THE SYSTEMS ANALYSIS AND DESIGN ISSUES FOR THE E-GOVERNMENT

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ABSTRACT

The development of the e-government requires a large amount of capital investment to establish the infrastructure and architecture for accommodating the Internet telecommunication needs. It is essential to adopt a structured systems development methodology for creating a successful e-government in order to maximize the utilization of the limited resources and achieve the strategic intentions. The development process has to address the several unique issues and constraints of the e-government. A case study of the systems analysis and design for an Internet based geographic information system of the Sacramento County in California is presented and discussed.

KEYWORD: systems analysis and design, e-government

INTRODUCTION

The e-government is a special type of the e-business with its particular non-profit oriented objectives and characteristics. It utilizes the Internet as a more efficient and easier way to delivery the federal, state, and local government information and services to the public. In one hand, these new Internet oriented government computer information systems demand some capital investment for building a solid information technology infrastructure and architecture foundation as the other types of e-business. On the other hand, the e-government has its own characteristics and constraints that need to be carefully examined and addressed before starting the development process. It is essential for the government top management and development team to carefully examine the surrounding environment and adopt a most suitable development methodology in order to avoid any unnecessary computer information systems investment tragedy.

The major purpose of this research is to investigate and utilize the advantages of systems development life cycle in the structured methodology as a proper process guidance to establish a successful e-government. The required information technology infrastructure and the existing environmental constraints in the e-government settings will first be addressed. Then, the major contents of each development phase in the systems development life cycle are described and discussed in terms of creating the e-government. Finally, a case study of practicing the system analysis and design for an Internet based geographic information system of the Sacramento County located in the State of California is presented.

SYSTEMS DEVELOPMENT FOR E-GOVERNMENT

The framework of SDLC for an e-government stays the same as the other traditional computer information systems. The e-government development can employ the structured SDLC to plan, execute, and control the development process for the following two reasons: (1) It enforces the formality and

control over the development process; and (2) it provides the close communications among the management, systems analysts, software engineers, and end users to build efficient and useful computer applications.

In general, SDLC for e-government, like other computer information systems, is comprised of a set of five predefined and sequential in ordered phases (Hoffer et al. 2002) that includes systems planning, systems analysis, systems design, systems implementation, and systems support.

The systems planning phase involves the determination of the systems objectives with the existing constraints. In general, the systems objectives for e-government include adaptability, availability, flexibility, functionality, manageability, maintainability, instant, integrity, portability, reliability, scalability, security, and user-friendly. It might be impossible to include every stated objective in implementing a specific e-government application due to the internal and external constraints. A ranking system can be used to evaluate the different objectives to sequentially prioritize their importance for all e-government applications.

There are three common constraints in developing the e-government application. First, the budget process of any additional resources for the e-government is a long, slow, painful, and political one for the information department. The funding for any new hardware, software, database tools, and human resources of the e-government application has to be estimated carefully to avoid the budget shortage.

The second one is placed by its existing information architecture used to support the legacy computer information systems. The new e-government application has to be able to communicate not only with the internal existing computer information systems for information exchange but also the different systems used by the public. The integration among the new e-government information architecture, the internal old ones, and the external ones is a very important issue that needs to be carefully examined in the planning phase.

Last, it is not uncommonly that the government agency lacks of experts to handle the newest information technology for the development of e-government application. The information technology department has to adopt a combination approach of in-house, off-the self, and outsource. It is important to have an experienced project management individual to oversee and coordinate the internal and external project development efforts to achieve the highest productivity. Consequently, these constraints will define the scope of the e-government application.

The systems analysis phase is the study of the current organizational operations and information systems to define the user requirements and priorities for the new information systems (Ward and Peppard 2002). It involves the analysis of the organizational contexts and requirements that can be divided into three stages including feasibility assessment, problem recognition, and requirement identification. The feasibility assessment describes the proposed application environment. The problem recognition examines the current systems issues and opportunities. The requirement identification illustrates the visual systems functions of the logical design for the approval from the end user.

The systems design phase evaluates the possible alternatives and selects the most suitable solution for the physical design. There are three different design approaches that include the process-oriented design, data-oriented design, and object-oriented design (Connolly and Begg 2002). The project team should use the process-oriented design approach to document the system functions, the data-oriented design approach to establish an integrated and accurate database, and the object-oriented design approach to stress the reusable programming principle.

The systems implementation phase involves with the construction and the delivery of the new system into actual production for the organization. It includes various tasks such as network construction, database creation, software coding, new system installation and testing, manual development, contingency program set up, end user training, systems performance measurement, and new system operations.

The mass publication is one of the major functions in the e-government application. The implemented database structure and data base management system should have the capability to handle the storage and retrieval of the documentation in a very efficient way. The regulation, law, and form are constantly changing and required instant update. A good content management becomes an important tool for tracking the changes and validating the web page regarding hyperlink, legal, culture, and subject, etc.

A good end user training program should establish to reduce the frustration of unforeseen problems caused by phasing in the new e-government application. A special help desk, hot line, and frequent ask question web site should be created to handle the situation. Both online and hard paper copy of the documentation for the systems process, operations, procedures, end users should be available at the systems implementation time.

Contingency management is a set of predefined backup and recovery procedures to minimize the impact on the e-government application caused by the nature disaster, human error, and system failure. These written procedures have to be periodically tested and practiced by every involved individual for the validation and familiarity. The back up & recovery is definitely required to achieve the 24 hours a day and 7 days a week availability and 99.99% reliability for the e-business applications.

The systems support phase is the ongoing maintenance process of a computer information system after it has been delivered to the end user for production. The actual performance of the e-government application should be measured against the predefined standard. An interactive web site, e-mail system, or service center should be created to collect the opinions and comments from the internal and external end users for further systems performance improvement.

THE SYSTEMS ANALYSIS AND DESIGN FOR A GEOGRAPHIC INFORMATION SYSTEM

The primary functions of the Sacramento County Geographic Information System (GIS) Department are to provide high quality geographic services including basemap creation, custom map products, application development, training, supporting, and consultation to the Sacramento County, other government agencies, private entities, and public citizens.

System Objective

The GIS Department currently uses Environmental Systems Research Institute's (ESRI) suite of the desktop GIS software to deliver a static Internet website that is not adequate for deploying a dynamic multi-tiered Internet solution. The Department must perform a systems analysis and design that will yield a new system with proper hardware and software architecture that is to be compatible not only with the internal current systems, but also with the external non-standardized environment of the Internet.

The first step is to define the capability objectives for the new system in terms of hardware and software architectures. Six capability objectives specified by the GIS Department are scalability, performance, reliability, manageability, security, and cost. The relative importance and requirement of each objective discussed by the end user and management is presented in Table 1.

Objective	Requirement	Rating
Scalability	-Handle increased number of users -Planning horizon of five years	2
Performance	-Map generation < 20 sec -Attribute queries < 5 sec	4
Reliability	-Implementation of automatic monitoring -System uptime > 98%	4
Manageability	-Technology compatible with ESRI software suite -Mainstream technology -Mainstream standards -Minimize tuning and maintenance	3
Security	-Comply with County Information Technology Policy Board security policies -Compatible with County firewall	5
Cost	-Within the predetermined budget for any new hardware and software	4

Table 1: GIS System Objectives

System Analysis and Design

During the end user requirements analysis, it has determined that there are five primary software requirements that would have to be satisfied for the new and viable Internet based solution. These five constraints were:

1. The solution must have the ability to serve both vector and raster data to a client over the Internet.
2. The user environment must require only standard browser functionality in the Microsoft Internet Explorer and Netscape Navigator.
3. The development environment must comply with an open standard architecture (no proprietary programming languages).
4. The solution must be compatible with the ESRI GIS software product suite.
5. The product must be certified for both the Window NT and Windows 2000 server operating systems.

The GIS Deparptment has selected four GIS software vendors in term of the size, experience, and stability to be evaluated as candidates. Only the multi-tiered architecture configurations of ArcIMS 3.1n of ESRI allows for strategic software architecture to achieve optimal performance. Additionally, the system has unlimited scalability with the ability to add (plug-in) additional web servers and data servers in parallel on the back end. These findings make the ArcIMS 3.1 web-based GIS solution as the preferred alternative.

One alternative for a two-tiered ArcIMS 3.1 implementation and five alternatives for a three-tiered ArcIMS 3.1 implementation have developed. These six alternatives are evaluated using the system objective criteria. Table 2 presents the alternative analysis that has yielded a preferred alternative of the two-tiered software architecture in the two-tiered hardware architecture.

	Weight Factor on scale of (1-5)	Alt. 1		Alt. 2		Alt. 3		Alt. 4		Alt. 5		Alt. 6	
Manageability	3	H	9	H	9	M	6	H	9	H	9	M	6
Scalability	2	L	2	H	6	H	6	H	6	H	6	H	6
Performance	4	H	12	H	12	M	8	H	12	H	12	H	12
Reliability	4	L	4	L	4	L	4	L	4	L	4	L	4
Security	5	H	15	L	5	L	5	L	5	L	5	L	5
Cost	4	M	8	M	8	M	8	M	8	M	8	M	8
Score		**51**		46		40		48		49		47	
H (high) = 3													
M (medium) = 2													
L (low) = 1													

Table 2: Systems Architecture (Hardware) Design Alternatives Analysis

CONCLUSION

The e-government has its particular characteristics and objectives. Therefore, the development process of the e-government has several unique issues and constraints that require to be addressed. A case study of the systems analysis and design process for an Internet based geographic information system implemented in the Sacramento County of California is presented and discussed.

These results from the analysis and design strongly implies that the GIS Department needs to have (1) clearly defined contract for each software and hardware vendors in terms of date, deliverables, functions, and support; and (2) a experienced project leader to oversee the coordination and progress between the internal knowledge workers, the software, and hardware vendors; (3) a well defined conversion plan to phase in the new hardware and software; and (4) a measurement and feedback mechanism for the performance of GIS for future improvements in the future.

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