byte of data is received or transferred by the application protocol. It also establishes connection security, the basic characteristics of which are detailed below:

- Asymmetric or public keys, as well as cryptography (e.g., RSA [RSA], DSS [DSS], etc.) can be used to validate the peer's identity. While the

authentication process is not mandatory, it is usually required for at least one peer.

- The negotiation of the secret is secured- the determined secret cannot be intercepted by eavesdroppers and cannot be obtained by attackers even if they intercept the connection.
- The negotiation is reliable: the parties included in the communication can detect any potential attacker trying to alter the negotiation communication.

TLS' major advantage is that it functions independently of application protocols. TLS Protocol can have higher-level protocols layered on top of it transparently. However, the designers and implementers of these layered protocols have to decide how to interpret the exchanged authentication certificates and how to begin the TLS handshaking on their own, because the TLS does not outline how protocols add security with TLS.

Interoperability is fairly easy to achieve if the abovementioned specifications are met and the Web Services are established by methods listed in the Basic Profile guidelines. All utilized products have to be in line with the Basic Profile to obtain interoperability.

3.4 XML for Interoperability

Systems use different languages and different ways to communicate. Successful communication needs taking the same language which is not always the case as usual. A meaningful language is required to successfully transfer information between different applications. Data structures of internal programs are always seen as how they are mapped. Making the systems agree on a set of format for data exchange may create problems. Defined formats in a systems means limitations on data structures and schematics of programs. By those acceptances, systems become conditional to internal decisions.

Interoperability in internally conditional systems does not always provide interoperable structure. As the processes of the internal structure changes or new data fields are introduced, the connector or the systems will require updates. In order to

overcome this problem, more flexible and complex connectors are required. Those connectors may adapt to system changes without a manual step or internal data change in order to fix the problems which may appear on establishing interoperability.

A data communication language assumed for the domains is the eXtensible Markup Language (XML) [16]. XML is a flexible, meta-language used for data communications. XML is generally the language adopted in domains. XML has the ability to resolve various problems including parsing and character encoding recognition that makes XML the most efficient framework for building interoperability. For example, well designed and defined XML data structure will ease analysts work to do. An analyst will work more on understanding the systems instead of coping with data structures.

XML also contains other technologies that might facilitate establishing interoperability. Below are brief outlines for these specific technologies:

- XML Linking Language (XLink) [17]: XLink assists in the process of drawing random associations between Resources
- XML Schema: XML Schema functions as a schema description language for XML documents [18, 19, 20];
- XML Style sheet Language Transforms (XSLT): XSLT is a language that enables the identification of transformations between XML documents [21].

As a result, these technologies are significant when we consider translation of processes. On the other hand, they do not help with the process of determining the actual associations between documents [22]. Last of all, these technologies do not eliminate the constant need for human intervention, which do not eliminate the need of complex connectors.

Chapter 4
Interoperability in e-Government Services

Establishing interoperable e-government systems among Member Countries is one of the important projects of European Union (EU). European Union has decided to utilize pan-European e-Government services' specifications. The properties of PEGS primarily consist of establishing the infrastructure necessary for achieving interoperability at the pan-European level. Almost all of the States in EU have been using interoperability frameworks and middleware already. PEGS provides the additional components which are necessary to support e-Government services at the pan European level which makes it needed by EU states that already have interoperable systems in use. PEGS might be considered the "middleware of middlewares" [23], because it enables linking national middleware.

The figure one simulates the four cases which use levels used to define interoperability in PEGS [24]: *Trivial Interoperability* between administrations with common business operations, semantics, and protocols; *Technical Interoperability* between administrations with common business operations, common semantics and different protocols; *Semantic Interoperability* between administrations with common business operations, different semantics and different protocols; *Organizational Interoperability* between administrations with different business operations, semantics and protocols.

When any inter-work need appears between two Member State Administrations (MSAs) we have to cope with couple of challenges because of their service implementation's being specific to itself.. These ways of service implementations can be classified four generic cases as classified in Figure 4.1.

In case 1, there are MSAs which would like to run incompatible business processes and they desire to inter-operate. These MSAs have two choices to inter-operate. They can inter-operate by means of a “procedural gateway”. On the second choice, in order to qualify in the second case, they can implement a procedural adaptation of their business processes instead of using procedural gateway provided by trusted organizations [25].

In case 2, there are MSAs which would like to run compatible business processes without a common semantics. For example, they have similar business objects but do not use the same language to describe business objects they have. Their business object might be classified differently. In this case, MSAs have two choices. They can inter-operate by means of a “semantic gateway” created by trusted third parties. In order to qualify third case , the MSAs could implement a semantic transportation of their business objects rules into the rules of the destinations MSAs which means one MSA will obey the rules of the other one. This can be said as standard rules between the MSAs. This chance is typically is a long term process to become really effective. In many cases, such efforts were initiated to harmonize certain part of business object rules. On the other hand, many other harmonization efforts could not been addressed for different reasons.

In case 3, there are MSAs which would like to run compatible business processes with a common semantics. They still may not be able to trade electronic data effectively, because they may use different units, different protocols, different syntax, different languages, and different message formats, different character sets and so on. These MSAs can inter-work using the name of “technical gateway” by means of technical conversion provided. As an alternative way, the two MSAs could provide technical adaptation by themselves. When a successful technical adaptation is generated MSAs are classified ready for the fourth case.

In case 4, there are MSAs which would like to run compatible business processes with a common semantics, character-set, language, formats and common protocols. They do not need any gateway but require interconnecting transport and network infrastructure. This case will be referred as transparent or trivial inter-working.

In Figure 4.1, an overview is given for the above four cases of inter-working MSAs.

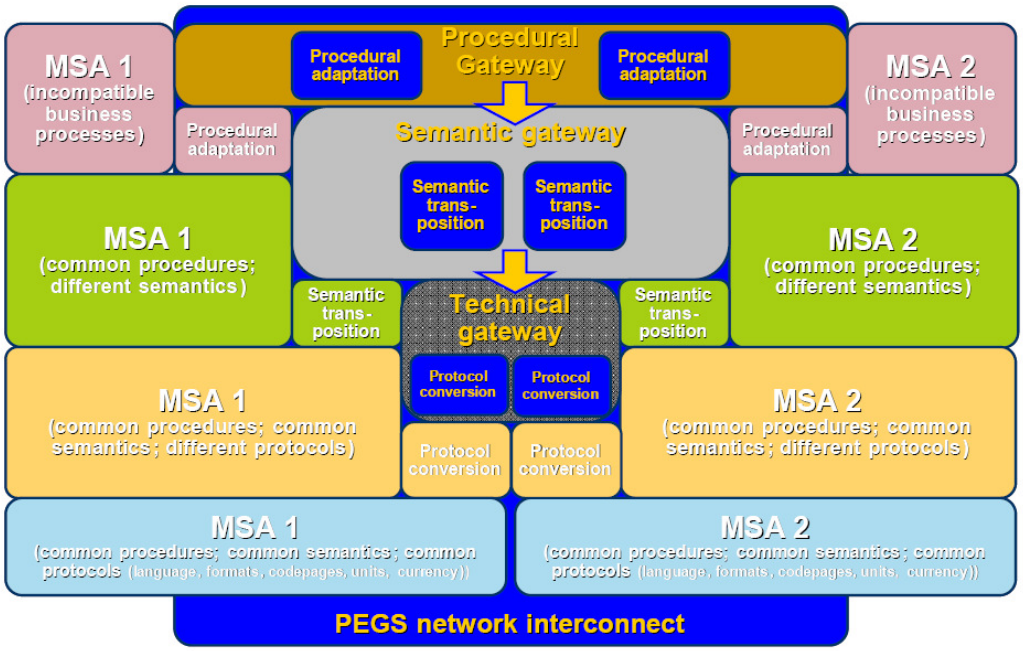

Figure 4.1 PEGS Infrastructure

The IDABC (Interoperable Delivery of European e-Government Services to public Administrations, Businesses and Citizens) Programme is one of the biggest supporters of PEGS to be developed to the European Union. IDABC includes lists of potential projects and horizontal measures by grouping public sectors. The IDABC Programme specifies that the Commission is responsible for maintaining PEGS lists for the benefit of businesses and the public. IDABC organize meetings and conferences with the sector leaders to be more focused on how to establish interoperable systems depending on the needs of the businesses and citizens

After the IDABC Decision, the Commission first set out to determine the needs of the citizens and businesses targeted by the PEGS specifications. It started a study in mid-2004, which aimed to list of services required by the citizens and businesses. An additional study was also conducted to determine how best to deliver these services in terms of infrastructure, which will assist in ascertaining the IDABC horizontal-measureslist.

By ensuring that the PEGS meet the needs of businesses and citizens and through establishing a horizontal measures list, the IDABC makes additional benefits to Community policies. Another advantage of the IDABC is that it will eliminate the limits that negatively affect transactions within the internal market. IDABC always enforce Communities to use latest recommended technologies to achieve interoperability. Consequently, due to these contributions, IDABC will eventually enhance European businesses and increase growth and competition within the European Union job market. Public sectors throughout Europe will have better standards. The EU citizens will feel the positive effects of the IDABC Decision while living. IDABC will have an important role in helping Europe fulfill the Lisbon Strategy and the eEurope Action Plan.

4.1 European Interoperability Framework

The European Commission's Interchange of Data Between Administrations (IDA) released the Final Version 1.0 of the European Interoperability Framework (EIF) for Pan-European E-Government Services [26]. The version was released after a ten-month period that included reviewing sessions and feedback from the Member States, industry representatives, and stakeholders. The Telematics between Administrations Committee (TAC) has already approved the version.

IDA the Interchange of Data between Administrations (IDA) is "a Community Program managed by the European Commission's Enterprise Directorate General. IDA supports the implementation of EU legislation, from internal market regulations to consumer and health policies, by facilitating the exchange of information between public administrations across Europe through the use of information technology."[27]

“The European Interoperability Framework document "provides recommendations and defines generic standards with regard to organizational, semantic, and technical aspects of interoperability, offering a comprehensive set of principles for European cooperation in e-government. EIF augments regional and national interoperability programs: "national administrations have developed or are in the process of developing Governmental Interoperability Frameworks for efficient communication

between themselves as well as with citizens and businesses; IDA is complementing this work by adding the pan-European dimension. "[27]

The European Interoperability Framework "supports the European Union's strategy of providing user-centered e-government services by facilitating, at a pan-European level, the interoperability of services and systems between public administrations, as well as between administrations and the public (citizens, businesses). It is an action of the eEurope 2005 Action Plan, under the e-government heading. "[27]

The EIF documents classify seventeen recommendations according to organizational, semantic and technical interoperability. According to the "semantic" Recommendation, XML is an integral part in the formulation of definitions in data exchanges: "Initiatives at pan-European level [designed] to develop common semantics on the basis of XML should be performed in a coordinated way and should consider cooperation with the existing standardization bodies. In particular, the XML vocabularies should be developed whilst taking into account the agreed core/specific e-government data elements. Specific European schemas and definitions should be made available to all pan-European stakeholders through common infrastructures." [27]

The following recommendation outlines the basics of ICT interoperability: "The following principles, of a general nature, should be considered for any e-government services to be set up at a pan-European level: Accessibility; Multilingualism; Security; Privacy; Subsidiary; Use of Open Standards; Assess the Benefits of Open Source Software; Use of Multilateral Solutions." [27]

The European Interoperability Framework Recommendations achieve applicability and validity in two ways. First of all, the approved documents do not establish a legal foundation for standardization and only concerns itself with the policy aspect. Second, the EIF "focuses on supplementing, rather than replacing, national interoperability guidance by adding the pan-European dimension. In order to operate at pan-European level, a Member State administration must therefore already have a national interoperability framework or equivalent technical strategy for the delivery of e-government services in place. However, the recommendations and guidelines of

the Framework and related documents, such as the IDABC Architecture Guidelines, are mandatory for pan-European projects carried out in the context of IDABC program." [27]

The European Interoperability Framework has been prepared by the Commission in collaboration with a group of experts from the Member States. “A draft version was first published on the IDA website in January 2004 asking all interested parties to comment on the document. During the following months, IDA received more than twenty comments on the draft document from reviewers. Issues "related to the governance of and compliance to the document and the definition of open standards outlined in the draft" received most attention in the review; "both points were slightly revised after consultation with the Member States and industry stakeholders." [28]

Chapter 5
An Example

CityPortal project contains three web pages, one web service and 2 integrations of services.
All of the information used in the project will be explained in this chapter.

5.1 Service Definitions

There are tree services in the CityPortal project. First one is for the citizens, second one is for the CityPortal web site (web service), and the last one is for the Electric and Water technicians to use in the installation of their services.

5.2 Design and Implementation Details

City portal project codes were generated using Microsoft C#.Net technology. Web service uses standard WSDL (web service definition language) architectures. Data exchange method is standardized by extensible markup language (XML) version 1.0.

We have three main pages:

- City portal: Local people log in to the portal to apply new electric line and/or water line installation when they move to one apartment to the other. Page asks users' TC ID number and the other identical data to authorize the user if it is real or fake application. City portal works with our web service which is similar to 'mernis project'.
- Local electric company registration flow site: Real registrations of citizens are listed in this site with the address and other applicants' data. Installations are done depending on the data which come from city portal.

- Local water company registration flow site: Real registrations of citizens are listed in this site with the address and other applicants' data. Installations are done depending on the data which come from city portal.

We have three DB tables used by Web Service and installation requests, following Tables 5.1 ,5.2, 5.3 show their data structure. Table 5.1 is used by municipality web portal in order to keep application data by the citizens. Successful applications are written into database with the uninstalled status which is mainly important for `basvuru sorgulama/islem sayfasi` which is another user of cityportal_people table while querying recorded data for the technicians. Tables 5.2 and 5.3 are used in Mernis web services. Table 5.2 holds the citizen information of the nation. Table 5.3 contains systems users whom are registered as authorized users of Mernis system. Mernis system controls each out coming connections to its web services and need authentication by user/password which is kept in Table 5.3 in our example application.

Table 5.1 CITYPORTAL PEOPLE table definition

ID	int	Unique row ID
SSN	varchar(50)	Social security number of applicant
FIRSTNAME	varchar(50)	First name of applicant
LASTNAME	varchar(50)	Last name of applicant
BIRTHDATE	varchar(50)	Birth data of applicant
MOTHERNAME	varchar(50)	Mother name of applicant
FATHERNAME	varchar(50)	Father name of applicant
TEL	varchar(50)	Phone number of applicant
ADDRESSS	varchar(250)	Home address of applicant
ETESNO	varchar(50)	Electricity line number of application
STESNO	varchar(50)	Water line number of application
STATUSS	int	Status of application installed/not installed

Table 5.2 MERNIS_MERNIS table definition

ID	int	Unuque row ID
SSN	varchar(50)	Social security number of citizen
FIRSTNAME	varchar(50)	Citizen name
LASTNAME	varchar(50)	Citizen last name
BIRTHDATE	varchar(50)	Citizen birth date
MOTHERNAME	varchar(50)	Citizen mother name
FATHERNAME	varchar(50)	Citizen father name
BIRTHPLACE	nvarchar(50)	Citizen birth place
MARITALSTATUS	nvarchar(50)	Citizen marital status
RELIGION	nvarchar(50)	Citizen religion
BLOODSIGN	nchar(10)	Citizen blood sign
REG_CITY	nvarchar(50)	Citizen registered city
REG_PROV	nvarchar(50)	Citizen registered province
REG_STREET	nvarchar(50)	Citizen registred street
REG_PAGE	nchar(10)	Citizen registered page
REG_FAMILYNO	nchar(10)	Citizen registered family number
REG_ORDERNO	nchar(10)	Citizen registered order number
ID_PLACE	nvarchar(50)	Citizen registered id card place
ID_REASON	nvarchar(50)	Citizen registered id given reason
ID_REGID	nvarchar(50)	Citizen registered id
ID_GIVENDATE	nchar(10)	Citizen id given date
ID	int	Citizen card id
SSN	varchar(50)	Citizen social security number

Table 5.3 MERNIS_USER table definition

ID	int	Unique row id
USERNAME	varchar(50)	Web servive system user name
USERPASSWORD	varchar(50)	Web service system user password

Interactions between the services and the pages are shown in Figure 5.1. As a brief description of Figure 5.1; city portal web site calls `Mernis` web service (named as TC ID web service in figure) then TC ID web services connects to its database to gather information then answers to city portal web site. City Portal Web Site system algorithm decides to continue or stop giving error messages depending on the answers acquired from `Mernis` system. System writes successful applications to its corresponding tables as shown in the figure. More understandable system flow is discussed in the next chapter giving screen shots of user interface in each step.

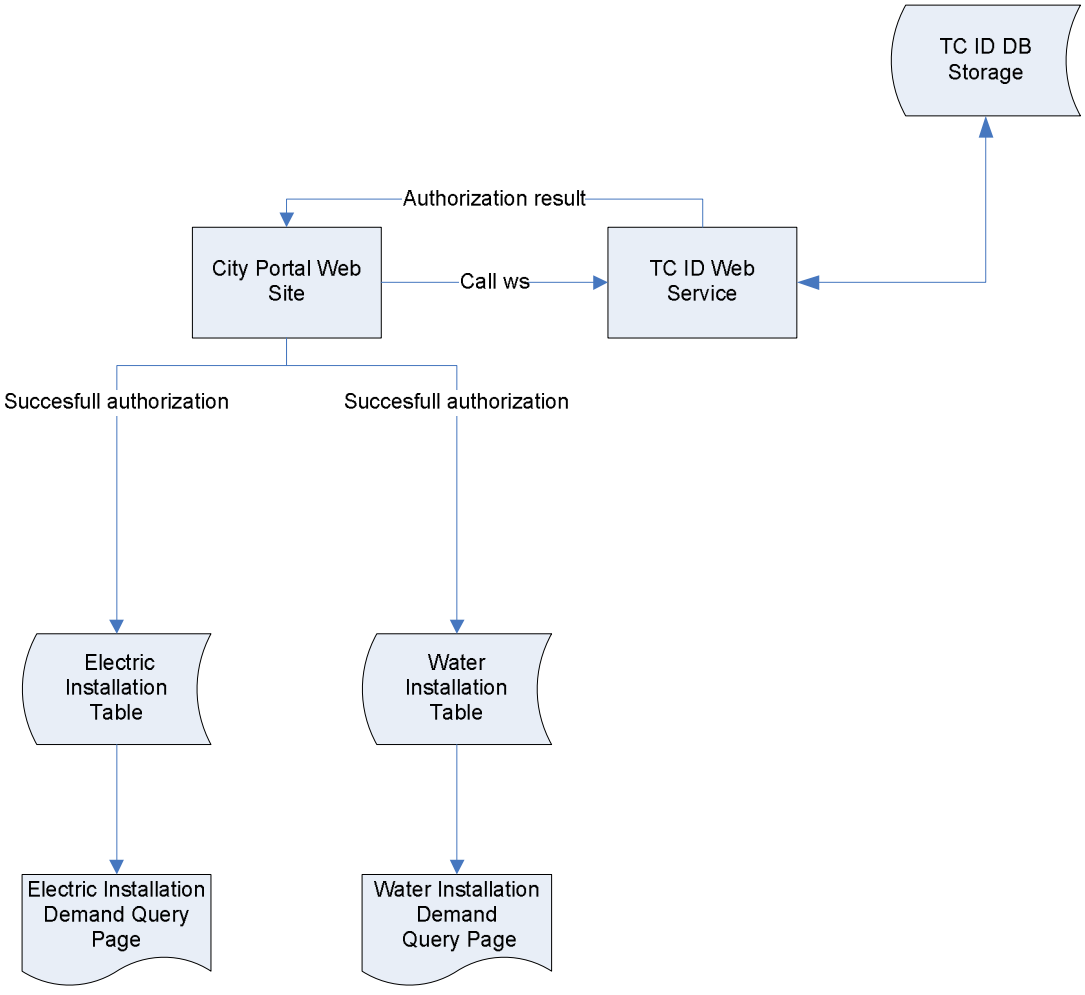

Figure 5.1 CityPortal Project Workflow Diagram

I would use `mernis project` for real time `user authorization` instead of my own created web service. Although I have completed my analysis on Mernis, Turkish government decided to close public usage of mernis in 2006 which I have end up with using my own mernis like web service. Now, Mernis is accessible for the government usage and other foundations related to the Turkish government by paying very small amount of search fee.

Our web service authorizes the citizens by the unique TC Kimlik No id. Web service's algorithm is very similar to `Mernis` example which we mentioned before. First of all, Mernis web service ask user/password which is given to your company or division in order to communicate your applications with mernis system Mernis does not allow unauthorized connections' query attempts. After you provide successful user/password combination, mernis web service authorizes the citizens by their identity card's TCID which we call 'input' to the web service. When TCID exists in mernis system, mernis web service returns set of given TCID detail identity information (birth place, father name, mother name and so on) for your usage.

Web service Name Space details are given in Figure 5.2. This definition is usable to understand more about mernis web service which is named as Service1 in out example code. As seen at the beginning of Figure 5.2, definition section explains that this web service has two operations. AuthenticateUser function has to be used to authenticate your connection to the mernis web service. You should first call this function to get permit in order to use the web service by giving the correct user/password combination. GetMernis function return's data about the given SSN in XML format as we explain earlier in interoperability technology section.

Furthermore, following sections of Figure 5.2 gives coding samples about how to call web services namespace in development environments like c#, visual basic, c++. At the end of last paragraph, more detailed information links are provided.

Service1

The following operations are supported. For a formal definition, please review the Service Description.

- AuthenticateUser
- GetMERNIS

This web service is using http://tempuri.org/ as its default namespace.

Recommendation: Change the default namespace before the XML Web service is made public.

Each XML Web service needs a unique namespace in order for client applications to distinguish it from other services on the Web. http://tempuri.org/ is available for XML Web services that are under development, but published XML Web services should use a more permanent namespace.

Your XML Web service should be identified by a namespace that you control. For example, you can use your company's Internet domain name as part of the namespace. Although many XML Web service namespaces look like URLs, they need not point to actual resources on the Web. (XML Web service namespaces are URIs.)

For XML Web services creating using ASP.NET, the default namespace can be changed using the WebService attribute's Namespace property. The WebService attribute is an attribute applied to the class that contains the XML Web service methods. Below is a code example that sets the namespace to "http://microsoft.com/webservices/":

C#

```
[WebService(Namespace="http://microsoft.com/webservices/")]
public class MyWebService {
    // implementation
}
```

Visual Basic

```
<WebService(Namespace:="http://microsoft.com/webservices/")> Public
Class MyWebService
    ' implementation
End Class
```

C++

```
[WebService(Namespace="http://microsoft.com/webservices/")]
public ref class MyWebService {
    // implementation
};
```

For more details on XML namespaces, see the W3C recommendation on Namespaces in XML.

For more details on WSDL, see the WSDL Specification.

For more details on URIs, see RFC 2396.

Figure 5.2 Mernis Web Service Name Space Details

Mernis web service definition is given in Figure 5.3. Service definitions begin with xml version control and declaration. Web service declarations are in the form of XML version 1,0 and encoding “utf-8” which informs about the language that is used till the end of the document.

In the first part, “wsdl:definitions” section details license for WSDL schema and its web links to be seen. “wsdl:types” is the second part of web service definitions. Web service functions, their required input-output parameters, functions’ returning values and their types are defined in this section.

Service’s port type and its links, different SOAP and SOAP12 definitions and its related web service functions such as “element="tns:AuthenticateUser"” are provided in the next part of web service definition paragraphs in detail. SOAP standard is the key essence since we predict that SOAP plays the main role in terms of interoperability success.

```
<?xml version="1.0" encoding="utf-8" ?>
- <wsdl:definitions xmlns:soap="http://schemas.xmlsoap.org/wsdl/soap/"
    xmlns:tm="http://microsoft.com/wsdl/mime/textMatching/"
    xmlns:soapenc="http://schemas.xmlsoap.org/soap/encoding/"
    xmlns:mime="http://schemas.xmlsoap.org/wsdl/mime/"
    xmlns:tns="http://tempuri.org/"
    xmlns:s="http://www.w3.org/2001/XMLSchema"
    xmlns:soap12="http://schemas.xmlsoap.org/wsdl/soap12/"
    xmlns:http="http://schemas.xmlsoap.org/wsdl/http/"
    targetNamespace="http://tempuri.org/"
    xmlns:wsdl="http://schemas.xmlsoap.org/wsdl/">
- <wsdl:types>
- <s:schema elementFormDefault="qualified"
    targetNamespace="http://tempuri.org/">
- <s:element name="AuthenticateUser">
- <s:complexType>
- <s:sequence>
  <s:element minOccurs="0" maxOccurs="1" name="username" type="s:string"
    />
  <s:element minOccurs="0" maxOccurs="1" name="password" type="s:string"
    />
    </s:sequence>
    </s:complexType>
    </s:element>
- <s:element name="AuthenticateUserResponse">
- <s:complexType>
- <s:sequence>
  <s:element minOccurs="0" maxOccurs="1" name="AuthenticateUserResult"
    type="s:string" />
```

```
    </s:sequence>
    </s:complexType>
    </s:element>
- <s:element name="GetMERNIS">
- <s:complexType>
- <s:sequence>
  <s:element minOccurs="0" maxOccurs="1" name="SSN" type="s:string" />
    </s:sequence>
    </s:complexType>
    </s:element>
- <s:element name="GetMERNISResponse">
- <s:complexType>
- <s:sequence>
- <s:element minOccurs="0" maxOccurs="1" name="GetMERNISResult">
- <s:complexType>
- <s:sequence>
  <s:element ref="s:schema" />
  <s:any />
    </s:sequence>
    </s:complexType>
    </s:element>
    </s:sequence>
    </s:complexType>
    </s:element>
    </s:schema>
    </wsdl:types>
- <wsdl:message name="AuthenticateUserSoapIn">
  <wsdl:part name="parameters" element="tns:AuthenticateUser" />
    </wsdl:message>
- <wsdl:message name="AuthenticateUserSoapOut">
  <wsdl:part name="parameters" element="tns:AuthenticateUserResponse" />
    </wsdl:message>
- <wsdl:message name="GetMERNISSoapIn">
  <wsdl:part name="parameters" element="tns:GetMERNIS" />
    </wsdl:message>
- <wsdl:message name="GetMERNISSoapOut">
  <wsdl:part name="parameters" element="tns:GetMERNISResponse" />
    </wsdl:message>
- <wsdl:portType name="Service1Soap">
- <wsdl:operation name="AuthenticateUser">
  <wsdl:input message="tns:AuthenticateUserSoapIn" />
  <wsdl:output message="tns:AuthenticateUserSoapOut" />
    </wsdl:operation>
- <wsdl:operation name="GetMERNIS">
  <wsdl:input message="tns:GetMERNISSoapIn" />
  <wsdl:output message="tns:GetMERNISSoapOut" />
    </wsdl:operation>
    </wsdl:portType>
- <wsdl:binding name="Service1Soap" type="tns:Service1Soap">
  <soap:binding transport="http://schemas.xmlsoap.org/soap/http" />
- <wsdl:operation name="AuthenticateUser">
  <soap:operation soapAction="http://tempuri.org/AuthenticateUser"
     style="document" />
```

<wsdl:input>
<soap:body use="literal" />
</wsdl:input>
<wsdl:output>
<soap:body use="literal" />
</wsdl:output>
</wsdl:operation>
<wsdl:operation name="GetMERNIS">
<soap:operation soapAction="http://tempuri.org/GetMERNIS"
style="document" />
<wsdl:input>
<soap:body use="literal" />
</wsdl:input>
<wsdl:output>
<soap:body use="literal" />
</wsdl:output>
</wsdl:operation>
</wsdl:binding>
<wsdl:binding name="Service1Soap12" type="tns:Service1Soap">
<soap12:binding transport="http://schemas.xmlsoap.org/soap/http" />
<wsdl:operation name="AuthenticateUser">
<soap12:operation soapAction="http://tempuri.org/AuthenticateUser"
style="document" />
<wsdl:input>
<soap12:body use="literal" />
</wsdl:input>
<wsdl:output>
<soap12:body use="literal" />
</wsdl:output>
</wsdl:operation>
<wsdl:operation name="GetMERNIS">
<soap12:operation soapAction="http://tempuri.org/GetMERNIS"
style="document" />
<wsdl:input>
<soap12:body use="literal" />
</wsdl:input>
<wsdl:output>
<soap12:body use="literal" />
</wsdl:output>
</wsdl:operation>
</wsdl:binding>
<wsdl:service name="Service1">
<wsdl:port name="Service1Soap" binding="tns:Service1Soap">
<soap:address location="http://localhost:2902/Service1.asmx" />
</wsdl:port>
<wsdl:port name="Service1Soap12" binding="tns:Service1Soap12">
<soap12:address location="http://localhost:2902/Service1.asmx" />
</wsdl:port>
</wsdl:service>
</wsdl:definitions>

Figure 5.3 Mernis Web Service Definitions

5.3 Screen Shots of Programs

In the first page, citizens open the CityPortal web site and fill the required information which is used to query mernis system and kept for the installation. In order to query mernis system, program requires the Tc Kimlik NO, field to be full. As shown by Figure 5.4, system requires just the TCID in the first place.

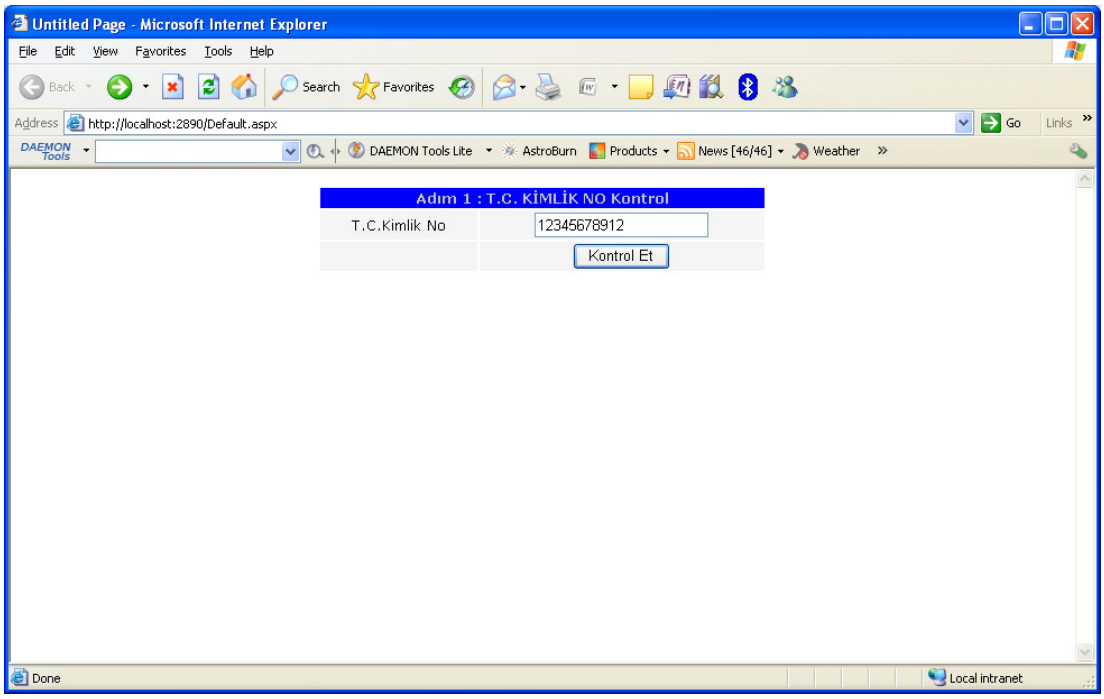

Figure 5.4 First Page

When users click on “Kontrol Et” button, system goes to the next page. Next page detects if the given TCID exist in mernis system or not. Correct TCID information is fetched from the mernis system and two random questions is asked to authorize if that citizen is real or fake.

Completing all the required fields user hit the ‘Kontrol et’ button (shown in Figure 5.4 at the bottom) then page calls the MernisWebService and gets the result. If the result returned by the Web service is true then we see the security check page as seen in Figure 5.5.

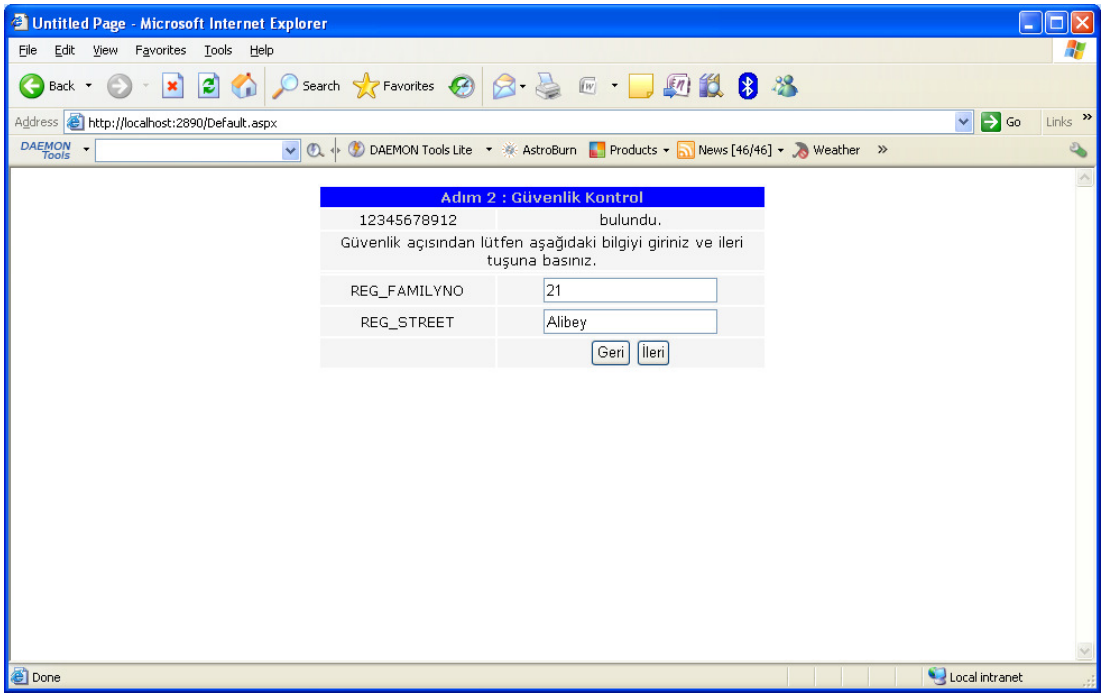

Figure 5.5 Security Check Page

In this state, user is asked to fill two random questions about his/her identity card information. Those information are printed on the ID card, user must held his/her id card in order to continue his application. After required information is given, system checks given ID number in application database if given ID exists in application table. Pre-applied users will be informed with the “Applicant Info Page” (shown in Figure 5.7) by giving previous recourse data. System ready for electric or water application if provided ID is not in the application table. In the third page (shown in Figure 5.6), user is asked to fill address and contact phone number which will be required to double check user information before going to installation. Pressing the “Kaydet” button (show in Figure5.6) page writes the application records in the DB table (Table 5.1), and also shows the unique installation ID for both electricity and water lines.

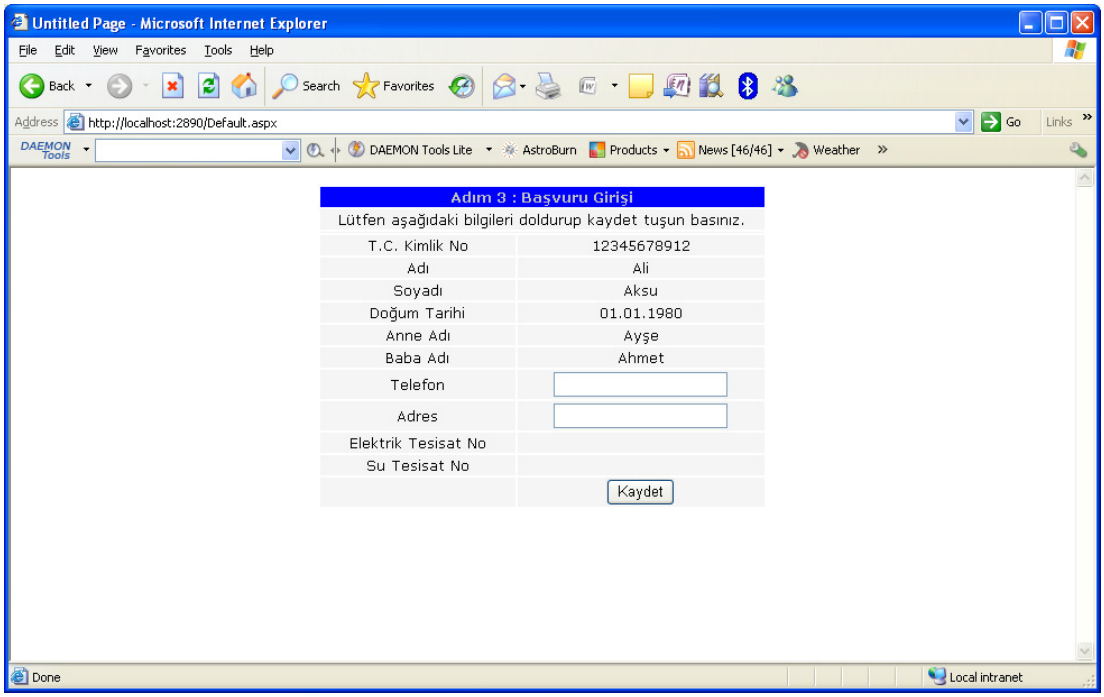

Figure 5.6 Successful Authorization Page

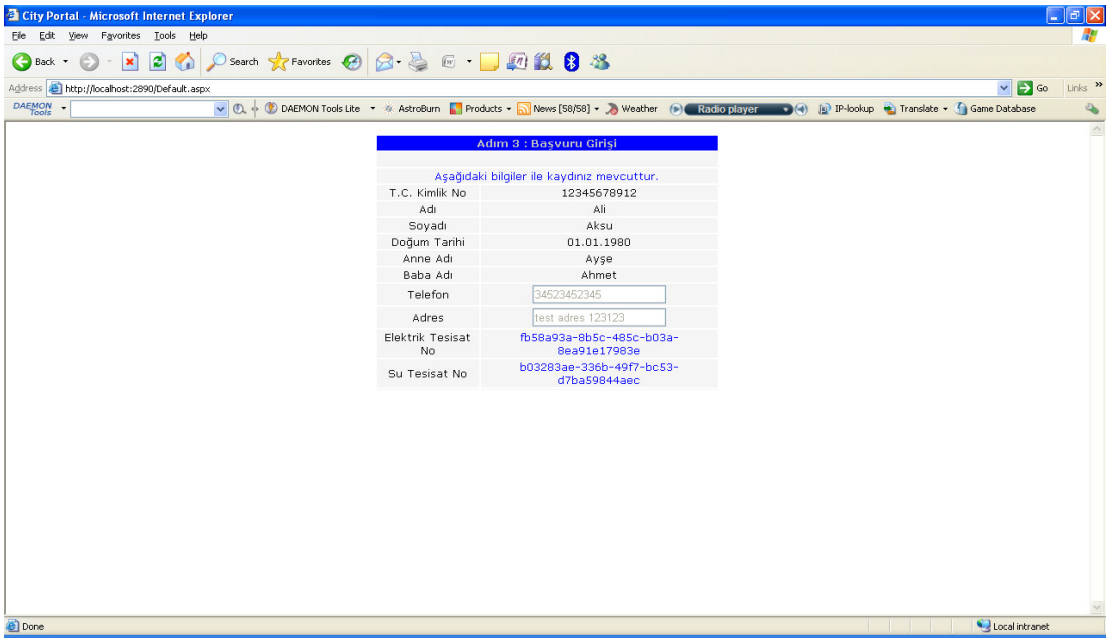

Figure 5.7 Applicant Info Page

In the installation process, responsible workers open the page shown in Figure 5.7 and follow the workflows which are created for current installations. Installation page has filter at the top allowing users to choose installed/uninstalled application filters. When technician completed his installation, he opens the page and finds the

line he currently installed and clicks the diskette button to make application status installed.

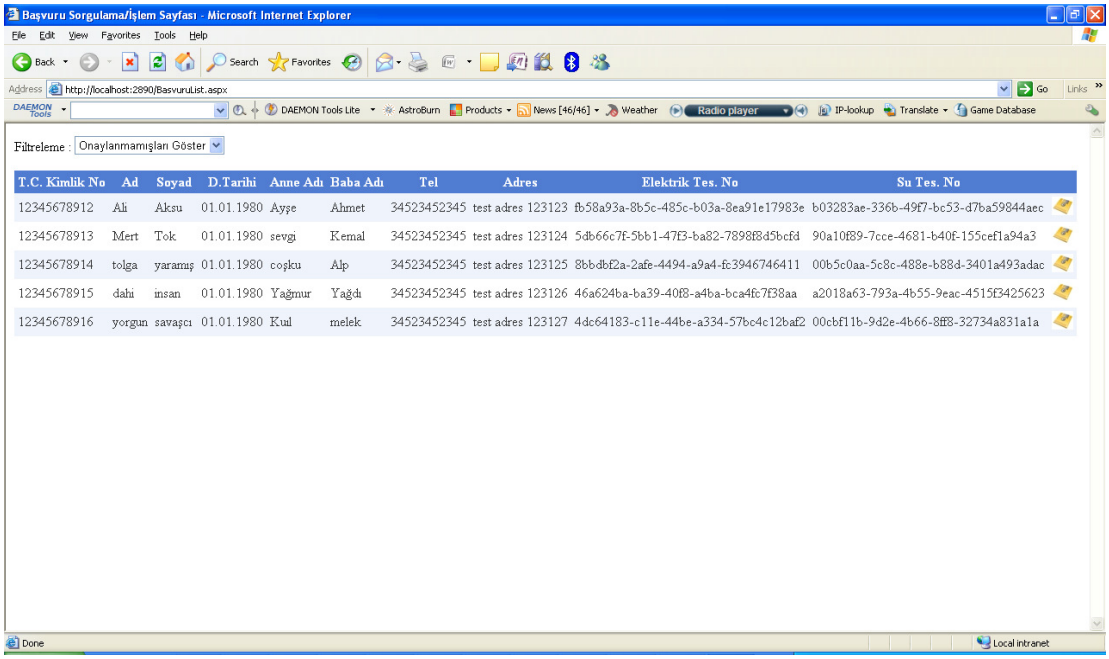

Figure 5.8 Water/ Electric Installation requests web page

Chapter 6
Conclusion and Recommendations for Future Work

Concluding all of the works done and the possible future work to be done will be discussed in this chapter.

6.1 Conclusions

In this thesis, we clearly defined and investigated the `interoperability` concept and its usage in e-government services by focusing on core web service technologies and their standardization works upon e-government services. Best practices were playing the main role helping our exampling and defining works done under the `e-government Interoperability` topic.

This study was a first step in this category. Our example is not a collaborate one; it is just for the ideas we achieved for this work.

6.2 Recommendations for Future Work

In the first place, the electronic authentication of documents and electronic archiving systems are not high enough to stop paper works in e-Government examples. Authentication mechanisms must be embedded into personal computers such as finger print readers. Mobile signature usage is one of the other solutions for secure login purposes. Smart kiosk systems are in use and seem as the most successful windows of governments for the citizens.

Individualizing the e-government services can be one of the future works. Adding artificial intelligence work to individualized services will be a big plus. Services that are served to the citizen can be changed depending on person's situation. For

example, a divorced woman can have rate discount on all the taxes that she is required to pay. Recognition of women's divorced status can be made by MERNIS status as close example which we use in our project.

E-government can also strengthen democracy by improving two-way communication between the citizens and their government. In order to serve high quality and well used services lots of surveys can be done in advanced. It is very important to sense citizens' logic and requirements to make e-government services successfully used by.

Technical interoperating problem can be minimized using SOA as the most appropriate system development framework. More research and exchange of experiences about SOA can be shared through "SOA interoperability portals" among the e-government systems developers.

References

[1] http://www.nvi.gov.tr/Hakkimizda/Projeler,Mernis_Genel.html

[2] What is e-government
http://pa.oxfordjournals.org/cgi/content/abstract/54/1/88

[3] Types of E-Government Websites
http://www.egov.infodev.org/en/Section.78.html

[4] Supreme Court of India
http://www.supremecourtofindia.nic.in/

[5] Good Practice frameworks
http://ec.europa.eu/information_society/activities/egovernment_research/gpf/cases/search_country/index_en.htm

[6] Center for e-Governance program
http://www.egovcenter.info/Database/tabid/1573/Default.aspx

[7] Putting citizens first "Example Projects"
http://ec.europa.eu/information_society/tl/soccul/egov/projects/index_en.htm

[8] E-government Turkey 2007
http://www.epractice.eu/files/Turkey_e-Inclusion%202007.pdf

[9] Mernis Definition
http://www.nvi.gov.tr/92.html

[10] eGovernment Factsheet - Turkey - History
http://www.epractice.eu/en/document/288413

[11] Improving Access to Government through Better Use of the Web
http://www.w3.org/TR/egov-improving/

[12] Cover Pages: Extensible Markup Language (XML)
http://xml.coverpages.org/xml.html

[13] EIF- IDA working document
ec.europa.eu/idabc/servlets/Doc?id=18060

[14] GridWise Interoperability Context- Setting Framework
www.gridwiseac.org/pdfs/interopframework_v1_1.pdf

[15] http://www.ws-i.org/deliverables/workinggroup.aspx?wg=basicprofile

[16] C. S.-M. T. Bray, J. Paoli and E. Maler. http://www.w3.org/TR/REC-xml, October 2000. eXtensible Markup Language (XML) 1.0, W3C recommendation.

[17] C. M. Sperberg-McQueen and Henry Thompson. XML Schema. W3C Architecture Domain, April 2000.http://www.w3.org/XML/Schema

[18] H.S. Thompson, D. Beech, M. Maloney, N. Mendelsohn, editors. XML Schema Part 1: Structures. W3C Recommendation, May 2, 2001. http://www.w3.org/TR/xmlschema-1

[19] P.V. Biron, A. Malhotra, editors. XML Schema Part 2: Datatypes. W3C Recommendation, May 2, 2001.http://www.w3.org/TR/xmlschema-2

[20] J. Clark, editor. eXtensible Stylesheet Language Transform (XSLT) Version 1.0. W3C Recommendation, November 16, 1999. http://www.w3.org/TR/xslt

[21] Masinter, L., Hyper Text Coffee Pot Control Protocol (HTCPCP/1.0) , RFC 2324, 1 April 1998.

[22] XML Linking Language (XLink) Version 1.0 http://www.w3.org/TR/xlink/ , 27 June 2001

[23] Technical description of target eGov infrastructure for delivering PEGS,PEGS Infrastructure – Requirements Synthesis Document (IDA) http://ec.europa.eu/idabc/servlets/Doc?id=18946

[24] Technical description of target eGov infrastructure for delivering PEGS, Architecture for delivering pan-European e-Government services (IDA) http://ec.europa.eu/idabc/servlets/Doc?id=18946

[25] An interoperability framework PEGS, Final paper,http://www.semantic-gov.org/index.php?name=UpDownload&req=getit&cid=2&lid=237

[26] e-government Interoperability and Pan-European Services http://ec.europa.eu/information_society/activities/e-government_research/focus/interoperability/index_en.htm

[27] Europe Framework for pan-European e-government services http://ec.europa.eu/idabc/en/document/2319/5644

[28] IDA Releases European Interoperability Framework for Pan-European E-Government Services, http://xml.coverpages.org/ni2004-12-06-a.html

References Not Cited

[1] Breaking Barriers to eGovernment
http://www.egovbarriers.org/?view=example&example=procurement

[2] CFT: Content Interoperability technologies for European e-government services,
http://ec.europa.eu/idabc/en/document/5703

[3] IST e-government projects,
http://ec.europa.eu/information_society/activities/e-government_research/projects/e-government_projects/index_en.htm

[4] e-government cases catalogue (imported from Good Practice Framework),
http://www.epractice.eu/index.php?page=fix&p=1

[5] Interoperability Layer,
http://www.bungeni.org/07-system_architecture/05_interoperability_layer

[6] D. Wang. Automated semantic correlation between multiple schemas for information exchange. Master's thesis, Department of Electrical Engineering and Computer Science, MIT, Cambridge, 2000.

[7] Software Engineering Institute, Carnegie Mellon University
http://www.sei.cmu.edu/isis/guide/introduction/lci.htm

[8] SOA Magazine, Web Services Specifications and SOA Interoperability
http://webservices.sys-con.com/read/314083_1.htm

[9] O'Reilly Network Info Center
http://webservices.xml.com

Appendix A

CD Containing Thessis Text and Source Code of Example

Vita

Tutku Gövsa was born in Istanbul, Turkey, on September 22, 1976. He graduated from Kabatas Erkek High School in June 1994. The following year he entered to The Vocational School of Computer Technology and Programming in Bilkent University. After Vocational School, he continued to Computer Science and Information and Decision Science program in Bishops University, QC CANADA, and received a Bachelor of Science Degree in Computer Science in June 2000. He started working in Benkar Advantage Credit Card Company as software developer in 2000. After completion of military service, he continued working at Koc.net in 2006. Recently, he is working as Siebel CRM consultant in Innova.