

Advances in Electronic Government in the US

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Digital government (E-government) is defined as the model for a government organization using the Internet to provide services and disseminate information to citizens and public or private organizations. In recent years, there has been a noticeable shift in the way governments are using technology to change their infrastructures to support digital government for taking advantage of electronic commerce for online transactions and services [1],[2]. In 1995, only 8.7% of local governments had websites while in 1997, 40% of the organizations had websites [1]. This number later increased to 83% in 2000. Recent studies have shown that spending by the US government will increase at a fast rate from \$1.5 billion in 2000 to \$6.2 billion in 2006. [1]The change has begun with larger governments and is slowly moving to the local and county organizations that closely interact with citizens. However, the development of transactions and online services has been progressing at a slow pace. The adoption of web sites are related to the government demographics such as size and region. There are several factors such as confidentiality, scalability, and that affect this process of transitioning. This paper explores these ideas, describes different stages of digital government, and discusses current research in this field.

Four distinct stages may be used to measure the development of a digital government website or application [2]. In the first phase, Catalog, users have the ability to access and download forms and other static documentation. The second phase, Transactional, allows users to send and receive personal information with the website and it can also accept online payments for bills and other fees. This stage of development also consists of implementing a database to store data for tracking processed transactions. This stored information can later be queried to determine any necessary improvements to

the site and also model strategies to better suit citizens' needs. Vertical Integration, the third phase, allows businesses to interact with various governmental departments to register electronically and build new relationships with public organizations. Finally, Horizontal Integration lets users complete transactions with various levels of government: local, county, and state, and allows businesses to retrieve permits and other services. This final stage links local area governments with the federal level. These stages of improvement do not necessarily occur in a ordered fashion since organizations may jump to a higher level in one step.

To overcome challenges in development and achieve these four stages, several factors are involved. The most important aspect is governments require a sound strategic plan. A lack of an effective plan can cause a barrier of development and deployment of services for citizens. These plans must also take in consideration the available financial resources and web staff to build and maintain a website or application. The lack of financial resources is a major barrier in the transformation to digital government. Limited resources prevent ample strategic planning necessary for a complete process. In the United States, for example, the development of local government applications and websites are still at the beginning stages. Local US governments generally do not have the necessary IT knowledge or staff required for this process. Another important requirement is to deal with security and protection of citizens' personal information. This infrastructure is required for local governments to allow them to design a model for and implement their website.

With an effective and sound strategic plan with ample resources, transforming traditional government information structures into a digital government format will lead

to several perceived impacts for its population [1], [2]. Digital government will help to reorganize and improve the interaction with businesses. This action accomplishes faster and more efficient ways to collect information and distribute services. It is important for a public organization to achieve a high level of development since it would allow better sophistication for its citizens. Processing requests from citizens will require less time and entail lower administrative costs. Staff from larger government organizations will also experience less demands since most of their tasks would now become automated by the digital government websites. Another important impact will be the increase of revenues from providing the services such as paying bills, taxes, tickets from traffic violations, and permit fees. By implementing both horizontal and vertical integrations, the digital government structure will have the ability to access various commercial and private sectors as well as individual citizens from several geographic regions. These impacts will lead to an improved quality of service in both the private and public sectors.

The improvement rate of digital government is slow because of the large amount of resources required driving it to have a high cost performance ratio. Government agencies are large and need the ability to move an abundant amount of information both quickly and efficiently. A schema for a digital government website or application consequently needs to provide a high level of services and flexibility for the amount of resources used in development.

There are several challenges for digital government: it needs to maintain cohesion with the different agencies, allow citizens to access information and execute transactions, provide options to build relationships between public and private organizations, and manage resources [3]. The digital government structure needs to

maintain private records of personal information for the citizens and prevent access to this information. It is also important to prevent false transactions from occurring to maintain the integrity of the system. A security policy needs to be well defined to keep authorized access and prevent any denial of service attacks. The level of security policy for particular information can be based upon the people who can access it. Income tax or census data, for example, is generally more sensitive than accessing information for voter registrations. Records will need to be maintained to keep tracks of the users that access these systems [4]. This policy will track the people viewing documents and help find malicious users that may cause denial of service attacks.

There are three main methods used for providing security within a digital government website: authentication, access control, and audit [3], [4]. Authentication refers to the idea that a user needs to provide a form of identification to access the digital government website. The access control lists are used to determine which documents and services a user may view. An audit stores data from sessions and is used to prevent holes in the system's security. The two main models for building access control lists are Discretionary Access Control (DAC) and Mandatory Access Control (MAC). The DAC is a more a rigid representation by setting a set of access control to the users. MAC provides better scalability by defining a set of subjects and objects and their relationships for view and altering their content. To maintain a high level of security, the organizations need to change their policies regularly.

Maintaining the privacy of citizens' personal information is another factor involved in the design of digital government applications. There is a possibility that this information can be leaked by other entities if secure measures are not taken. Cookies are

small structures stored in Web browsers containing user preferences from previously visited websites. When a user starts a new session with a digital government website, this set of data may be accessed through the web browser. Digital government applications need to be designed to prevent personal information from being stored or accessed through cookies. Data encryption should be implemented to keep a secure transfer of information throughout the entire session.

There are recent developments in research to find ways to build more secure digital government applications that are strive to be effective under a limited amount of resources. Public policy protects citizens from having their private information available to other people and organizations without their consent. Most government agencies try collecting and analyzing this information to build statistical reports about the population such as census data. The National Agricultural Statistics Service (NASS), an organization that collects and studies information about chemical usage by farms throughout the nation has developed methods to analyze and display this information to users [5]. The data for the application is based upon the agricultural use of chemicals from 1996 through 1998. The goal of NASS's project was to provide a method to query information about the chemical usage with affecting the identity of farms. To build the model, two rules were developed to provide consistency and maintain confidentiality. One of these, the N-rule, is defined to be the number of items being sampled. When the number of farms in the query sample is small, there can be problems in identifying its members and this value takes this problem into consideration. The second rule, p-rule, represents the state when the sample contains a dominant farm whose land area is the majority of the total size. To maintain the confidentiality of the information, the

application will increase the sample size based upon the N and p rule values. The application also contains a Query History Database (QHD) whose purpose is to maintain a history of all queries, users, and previously unreleased data. This added application prevents users from accessing undisclosed information. This project addresses two important issues that arise in developing digital government websites and applications in the United States, both scalability and equity. As the size of the project increases, the amount of computational analysis will increase at a very large rate and the development of the system needs to be directed to supports all types of queries.

Another application, Webocrat, attempts to define ontologies that model a way for agents to apply collected information and build relationships [6]. The ontology has its own collection of syntax and semantic rules to build relationships between the data. This model applies a knowledge based method allowing information to be customized based upon potentially changing design situations. This design permits various actions within a life cycle: identifying and acquisition of information, development of applications and relationships, and the display and collection of knowledge. The model used to design Webocrat is based upon 5 distinct modules. The Knowledge Model holds the central position in this application. Its purpose is to collect and organize data and describe its content. The other modules rely upon this central unit to retrieve information. The Web Content Management module's purpose is to build documents and publish them for citizens to browse over the Internet. The Discussion Forum module provides services to discuss topics on this application. The Electronic Submissions module allows users to submit and access documents and the Helpdesk module helps users locate documents

within the structure. This project addresses similar design issues for digital government to provide strong modularity of services.

The Unitary Network is a project being developed by the Italian government to create better cooperation between the government agencies and modernize its systems [7]. This project has to address issues such as gathering and analyzing data from legacy systems, scalability, and supporting a complex diverse structure. Unitary uses a centralized site that stores the information and it is then utilized by other applications.

To collectively use services by several agencies, macro processes are built and executed accessing data from these entities. However, when the security policies for these agencies are different, it will hinder the efficiency of the execution. This project reflects similar design issues faced by the US agencies for building a digital government. A digital government design needs to be cost effective and at the same allow information sharing between different organizations.

Digital government is an evolving concept and continues to change at a slow rate. Due to a limited number of resources available governments cannot progress at a fast pace. However with an effective strategic plan that focuses on the organization's long-term goals, an effective digital government model can be attained. Other challenges such as financial resources, security, and building cooperation between agencies are important issues during design and development. Although growth is only available in small steps due to fluctuating budgets and economies, digital government will still continue to improve at a large rate in the long term.

References

- [1] Stephen Holden, Donald Norris, and Patricia Fletcher. "Electronic Government at the Local Level: Progress to Date and Future Issues." *American Society for Public Administration*, 2003.
- [2] Donald Norris and M. Jae Moon. "Advancing E-Government at the Grassroots: Tortoise or Hare?" University of Maryland, Baltimore County. 2003
- [3] James Joshi, Arif Ghafoor, Walid G. Aref, and Eugene H. Spafford. "Digital Government Security Infrastructure Design Challenges" *Computer* vol. 24, 2. pp. 66-72, 2001.
- [4] James Joshi, Arif Ghafoor, Walid G. Aref, and Eugene H. Spafford. "Digital Government Security and Privacy Challenges." William J. Melver, Jr. and Ahmed K. Elmagarmid (editors) *Advances in Digital Government Technology, Human Factors, and Policy*. Boston, Kluwer, 2002, Chapter 7, pp. 121-136.
- [5] Alan F. Karr and Ashsiah P. Sanil. "*Web-Based Systems that Disseminate Information but Protect Confidential Data.*" National Institute of Statistical Sciences.
- [6] Jan Paralic, Tomas Sabol "Work with Knowledge for Support of e-Government" *Znalosti* 2003.
- [7] M. Mecella and C. Batini, "The Unitary Network and the Cooperative Architecture: A Review of the First Projects, " Technical Report; Department of Systems and Computer Science, University of Rome, La Sapienza, 2001