

# Renovating Information Technology Infrastructure to effectively provide E-Services

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**Abstract.** Most times the provision of e-government services is dealt with independency of the legacy system itself. As more complex transactional services are provided to the public and the degree of on-line interaction between e-government service users (Internet) and legacy system users (Intranet) increases, the integration between e-service provision platform and existing legacy information system becomes a one-way direction. Although current technological trends as the J2EE architecture and web service platform promise the seamless integration of any type of system, this is not always true. In this paper we discuss the implications of such an integration and the strategic decisions made regarding legacy system renovation.

## 1. Introduction

In order to take advantage of their assets, more and more governments take advantage of information and communication technologies (ICT) and the continuing expansion of the Web and started e-government strategies to renew the public sector and eliminate existing bureaucracy and therefore reduce costs ([1], [2]). It is obvious that governments and governmental institutions are the most complicated organizations in the society providing the legal, political, and economic infrastructure to support the daily needs of citizens and businesses ([3]). Majority of Internet users believe that their government is doing a good or excellent job developing online resources that allow them access to information and conduct online transactions with the government ([4]).

Markellou et al. ([5]) proposes that for the implementation and successful operation of e-government, the proper design, which will be the basis in order to receive a series of strategic, administrative and operational benefits, is necessary. The application of e-government in the public domain can be gradually performed in fourteen levels, easing the adjustment of the traditional governmental model to the electronic one. Depending on the maturity and the resources of each governmental authority, the authority is level categorised and the bottom levels may gradually be

applied. This allows the unobstructed flow of information from/to the public sector and gives the possibility not only to the citizens but also to the businesses (private sector) to acquire better access in the services that state provides. The Hellenic Ministry of Economy and Finance and especially its General Secretariat of Information Systems (GSIS) has applied the fourteen levels approach ([5]) in order to provide e-services to citizens and businesses. In this paper, we discuss the case of reengineering existing legacy information systems in order to effectively support e-services. Problems rose from the operation of existing legacy and e-service platform are discussed. Subsequently, the new e-government portal characteristics are presented and the requirements and decisions made for renovating existing legacy system are presented.

## **2. Existing Legacy and E-Services Platforms**

The organization supports more than 350 regional offices all over Greece. The current version of the legacy information system is based on the client-server model and is fully functional since the early nineties. All application logic is programmed within the client platform (heavy client – light server model), while data is distributed in “local” database servers located in each regional office. A Central database is supported in GSIS for data synchronization and lookup purposes. It also facilitates computation of statistics and data maintainability and security. The information system can be characterized as the legacy system of the organization, since no services can be provided without accessing it. Most data related to a specific citizen are maintained as local data in his/her regional office. Local data are asynchronously replicated in the central database using a transaction management system (TMS). The central database provides the overall view of each citizen’s record. This three-layered hierarchical architecture is a typical one for client-server systems built in the nineties. Although it works efficiently, it has some drawbacks, since updating local data from another regional office or providing e-services through the Internet becomes a complicated task imposing restrictions. Client workstation support is also expensive since a large amount of software products must be installed/updated in each workstation. Thus, local support must be provided in all regional offices regardless of their size.

Current e-services imitate existing bureaucratic procedures and are based on an off-line policy. This means that although citizens initiate a request using an e-service available through the WWW, they still have no feedback about the progress of a case plus the uncertainty that creates the lack of a contact in person. The necessity to assure maximum data privacy, security and integrity in combination with the existing technology capabilities resulted in implementing them in an independent development platform and run-time environment. These services operate since the late nineties. The process of data exchange between the e-services platform and the internal legacy information system is carried out through manual procedures, using intermediate backup media or occasional short-time network links. The fore-described policy has a number of side effects. The most important is the frequent inconsistency between the two databases’ data and the significant delays for the dispatch of certain procedures. Other side effect is the uncertainty that human interference causes.

### 3. E-Government Portal

GSIS provides a new e-services environment through an e-government portal. The main target of the portal is to minimize the need of citizens' presence in regional offices and intends to deal with all the drawbacks mentioned in the previous section. The intention for this new environment is to serve citizens so as to be able to carry out more than 90% of their common procedures, which take place at a regional office, through the Internet. The new system will be based on a uniform development and run-time environment based on the J2EE architecture. Application software is generated using open tools and solutions, like XML and Web services. The portal should facilitate on-line transactional services and ensure on-line access to the databases of the legacy information system. A number of issues are also dealt for the completeness of the new system. User certification and authorization, security, data integrity, confidentiality and other issues are under consideration and will be solved during the implementation of the system. The most significant characteristics of the new e-services that affect the existing legacy information system infrastructure are:

**Single, real time registration and authentication.** Since all services will be hosted at the same environment (application, web and data base servers) it is easy to ensure common registration and authentication procedures.

**Provision of most of the services offered in local branches.** The idea behind this vision is to offer citizens and businesses the ability to carry out their common obligations and claims for a case percentage more than 90%. That means that regional offices will receive fewer citizens in person and only for special and non-standardized cases.

**Enhanced security.** A present open issue-challenge is security assurance through the Internet.

**Improved Response Time.** All e-services are expected to have a quick response time to the end user. That means that all back office processes and internal communication must be optimized. Exception for this demand is network transfer time because of its dependence to the user's connection type with the Internet.

**Added-Value Services.** The new generation of an environment, like the one we are discussing here, couldn't continue adopting the existing approach by just imitating standard bureaucratic procedures. It is time for it to offer added-value services, upgrading the relationship of citizens with government and, in our case, with the financial authorities.

**Powerful User Support.** The referring variety of target groups for the new e-services platform, signifies the variety of regarding user knowledge about the use of a personal computer and/or the utilization of the Internet. In order to support a significant number of users with limited IT skills, the responsible authority has to organize an efficient support mechanism for them.

**Interoperability.** It is crucial for the implementation of one-stop points-of-service that make it easy for citizens to access high-quality government services.

**Internal Connectivity.** In order to achieve the fore mentioned requirements - characteristics, the new e-services portal must communicate with the existing legacy information system in a more frequently basis supported by enhanced security mechanisms. The ultimate scope is to implement a real time communication and synchronization between the two systems, even to integrate them into one single system, addressed to both internal and external (Internet) users.

#### 4. Renovating Legacy Information System

The current version of the legacy information system is based on a distributed client-server model, where database servers are maintained in all regional offices and a central database is supported in GSIS for data synchronization and lookup purposes. After ten years of successful operation, GSIS obtained funding for hardware replacement of existing hardware platforms. In the following, we discuss the requirements impose the renovation of the legacy information system, the decisions made and benefits and drawbacks of the solutions adopted.

The current version of the legacy information system was built having in mind the fact that most citizens expected to be serviced in their local regional office. In an attempt to simplify procedures and minimize bureaucracy, it was decided to encourage citizens to ask for services in any regional office regardless of their local office. Thus, database synchronization becomes far more complicated and should be performed on-line.

The central e-government portal facilitates e-services to citizens allowing them to complete most common transactions (more than 90%) without visiting any office. The Web Service interface facilitates other public organizations to safely access the system. Thus, the number of citizens visiting local offices to complete their cases is decreasing and, thus, the usage of the legacy information system. It is expected that the number of citizens visiting regional offices will be decreased 30% within the first year of the portal's operation. Furthermore, in order to provide on-line transactional services, the portal should obtain secure access to the legacy system databases. This can be accomplished by interacting with Central Database, since both are hosted in the Data Center of GSIS. Thus, on-line bi-directional synchronization of local and central databases on the legacy system is a hard constraint in order to ensure consistency.

In order to effectively support both systems (e.g the portal and the legacy system), GSIS should be able to apply the same policies and minimize maintenance cost. Thus, the following factors should be considered:

- Unify the infrastructure supporting both systems
- Obtain a central administration policy and minimize administration cost
- Minimize training cost to support both systems

GSIS decided to explore redesigning the architecture of the legacy information system by adopting modern technological trends as server-based computing and light clients. It was decided to explore whether the already obtained funding for hardware replacement and application maintenance could be used for this purpose.

One of the major dilemmas faced was whether applications should be rewritten to facilitate a web interface to end-users or whether a remote program execution platform (e.g. CITRIX [6]) should be used to execute existing applications. Furthermore, GSIS should maintain two different development environments (a J2EE-based one for the portal and the existing form-based one) for the same system. Both portal and legacy system support almost the same functionality, since the portal supports about 80% of the transactions supported by the legacy system. The cost of maintaining such applications proved to be less than the one for existing form-based environment. Although the "actual" code implementing portal e-services could not be used to replace existing legacy applications, unifying the development

environment for both systems promotes code reusability and simplifies code maintenance.

The following decisions were reached:

1. Replace distributed databases of residential offices with a central one hosted in the Data Center of GSIS.
2. Support server-based computing and benefit from the fact that all server equipment is consolidated in the Data Center.
3. Rewrite most applications of the legacy information system to facilitate a web interface based on J2EE architecture.

The cost of rewriting legacy application code and maintaining the system for one year proved to be the same as the cost of maintaining existing applications for three years. This cost includes basic existing application maintenance with no additional application development. GSIS decided to adopt this policy and freeze the functionality of existing legacy applications for two years. It should be noted that only the user interface part of applications is rewritten. The cost of purchasing hardware to implement a central solution proved to be 20% less than local server replacement cost. Thus, it was decided to maintain existing servers of two more years and also initiate procedures for obtaining new hardware. It is estimated that hardware maintenance cost will be decreased, although not considerably.

## 5. Conclusions

The provision of on-line transactional e-government services drastically affects underlying legacy information systems, since it imposes new functional requirements to it. GSIS ensured funding for hardware replacement (server infrastructure supporting databases in regional offices and the central database) and applications maintenance for the existing legacy systems for two years. Exploiting the same funding, it was possible to redesign the system architecture and rewrite applications of the legacy information system to facilitate a web interface based on J2EE architecture.

## 6. References

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