

# An Integrated Platform for Tele-voting and Tele-consulting within and across European Cities: The EURO-CITI Project

Efthimios Tambouris

Archetypon S.A., 236 Sygrou Ave., Kallithea, 176 72 Athens, Greece  
tambouris@archetypon.gr  
<http://www.archetypon.gr>

**Abstract.** Tele-democracy is becoming increasingly important for local authorities in Europe. The EURO-CITI project aims to specify, develop and evaluate an integrated platform for two tele-democracy services, namely tele-voting for opinion poll petitions and tele-consulting. The technical developments are divided into those for operators at local authorities and those for citizens. The platform empowers operators at local authorities to initiate a call-for-vote on a local problem, to dynamically set-up secure networks of cities and initiate a call-for-vote on common problems, to monitor voting results and extract statistical information, etc. Regarding security and privacy, authentication/authorization solutions are proposed and a Public Key Infrastructure is specified. The trial sites for the EURO-CITI platform are three European cities, namely Athens, Barcelona and London Borough of Brent.

## 1 Introduction

Electronic government and tele-democracy are high in the agenda of the European Commission [1][2]. The benefits of both e-government and tele-democracy are now well understood by local authorities worldwide that launch relevant initiatives [3][4].

In the case of tele-voting for realizing opinion polls petitions, the application of technology provides some straightforward advantages (such as increased convenience and accessibility and reduced costs) but also a historic opportunity to re-establish some form of direct democracy. The concept of direct democracy suggests that all citizens decide via voting on their problems. This concept was abandoned as local communities were growing in size.

The aim of this paper is to present an integrated tele-democracy platform for tele-voting and tele-consulting services within and across cities. The technical infrastructure is deployed in Athens, Barcelona and London and will enable the respective Local Authorities (LAs) to conduct “intra-city” or “local” as well as “inter-city” or “network” tele-voting and tele-consultations. This platform has been developed within EURO-CITI [5][6], a research project partially funded by the European Commission under the IST programme [7].

This paper is organized as follows. In section 2, a general overview of the EURO-CITI architecture and respective tele-democracy services is given. In section 3, the

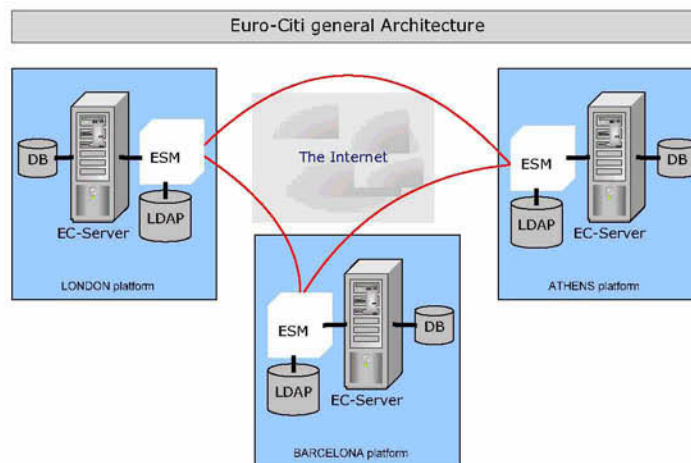
characteristics of the services are outlined while in section 4 technical details are presented. In section 5 the approach to security/privacy issues is outlined. Finally, in section 6 the conclusions and future work are given.

## 2 The EURO-CITI Platform: Architecture and Services

The main objective of EURO-CITI is to exploit the potential of on-line democracy by developing and demonstrating new transaction services, namely tele-voting for realizing opinion poll petitions and tele-consulting. The development of these services calls for a common underlying architecture to facilitate their implementation and fully exploit their potential. In this section, the EURO-CITI technical architecture is presented and the EURO-CITI services are outlined.

### 2.1 EURO-CITI Architecture

The EURO-CITI architecture consists of a number of platforms (one per city) that communicate over the Internet. This architecture is depicted in figure 1 in the case of three cities, namely Athens, Barcelona and London Borough of Brent.



**Fig. 1.** EURO-CITI Architecture

The main components of the platform in each city are:

- The EURO-CITI (EC) Server where all applications for the operators and citizens reside.
- The EURO-CITI Security Manager (ESM) that is responsible for secure communications between platforms and authentication.
- The Lightweight Directory Access Protocol (LDAP) where all citizens and operators general information reside.
- The DataBase (DB) where all applications data reside.

Each local authority hosts one server. Those servers run the EURO-CITI services and are connected to sub-systems such as applications databases and LDAP repositories. EURO-CITI servers are able to communicate with each other thanks to the ESM component. Security requirements are fulfilled in order to provide citizens with trustworthy and secure services.

## 2.2 EURO-CITI Tele-voting

The EURO-CITI tele-voting application consists of two different tools:

- The *Tele-voting Administrative Tool* allows operators to initiate a call-for-vote, to invite other cities in a common call-for-vote, to determine the eligible voters, to initiate a call-for-vote in different languages etc.
- The *Tele-voting Service* allows citizens to vote, to request a call-for-vote, to extract statistics (if allowed by the operator), to switch between different languages etc.
- The EURO-CITI Tele-Voting service will be used for opinion poll petitions. In that context, three tele-voting scenarios have been identified by the participating local authorities as particularly important:
  - “**Local Voting**”. In this case, a voting issue is posted in one EURO-CITI server and eligible voters are citizens who are registered in that server.
  - “**Local Voting with European Scope**”. In this case, a voting issue is posted in one EURO-CITI server (termed initiator). Here, eligible voters consist of citizens who are registered in the initiator as well as citizens from other cities. These cities however must have been invited by the initiator and accepted that invitation.
  - “**Network Voting**”. In this case, a voting issue is proposed by one EURO-CITI server (termed initiator) and is posted in all servers (i.e. cities) that have accepted to participate in that voting. Here, eligible voters for each server are the citizens who are registered in that server.

## 2.3 EURO-CITI Tele-consulting

The Tele-Consulting module offers two types of services, Tele-Consultation and e-Forum. Each service is composed of two different tools:

- **Tele-consultation**
  - The *Tele-Consulting Administrative Tool* allows the operators to set up consultation campaigns.
  - The *Tele-Consultation Service* allows citizens to participate in consultation campaigns.
- **e-Forums**
  - The *e-Forums Administrative Tool* allows the operators to create new forums, to create new categories and to track the opinion given by the citizen in the different forums.
  - The *e-Forum Service* allows citizens to participate in the available forums by expressing their opinion or commenting on the opinion of other citizens.

In Tele-Consultation both “Local consultation” and “Local consultation with European Scope” scenarios are supported, where these scenarios have the same scope as in Tele-Voting. However, in e-Forums only “Local” scenarios are supported.

### 3 Characteristics

The main characteristics of the EURO-CITI integrated platform are:

- Intuitive, easy-to-use graphical interface for operators and citizens.
- Access from multiple devices for citizens.
- Authentication using multiple methods (login/password, smart cards, digital certificates).
- Security at the system level but also at the application level (in the case of tele-voting service).
- Ability to dynamically set up virtual private networks between cities in order to perform a common voting or consultation.
- Multilingual versions available for the operators to choose during installation.
- Multilingual content (e.g. postings) by operators are supported.
- Multilingual interface and content is available to citizens at any time.
- Archiving and auditing facilities are available to operators.
- Support of open standards e.g. Java, XML, WAP.

The specific characteristics of the tele-voting service are:

- Operators may create a new voting issue by inserting voting subject, options, duration, scope, category, keywords, URL for further information, multilingual information; by inviting other cities (in the case of network voting) and by determining eligible voters based on age, nationality and gender.
- The service supports multiple open voting issues at any time.
- Voting is secure and anonymous. No citizen is allowed to vote more than once for the same issue and no one is able to alter votes (democracy requirement). Also, citizens are able to verify their personal voting.
- Citizens are notified about forthcoming polls.
- Citizens are able to view the results of previous voting issues and the partial results of current voting issues (if the operator has enabled this option when creating the voting issue).
- Citizens are able to suggest a voting issue.

The specific characteristics of tele-consulting are similar with the relaxation of security constraints.

### 4 Development

The architecture used to develop the EURO-CITI platform is based on the J2EE standard. As an example, in figure 2 the software architecture for tele-voting is depicted. This architecture caters for a number of requirements (e.g. communication between services over ESM, communication of services with the Database and LDAP, access from multiple devices, support of multiple authentication methods etc.)

Each page of the resulting services is structured in three main parts (figure 3):

1. *Fixed part*: it includes the page head and the rest of components of the static design.
2. *The menu*.
3. *The page content*.

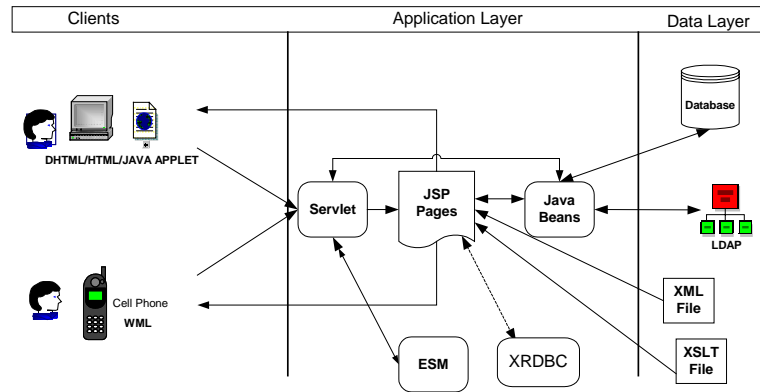


Fig. 2. Tele-voting Software Architecture

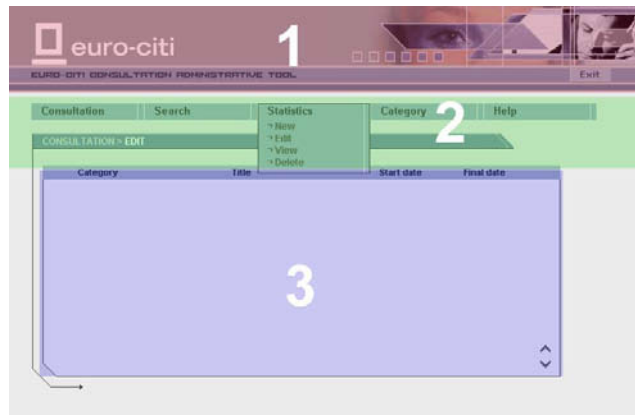


Fig. 3. Interface

## 5 EURO-CITI Security/Privacy Elements

Citizens access the EURO-CITI services through personal computers (Home PCs, kiosks) or WAP devices [8] using the Internet or wireless networks respectively. Links between the EURO-CITI nodes are protected by the following protocols (figure 4):

- From WAP devices to WAP gateway: **WTLS**
- From WAP gateway to EC servers: **SSL**
- From PC devices to EC servers: **SSL**
- From EC server to EC server: **IPSec**

Servers of different cities communicate with each other in the context of *network services*. A network service is launched by one city and is accessible from citizens of other cities. The participating cities can send their results to the city that has launched

the service. In this context, citizens registered in a city and participating to a service of another city must be *remotely authenticated*.

For instance, if a citizen registered in London accesses a secure service proposed by Athens, the Athens server will have to ask to the London server if the citizen is authorized to access the service or not.

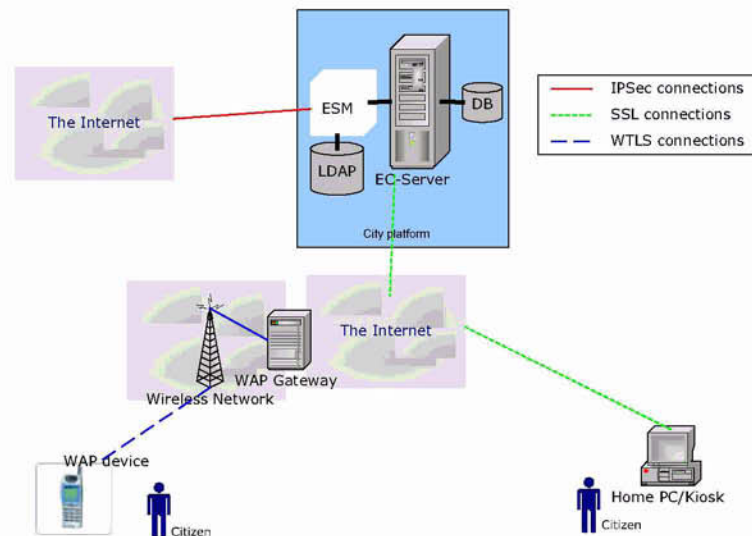


Fig. 4. EURO-CITI Security

With respect to authentication, two main methods are implemented: the login/password paradigm and the certificate-based authentication. These two solutions are combined with the use of Smart Card to realize four authentication solutions:

- **Simple login/password:** the citizen has to memorize his login/password pair. Citizens must use these credentials discretely in order to avoid their use by another person.
- **Login/password with smart card:** The smart card stores several login/password pairs. The citizen fills in the login/password window with a drag and drop application. The login/password pair can be provided to the citizen or stored in the smart card. Using the smart card is totally transparent for the EURO-CITI applications.
- **Certificates-based authentication:** certificates provide strong authentication with the use of complex cryptographic algorithms.
- **Certificate with smart card:** This is the strongest authentication method implemented. This authentication scheme is a two-levels authentication method. The use of the citizen's private key is protected by the card PIN code and it is never exported out from the smart card, thus enhancing a high security level.

In case a citizen owns a digital certificate, this certificate is stored either in a smart card or in the citizen's hard disk.

### 5.1 Public Key Infrastructure

The EURO-CITI architecture includes a Public Key Infrastructure (PKI) that manages digital certificates for citizens and web servers. A private PKI solution has been selected for managing citizen certificates while a public PKI solution handles EURO-CITI server certificates.

The EURO-CITI infrastructure includes all the key components of the following architectures:

**The Certification Authority (CA)** delivers, revokes, and renews the certificates. It implements the security policies that define the certificate content depending on both the certificate users and the future usages of certificates. The CA also archives certificates and private encryption keys (not implemented in EURO-CITI since data encryption is not required). The CA publishes the certificates and the *Certificate Revocation List* (CRL) in the directory. The CRL is the list of all the certificates that have been revoked.

**The Registration Authority (RA)** handles tasks *on behalf* of the CA. This mainly includes certificate applications, validation of certificate application, request of certificate suspension / revocation / renewal. In some cases, Local Registration Authorities can assist the RA in its task. These people handle locally the RA processes.

**The Directory** is a repository used to publish the EURO-CITI entities identities, like their name, first name, address, etc. The CA also uses the directory to publish certificates and CRLs. The EURO-CITI directory supports the LDAP protocol.

## 6 Conclusions and Future Work

The EURO-CITI platform equips local authorities with the necessary technical infrastructure in order to provide two important tele-democracy services: tele-voting for realizing opinion poll petitions and tele-consultations.

The trial sites for the evaluation of the EURO-CITI platform include three European cities, namely Athens, Barcelona and London Borough of Brent. For the evaluation, one hundred citizens of each city will be provided by smart cards while a significantly larger number will be provided by login/password credentials. The evaluation will include intra-city scenarios where, for example, citizens from one city will be able to vote on local issues. The evaluation will also include inter-city scenarios. In these scenarios, the operators at a city will propose a common call-for-vote and will invite other cities to join them. Upon acceptance, virtual private networks will be dynamically created and common votes will be possible for citizens across all participating cities.

### Acknowledgments

The work presented in this paper was carried out as a part of the EURO-CITI project [6]. The EURO-CITI project (EURO-CITI IST-1999-21088) is partially funded by the European Commission under the IST programme [7]. The EURO-CITI consortium

consists of the following partners: Archetypon S.A. (EL); University of Athens (EL); Schlumberger (F); T-Systems Nova (D); Indra Sistemas (E); Ajuntament de Barcelona (S); Municipality of Athens Development Agency (EL); London Borough of Brent (UK). The ideas expressed in this paper are those of the author and do not necessarily express the ideas of other partners.

## References

1. European Commission: Public Sector Information: A Key Resource for Europe, Green paper on Public Sector Information in the Information Society, <ftp.echo.lu/pub/info2000/publicsector/gppublicen.doc> (1999).
2. eEurope2002: An Information Society For All, Action Plan of the European Commission, available at [http://europa.eu.int/information\\_society/international/candidate\\_countries/doc/eEurope\\_june2001.pdf](http://europa.eu.int/information_society/international/candidate_countries/doc/eEurope_june2001.pdf), [Accessed 14 May 2002].
3. Caldow J.: Cinderella Cities, Institute for Electronic Government, IBM Report (2002).
4. Telecities home page, 2002, <http://www.telecities.org>, [Accessed 14 May 2002].
5. Tambouris E., Gorilas S., Spanos E., Ioanidis A. and Gomar G.I.L.: European Cities Platform for Online Transaction Services: The EURO-CITI project, Proceeding of the 14<sup>th</sup> Bled Electronic Commerce Conference, vol. 1 (2001) 198-214.
6. EURO-CITI project, <http://www.euro-citi.org>, [Accessed 14 May 2002].
7. IST Home page, <http://www.cordis.lu/ist>, [Accessed 14 May 2002].
8. Tambouris E. and Gorilas S.: Investigation of tele-voting over WAP, SoftCOM2000, vol. II (2000) 643-653.