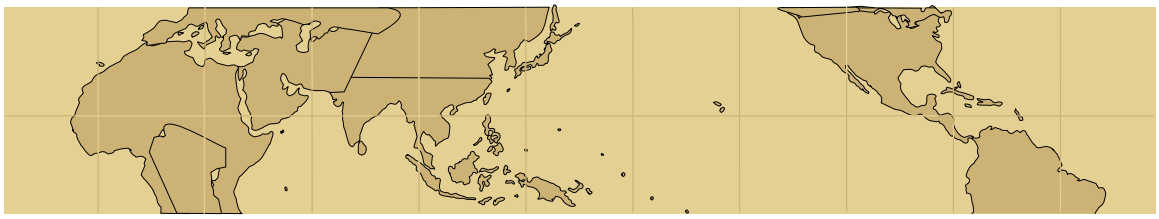

Digital Government in American Cities
Report on two NSF Workshops in 2001

Edited by: Ugo Buy and Albert J. Schorsch, III
University of Illinois at Chicago

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Foreword

This document summarizes a collection of paper presentations, meeting notes, discussion summaries, and questionnaires written by participants to two workshops on digital government in urban environments. The first workshop took place in Chicago, Illinois in March 2001; a follow-up workshop took place in Redondo Beach, California in May 2001. We are deeply grateful to L. Vaughn Blankenship, who co-chaired the program committees of both workshops, for collecting meticulously workshop materials and for passing them on to us. Without his patient work, writing this report would have been impossible.

We also wish to acknowledge a great many individuals and institutions for their contributions to the workshops as discussed, summarized, and abstracted in this report. First, we thank the National Science Foundation for sponsoring these two events. Additional financial support was provided by the College of Urban Planning and Public Affairs and the Great Cities Institute at the University of Illinois at Chicago. We are especially grateful to Lawrence Brandt, National Science Foundation, for his sponsorship, for his guidance during workshop preparations, and for his participation to both workshops. We thank all members of the program committee of the Chicago workshop for generously contributing their time, knowledge and expertise to this project. We are especially in debt with L. Vaughn Blankenship, University of Illinois at Chicago, and Patricia Diamond Fletcher, University of Maryland Baltimore County, for jointly chairing this Program Committee and for running the workshop. Sharon Dawes, The University at Albany, strongly contributed to all these activities.

We are grateful to the committee members who agreed to co-chair the four tracks at the Chicago workshop: Lucy Bisognano (Council for Excellence in Government), Joseph Danziger (University of California at Irvine), William Dutton (University of Southern California), Christopher Lee (City of Mobile, Alabama), Richard Mason (Southern Methodist University), John McCarthy (Critical Infrastructure Assurance Office and US Coast Guard), Donald Norris (University of Maryland Baltimore County), and Nancy Olson (City of Milwaukee). Track co-chairs were instrumental in moderating track discussions during break-away sessions, summarizing discussions in their tracks during the last plenary session, and in writing summaries of these discussions. We acknowledge numerous staff members at the University of Illinois at Chicago who shared the burdens and rewards of conference organization, including Eve Ali-Boles, David Perry, Joy Pamintuan, and Jodi White. Graduate student Brigid Rauch provided valuable assistance in organizing track materials, attending the workshop, moderating a break-away session, and organizing notes produced by workshop participants.

We thank Yigal Arens (University of Southern California), L. Vaughn Blankenship (once again!), and Melvyn Ciment (The Implementation Group) for organizing and running the follow-up workshop in California. Yigal Arens and Melvyn Ciment also edited an excellent companion report for that workshop. Finally, we are grateful to all the attendees of both workshops for making these events so interesting, informative, and lively.

1. Introduction

This report summarizes the main conclusions of two workshops on digital government that took place in 2001. The first workshop, entitled *Foundations of Electronic Government in America's Cities: A Multi-Disciplinary Workshop*, took place in Chicago, Illinois on March 8–9, 2001. The second meeting, a one-day mini-workshop titled *Urban Digital Government Grand Challenges* took place in Redondo Beach, California, on May 24, 2001, immediately following *dg.o2001*, the National Conference on Digital Government Research. Both meetings were jointly sponsored by the National Science Foundation, by the College of Urban Planning and Public Affairs at the University of Illinois at Chicago (UIC), and by UIC's Great Cities Institute (GCI).

A consortium of 17 urban universities, called the *Great Cities Universities*, provided motivation for the two workshops. The members of this consortium are urban public research universities that have long been engaged in their surrounding communities. These universities are uniquely positioned to pursue some of the research projects suggested at the two workshops. A listing of the Great Cities Universities appears in Appendix C.

The two meetings discussed here are part of a sequence of several NSF-sponsored workshops on digital government issues. The purpose of these two workshops was to identify and prioritize research issues of critical importance to public administration and policy-making in urban environments.

Our interest in urban settings is motivated by various factors. The density and diversity of urban populations complicate government functions, such as development planning and service delivery. Urban and suburban environments are distinguished by a broad diversity in their racial, ethnic and economic makeup. The concentration of people typically found in cities has a profound effect on a variety of government issues including transportation systems, pollution control, economic policy, and law enforcement. While these issues are also present in some rural environments, they take on massive proportions in cities and their suburbs. In addition, the broad diversity of urban populations raises issues of social integration and equal opportunity.

Given the challenges raised by cities and their suburbs, the investigation of innovative approaches is especially appealing. Information technologies, such as the World-Wide Web (WWW) and the Internet, can greatly improve the efficiency of various areas of government. When organizing the workshops, we identified three main functional areas of government, namely *policy-making*, *representation*, and *service delivery*. Potential benefits of digital government applications include improved representation through electronic voting and digital forums, support for policy-making and public management through decision-support systems and electronic information repositories (e.g., demographic databases and geographic information systems), increased efficiency through streamlining, integration and automation of administrative procedures, and enhanced planning and delivery of a broad array of services.

To date, a majority of the US population lives in urban or suburban environments; most government services are delivered in these settings. Thus, a successful application of digital government technologies would result in improved government functions and cost reductions affecting a large portion of the US population.

Unfortunately, to date progress in digital government applications has been relatively slow, compared to progress in other applications of technology, such as e-commerce. There are several reasons for this state of affairs. First, the articulation of procedures and the development of tools for digital government will require a multidisciplinary effort across a diverse community consisting of academic researchers, public administrators, and individuals in private organizations.

Second, technical issues must still be addressed in order for digital government technologies to be deployed on a wide scale. Examples include providing adequate levels of computer security, handling heterogeneous information from different data sources, and defining appropriate user interfaces for the functions supported by digital government tools. Third, the effective implementation of digital government will require extensive applied research and experimentation in order to test out the effectiveness and the practicality of new procedures and tools.

The two 2001 workshops sought to address these difficulties by articulating a set of priorities for funding agencies and other participants in digital government efforts. Both workshops had a diverse attendance with different areas of expertise including computer science, public administration, political science, and urban planning. The format of the two workshops, consisting both of plenary sessions and

working discussion sessions, encouraged the exchange of ideas among participants.

The main conclusions reached by workshop participants can be summarized as follows.

1. To date a variety of digital government initiatives have been undertaken, mostly by local government agencies. However, there is little coordination among these initiatives; the relationships among those initiatives are poorly understood. There is a strong need to define a taxonomy for digital government actions and information in an effort to streamline and facilitate future initiatives.
2. The traditional funding models are not suitable for digital government efforts because these models are typically discipline-specific and research-oriented. By contrast, work in digital government is both multi-disciplinary and application-oriented. There is a strong need for new funding models at the federal level in order to accelerate and promote future initiatives in digital government.
3. The creation of a few centralized information clearinghouses would help in promoting coordination and knowledge sharing among participants in digital government efforts. The clearinghouses would act as repositories for various kinds of digital government materials such as experience reports, software tools, and references to ongoing digital government activities.
4. To date, it is difficult to evaluate the effectiveness and the technological value of digital government initiatives. The definition of standard metrics for digital government initiatives will help in focusing future efforts.
5. While information technology has made significant strides—especially with the onset of the Internet and the World-Wide Web—some additional basic research in various areas of computer science is needed in order for digital government initiatives to gain widespread acceptance among ordinary citizens. The specific areas of computer science requiring additional investigation include Human-Computer Interaction (HCI), data visualization, privacy and security, management of heterogeneous data sources, and data mining.

The goal of both workshops was to identify and analyze issues that are specific to cities and urban environments. *The general consensus of workshop participants was that no single government function is "owned" entirely by cities. Rather, the density, size and diversity of urban populations add new and unique dimensions to the demand for general government services.* For instance, population density generally implies reliance on extensive public transportation systems both within a city and between the city and its suburbs to alleviate traffic congestion on roadways. Thus, the activities of planning and managing a capillary public-transportation network are normally associated with urban government. In a similar fashion, the need to control pollution, a ubiquitous government function, is significantly complicated in cities because of the high concentration of such pollution sources as private vehicles, industrial waste and residential heating systems. The social, economic and racial diversity found in cities poses special challenges to urban planners and law-enforcement agencies. Urban planning is complicated by the need to reconcile the objectives and aspirations of different groups coexisting in a city. Law enforcement is complicated by the varying incidence of crime in certain urban environments.

In summary, although cities cannot claim ownership of any particular government function, the unique features of cities require the development of digital-government methodologies and tools to address specific needs found in urban environments. Moreover, these techniques and tools are likely to be broadly applicable beyond urban environments.

Shortly after the two workshops, the tragic events of September 11, 2001 took place. Three of the four dreadful attacks on 9/11 occurred in metropolitan areas, adding yet a new dimension to urban government issues. Although disaster response is a general government responsibility, the vulnerability of cities to terrorist attacks and possibility of mass casualties make disaster readiness especially difficult in urban areas.

The events on 9/11 have set off a broad debate and various legislative actions affecting several areas of government, such as crime prevention, law enforcement, and the safety of transportation systems. Information technology is clearly viewed as an essential tool in improving all those government functions. The consensus among workshop participants is that *digital government efforts had lacked a common sense of purpose and leadership before 9/11*. The political climate emerging from 9/11 signifies an even greater need for federal government agencies to coordinate digital government efforts in the years ahead.

This document is organized as follows. Section 2 discusses the organization and history of the two workshops. Section 3 reports on discussions and suggestions that emerged from the Chicago

workshop. Section 4 summarizes the main conclusions from the Chicago workshop. Additional information about the follow-up workshop in Redondo Beach, California can be found in the companion report titled *Report from the "Urban Digital Government Grand Challenges" Workshop* [2].

2. Workshop organization

The first workshop took place in Chicago on March 8—9, 2001. This workshop drew a multidisciplinary attendance of about 80 people, consisting of academic researchers and administrators, local government officials, and software developers for digital-government applications. The background of the participants was equally diverse including such fields as communication studies, computer science, information and decision science, library science, political science, public affairs, and urban planning. A complete list of workshop participants appears in Appendix A.

The workshop was organized by a program committee (PC) co-chaired by Patricia D, Fletcher, University of Maryland Baltimore County, and by L. Vaughn Blankenship, University of Illinois at Chicago. The organization of the Chicago workshop was decided at a PC meeting that took place on the UIC campus in Chicago on September 30, 2000.

The workshop was organized around 4 tracks (topics) reflecting major areas of work in digital government:

1. Human-computer interaction;
2. Functional areas of government;
3. Policy and governance; and
4. Citizen trust and privacy.

The workshop program alternated plenary sessions attended by all participants and discussion sessions for each track. The PC issued a call for papers in November 2000; ten submitted papers were published in the workshop's proceedings. A list of these papers appears in Appendix B.

The first track, *human-computer interaction*, was intended to evaluate the adequacy of existing technologies for supporting access to a broad array of digital government applications by ordinary citizens. The density and diversity of urban populations would require flexible approaches to graphical user interface (GUI) design seeking to appeal to populations with vastly different computer skills, ethnic backgrounds, communication skills and English literacy. This track was co-chaired by Nancy Olson and Joseph Danziger.

The track on *functional areas of E-government*, which was co-chaired by Christopher Lee and Donald Norris, explored various issues underlying the development of digital government software. These issues included the use of Geographic Information Systems, application development vs. outsourcing, user feedback, training, performance measurement and criteria for application functionality, and enabling communication infrastructure.

The track on *policy and governance* was co-chaired by Lucy Bisognano and William Dutton. This track focused on issues of law, guidance, and management structure and operating procedures that cut across the three main kinds of government functions, namely governance, service delivery and policy making.

Finally, the track on *citizen trust and privacy*, which was co-chaired by Richard Mason and John McCarthy, included various issues related to safe storage and retrieval of electronic information.

Randy Johnson, Commissioner, Hennepin County Minnesota, delivered the workshop's keynote speech, titled "Cities and Counties: Laboratories of Reality for E-Government".

The workshop's PC selected the following four submitted papers, one for each track, for presentation at plenary sessions during the workshop's first day:

1. "On line Tools for Public Participation," by Al-Kodmany;
2. "Geographic Information Systems and E-Government," by Gant et al.;
3. "Implication of Legal and Organizational Issues for Urban Digital Government Development," by Cresswell and Pardo; and
4. "Overarching Framework for Addressing Complex Legal Issues," by Zeichner.

A one-day workshop following the Chicago workshop took place in Redondo Beach, California on May 24, 2001. This workshop was colocated with *dg.o2001*, the national conference on Digital Government, which took place on May 20—23, 2001. The purpose of this follow-up workshop was to disseminate results of the Chicago workshop among Computer Scientists and Engineers attending the Digital Government conference.

The follow-up workshop was organized by a committee consisting of Yigal Arens (University of Southern California), L. Vaughn Blankenship (University of Illinois at Chicago), Ugo Buy

(University of Illinois at Chicago), and Melvyn Ciment (The Implementation Group).

Similar to the Chicago workshop, the follow-up workshop was divided into tracks. While tracks in the Chicago workshop were based on Computer Science issues relevant to digital government, tracks in the follow-up workshop were based on the three main functional areas of government:

1. Governance
2. Policy making
3. Service delivery

The goal of this track organization was to identify cross-cutting computer-science research issues and their relevance to various government functions in urban environments. The governance track, co-chaired by William Dutton and Paul Rosenbloom, addressed issues of citizen feedback, such as e-voting. The focus of the policy-making track was the creation of decision-support systems for government planners. This track was co-chaired by Jim Danziger and Lois Delcambre. The track on service-delivery discussed issues underlying the delivery of government services to the public. This track was cochaired by Peter Bloniarz, Salvatore Stolfo and Richard Mason. Additional information about the follow-up workshop can be found elsewhere [5].

3. Track discussions at Chicago workshop

We summarize the conclusions of the Chicago workshop for each of the four tracks. Each track was asked to assess the technological demands that are needed for the topics covered in the track. Also, each track was asked to identify potential projects for digital government research in the short term. The general tone of the discussions in all four tracks is that key computer science technologies enabling widespread application of digital government applications are either still nonexistent, or that knowledge of those technologies has not reached practitioners in public offices and software development organizations. Graphical user interfaces have not been widely tested on segments of the population that have not seen computers before. It is unclear whether current security technologies will provide reasonable defense against well-organized attempts at gaining access to protected information. Electronic information repositories store ever increasing amounts of data that could be used for decision-support systems. However, the difference in the format and the aggregation level of the information often prevents the use of multiple data sources in these systems. Finally, critical issues of access (e.g., the infamous *digital divide*) must be addressed in order for digital-government technologies to gain widespread acceptance. Table 1 in Section 4 below summarizes the various technological issues and their impact on digital government issues. First, we report the various conclusions of each track.

3.1 Human-Computer Interaction

The discussions in this group exposed different views that the term *Human-Computer Interaction* elicits in people of different disciplines. On the one hand, computer scientists define HCI to be the study of GUIs and of methods for realizing software systems that implement user interfaces. On the other hand, social scientists understand HCI to be the diffusion of the Internet and other computer media for dynamic, interactive activities within society as a whole. This view comprises not only the traditional computer science view of HCI, but also broader societal issues underlying the adoption of information technologies, among others, for government activities.[1] For sake of clarity, in the sequel we use the term HCI to mean the traditional CS-oriented field of GUI design and we will use the term *Human-Computer Communication (HCC)* to denote the broader view common among social scientist. Many of the discussions at the Chicago workshop actually involved HCC issues.

According to track participants Dawes and Fletcher, the HCI group raised six main kinds of issues.

1. **Use and impact**. The future use of digital government technologies will depend, to a large extent, on the benefit that the parties involved will draw from the technologies. Benefits can be measured as either reductions in the cost of delivering government services, or in increases in the quality of the services provided. In order for digital government to gain widespread acceptance it is imperative that these benefits offset the cost of developing, deploying and maintaining digital government systems.
2. **Partnering.** The successful production and use of digital government systems involves cooperation among various kinds of institutions and individuals, including funding agencies,

[1] This discrepancy may be an instance of Thomas Kuhn's *incommensurable* paradigms adopted by different disciplines.

federal and local government organizations, private-sector organizations, and individuals using digital government services. This issue is discussed further in the context of the Urban-Stakeholder Forum below.

3. **Innovation diffusion.** Current efforts in digital government have been marred by lack of coordination and duplication of efforts by providers of digital government services. For this reason, the establishment of digital government services is typically quite costly in this day and age. Moreover, this scattering of development efforts is likely to result in incompatible interfaces and systems, which will harm the acceptance of digital government services by prospective customers of those services. (See also the discussion on the *single portal* issue below.)

4. **Usability and visualization.** These terms characterize the social scientists view of the CS field of HCI. The design of GUIs for digital government systems will be especially complicated in urban settings by the heterogeneity of urban populations. Thus, the deployment of digital government systems in these settings raises a number of HCI issues, such as the design of bilingual or multilingual interfaces for non-native speakers, text-free interfaces for functionally-illiterate people, and adaptive interfaces to meet the needs of people within a wide range of computer-literacy skills.

5. **Preservation, durability and quality of data.** This HCC issue is concerned with the quality of the information accessible through digital government systems. The information in question could be personal information about individuals (e.g., in service delivery systems) or statistical information about groups of individuals (e.g., in decision support systems for policy-making, or in voting systems for representation). In all above cases, the information provided by digital government systems must be accurate, up-to-date, stored securely, and protected from malicious or erratic users. Some of these issues were also discussed in other workshop tracks, namely *functional areas of government*, and *trust and security.*

6. **Policy control.** Legislative actions will be required that facilitate the adoption of DGS systems. First, various legal issues must be addressed (e.g., involving the privacy of the data stored on digital government systems). Second, appropriate laws (e.g., on service delivery, representation) could facilitate the adoption of various digital government systems.

Participants in the HCI track also noted that the widespread introduction of digital government services faces formidable obstacles. The first obstacle is the confusion on the roles of the federal government, local government entities, and private organizations about leadership and coordination of efforts to set up digital-government systems and services. An additional obstacle is the digital divide and the lack of access to the Internet by large segments of the US population. The diversity of urban populations, resulting in widely differing knowledge of English and computer literacy, must be taken into account by developers of digital government software.

On the positive side, digital-government software has been rapidly improving both in the amount of the services supported and in the quality of the interfaces to those services. Here we summarize the discussions on each of the four issues, followed by six project proposals.

Solutions to some of the above issues will often be difficult to find. The thesis advocated by the Urban Stakeholders Forum [4] is that digital-government efforts will ultimately succeed only if customers and providers of digital-government systems will find it beneficial or profitable to use those systems. Therefore, finding the solutions means first and foremost understanding who the stakeholders are (i.e., people and organizations with vested interests in digital-government efforts), what motivations each stakeholder has, and the likely interactions among the various stakeholders. The following issues define this stakeholder-based view of digital government.

1. **Service providers.** What institutions and organizations will be responsible for setting up digital government services and for providing access to those services?

2. **Access.** What individuals and organizations will have access to digital government services?

3. **Services provided.** What kinds of services will be provided on-line?

4. **Single portal.** Is it important for digital government software systems to adhere to a uniform interface for all services provided?

The issue of who will provide the services is likely to be answered by both private organizations and local government agencies. In some cases public agencies have conducted their own software development in-house (e.g., the City of Milwaukee, Wisconsin). In

other cases public agencies have outsourced their services to private software developers.
In the future, it is likely that both private and public organizations will continue developing digital government applications. However, collaborative efforts, such as partnerships, involving private and public organizations will be highly desirable. These partnerships can potentially build upon the different skills and unique expertise of public and private organizations. For these reasons, funding models for digital government work should strongly encourage these partnerships.

On the issue of access, developers of digital government systems must focus on the needs and interests of potential users of those services. Graphical user interfaces of digital government applications should be geared toward a broad array of prospective users, despite the wide differences in language, computer skills, and Internet access among those users.

The differences among prospective users of digital government applications inevitably raise the issue of the *digital divide*. To date a significant portion of the US population is unable to use computer applications either because they lack the technical skills to use a computer or because they cannot afford to buy the needed equipment and Internet access. Fortunately, many issues in the digital divide look far less threatening today that they did just a few short years ago. First, computer use and computer literacy are spreading fast because of increased computer use in schools and workplaces, falling equipment prices, and improved user-friendliness of software systems. Second, the socio-economic disparities underlying the digital divide have often been addressed with increasing success by providing free access to computers in public libraries. Third, these trends are likely to continue unabated in the years ahead.

The services to be provided with digital government tools span all three areas of government, from public administration to governance and to support for policy-making. On the one hand, digital government technologies are likely to benefit the efficiency and the effectiveness of government functions. Thus, the broadest diffusion of these technologies is highly desirable. On the other hand, the growth in the number of digital government applications is detrimental to the establishment of a "single portal" into government services. As available digital government services increase in sophistication and breadth, the definition of uniform interfaces will inevitably become more difficult. This issue will be further complicated by the lack of communication among the multitude of application developers in public and private organizations.

The concept of access to digital government services through a single portal echoes a number of concepts that have been used successfully, such as the 9-1-1 emergency dialing system, the concept of one-stop shopping and one-button Internet access. Digital government applications should follow a similar approach because of its convenience and ease of use.

On the one hand, access to digital government services through a standardized set of interfaces is highly desirable. On the other hand, the realization of the single-portal strategy will be complicated by several factors. First, the range of digital government services will be both extremely broad and likely to evolve. Thus, it will be difficult to define a uniform set of interfaces for all such services. Second, digital government services will be offered by a wide array of public and private organizations, which will have to spontaneously agree to the accepted standards of the single portal. Third, the computer skills of digital government users will vary sharply. There is an obvious trade-off between the efficiency of a graphical user interface (i.e., the ability for a skilled user to find quickly needed information and services) and the ease of use of the interface (i.e., ensuring that unskilled users can still use the interface).

Participants to the HCI track identified the following projects. For each project we list a title, a statement of work, and the potential benefits to key project stakeholders.

1. Title: Knowledge management for durable urban information design.

   Work summary: Investigate stability, migration, accessibility, organization (e.g., typical taxonomies) of digital-government information.

   Benefits to stakeholders: Improved ability to search and retrieve digital-government data by ordinary citizens and government planners; availability of stable and reliable digital-government data to future generations.

2. Title: Enhancing the usability and impacts of digital government applications.

   Work summary: Investigate how individuals, groups and government personnel currently use selected digital government applications, such as Geographic Information Systems (GIS); assess the effects of these applications on policy and governance; determine how individuals learn how to use these applications; identify ways to enhance the *usability* and *visibility* of these

applications; identify changes in design, training and end user support that will enhance visibility

Benefits to stakeholders: Improved ability to search and retrieve digital-government data by ordinary citizens and government planners; availability of stable and reliable digital-government data to future generations; policy makers would obtain feedback on how digital government applications are used by citizens.

3. Title: Urban data visualization.

   Work summary: Define techniques and tools for predicting the effects of policy decisions on government services involved; define tools for supporting decision-making to address problems in the urban landscape; define tools for presenting urban data to ordinary citizens in ways that engage and empower the citizens.

   Benefits to stakeholders: Government officials and businesses could use decision-support tools for policy-making and business investments; ordinary citizens could provide input on both future government and business investment decisions.

4. Title: Assessing digital government readiness.

   Work summary: Define metrics for measuring the readiness of local government agencies to adopt digital government practice; define methodologies for guiding and providing assistance to local government agencies seeking to adopt digital government practices.

   Benefits to stakeholders: Beneficiaries of this project would include city and county governments, universities and private-sector technology providers interested in seeing the success of digital government systems.

5. Title: Strategic and consolidated planning for Great Cities IT efforts.

   Work summary: Collect and evaluate data about case studies involving university members of the GCU consortium (e.g., Chicago, Milwaukee and Memphis); study use of IT techniques and tools in the decision-making procedures of those cities.

   Benefits to stakeholders: Coordination of grass-root efforts to advance digital government technologies across different cities.

6. Title: Usable tools for citizens and decision makers to visualize urban design impact

   Work summary: Identify the data needs of citizens and decision makers related to urban design issues; identify the data quality criteria for citizens and decisions makers; identify ways to personalize urban design decisions support tools; identify the usability parameters of applications for citizens/professionals/decision making users; identify the different impacts of different levels of realism in 3-dimensional rendering of urban design outcomes; identify pathways for citizens to share their preferred visions and the trade-offs involved; teach different ways for citizens to discuss and negotiate their visions remotely.

   Benefits to stakeholders: Ordinary citizens, urban planners, transportation planners and environmentalists would all benefit from access to data relevant to decision-making in urban environments.

3.2 Functional Areas of Government

Discussions in this track focused on assessing the current progress of digital government technologies in public agencies and on identifying strategies for accelerating the adoption of these technologies.

Compared to other Internet applications (e.g., e-commerce), the progress so far of digital-government technologies has been relatively slow. First, the traditional organization of government functions is based on a traditional "stovepipe" model with little interaction among the different levels and jurisdictions involved in delivering a government service. As a result, the end users—whether ordinary citizens or private organizations—must often interact directly with many different government entities in order to obtain a desired service. This organization is not conducive to a successful automation and integration of government functions. Cultural factors, such as the traditional reluctance of government agencies to share information with each other, are also a barrier to the realization of digital government services. However, digital government technologies can potentially correct the existing inefficiencies. The structure of software applications that will automate the delivery of government services can lead to a new organization of government services based on the notion of a *life event.* In this model, all information exchanges pertaining to a given government service or function (i.e., an event) would be handled by the same (automated) government entity, possibly across different jurisdictions.

Second, local government agencies often fail to see a clear return-on-investment (ROI) for digital government technologies. An important reason for this state of affairs is that some benefits of digital

government technologies cannot be easily quantified. Examples of potential benefits include improved decision-making by urban planners, greater citizen involvement, and improved efficiency in the delivery of government services. Measuring these benefits will require the definition of quantifiable ROI and performance criteria, of strategies for financing digital government efforts, and of affordable pricing strategies for digital government products.

Third, at the time of the Chicago workshop some technological, cultural and political barriers had to be addressed in order to permit widespread application of digital government technologies. An important limitation is the lack of *interoperability* of existing software systems. Similar to the term "human-computer interaction", the word "interoperability" has sharply different meanings in different communities. On the one hand, in the world of computing interoperability denotes the ability for multiple software systems to interact meaningfully "despite differences of language, interface, and execution platforms." [6]. A significant obstacle to computing interoperability in digital government applications is that information useful to these applications is often stored in incompatible formats, such as different levels of aggregation of geographical data. Worse yet, related digital government applications often do not communicate relevant information to each other. This is usually the case for legacy software systems predating the onset of the world-wide web.

On the other hand, in the world of local government and the social sciences, the word interoperability denotes the ability for software systems to access and coordinate related information residing at different government levels and jurisdictions in an effort to deliver a given government function or service. Legal, cultural and political obstacles have hitherto prevented this kind of interoperability from taking place in local government. Overcoming these obstacles will require flexible cooperation among legislative bodies, local government agencies, and private-sector software vendors. Thus, achieving interoperability at the government level will inevitably be more difficult than realizing applications that are interoperable in a purely computational sense. Some participants hope that the impetus provided by software interoperability will in fact help in overcoming these barriers and lead to systems organized around life events.

Despite significant strides in human-computer interaction during the past two decades, the *user-friendliness* of existing computer applications is also identified as inadequate for various segments of the general population. This problem is obviously compounded by the digital divide as both access to the Internet and the ability to use effectively Internet tools are needed in order for ordinary citizens to use digital government applications.

Finally, at the time of workshop there is no universal model for driving the development of digital government applications. The development of these applications involves various kinds of participants, including at the very least (often cash-strapped) local governments and private IT companies. However, funding models for these applications and methods for sharing data among different constituencies are conspicuously lacking.

The track identifies the following four stages of adoption of digital-government technologies:

1. **Entry level.** Agencies at this level provide only a simple website with basic information about the purpose and organization of the agency. The page does not provide links to related pages and no interactive features are included in the page.
2. **Detailed level.** Pages at this level provide both interactive services and relevant links to related pages. These pages typically automate traditional government services by mirroring the traditional (stovepipe) structure of government agencies and their procedures.
3. **Leadership level.** Pages at this level provide a broad spectrum of government services that span across different jurisdictions and tie together multiple government entities in an effort to simplify the delivery of a government service. These pages add the new "life-event" model of delivery to the traditional "stovepipe array" organization of government services.
4. **Fully-automated level.** All services and functions that do not require physical user presence in a government agency are available interactively and in real time. The model of interaction between users and service providers is transaction-based. The life-event methodology is predominant with extensive links and data sharing among related pages.

Evidently, the key to overcoming the obstacles to widespread adoption of digital government technologies is to motivate government agencies to embrace these technologies. This objective can be accomplished in various ways. Computer scientists can contribute to these efforts by improving the software interoperability and user-friendliness of existing systems. Social scientists must define appropriate ways to factor the imponderable benefits

of digital government systems in investment decisions. The ability for local governments to share not only digital government applications and data repositories, but also tools for needs analysis and ROI estimation will play an important role in spreading these technologies. Ways to fund investment in digital government efforts (e.g., bond issues) should be publicized and shared among policy-makers. The federal government should take the initiative in promoting cooperation among the various parties involved in the production of successful digital government systems. Academic institutions, such as the Great Cities universities, can contribute by exploring various research issues.

The projects proposed in this track reflect the inadequacy of current knowledge about various issues pertaining to the adoption of digital government technologies by local government organizations and the design of successful applications.

1. Title: Meta-analysis of literature on information technology in local government as applicable to the adoption of digital government services.

   Work summary: Identify factors leading to the adoption, implementation and management of digital-government technologies by local government agencies; analyze past three decades of IT experience in local government; identify key lessons; generate guides to the adoption of digital government technologies.

   Benefits to stakeholders: This project would facilitate the adoption of digital government practices by local government agencies; software developers would benefit from increased knowledge on successful design and deployment of digital government applications; users would ultimately benefit as more and more digital government services become available; finally, academic researchers would become more deeply involved in digital government research.

2. Title: Development of assessment tools for digital government in local governments

   Work summary: Define metrics for evaluating ROI of digital government applications; identify performance measures and techniques for cost-benefit analysis; define surveys and survey tools for evaluating outcomes of digital government initiatives.

   Benefits to stakeholders: Improved digital government systems can be beneficial to both local government agencies and to users of digital government systems.

3. Title: Political, policy and organizational issues affecting interoperability initiatives across jurisdictions and levels of government.

   Work summary: Analyze political, policy and organizational factors that inhibit digital government from operating across jurisdictions and levels of government; predict extent to which new technologies may help overcome barriers to interoperability among government levels and jurisdictions.

   Benefits to stakeholders: Improved digital government systems would be beneficial to local government agencies, prospective users, developers and academic institutions in ways similar to the previous two projects.

4. Title: Mechanisms underlying adoption of digital government applications and benefits to their users.

   Work summary: Analyze external and internal factors affecting adoption in local government agencies; define methodologies to implement these applications; integrate digital technologies in strategic planning processes.

   Benefits to stakeholders: Improved digital government systems would be beneficial to local government agencies, prospective users, developers and academic institutions in ways similar to the three projects above.

3.3 Policy and Governance

As suggested by its title, the focus of this track was two-fold. First, the track discussed strategies for improving policy-making frameworks in local government institutions. Second, the track evaluated the potential benefits and likely obstacles to the adoption of digital government technologies for citizen representation. Similar to the track on functional areas of government, participants in the policy and governance track recognized that the current organization of government, built around multi-layered jurisdictions, does not provide an effective framework for policy-making at the local government level. While these discussions echoed the criticism of the "stovepipe" model in the functional-area track, the track on policy and governance emphasized strategies for removing barriers to the creation of agile and cohesive policy-making frameworks in local governments. *The need to overcome the stovepipe model of government operation is especially acute in urban environments because of the size of the populations served and the*

number of government agencies involved in policy-making and service delivery in these settings.

The definition of new effective and effective policy-making frameworks involves a careful balancing act between upholding the identity and mission of different jurisdictions with the need to streamline government operations. Improving citizen participation is equally difficult, facing such obstacles as the digital divide, several issues related to electronic voting, and definition of appropriate electronic channels for citizen advocacy and feedback. As of the time of the workshop, empirical research (e.g., field studies and case studies) is strongly needed in order to identify new policy-making frameworks and to overcome obstacles to improved representation. The case studies should be geared toward three specific topics related to policy and governance:

1. **E-politics:** Issues raised by digital government with respect to governance and representation (e.g., electronic voting, campaigns and elections, advocacy groups).
2. **E-management:** Issues underlying the creation of policy-making frameworks and the delivery of government services.
3. **E-highways.** Issues underlying the creation of an electronic infrastructure to support digital government services in urban environments (e.g., user access and training, the digital divide).

The three topics above reflect a different organization of government than the traditional partition into policy-making, representation, and service delivery. One may speculate that the boundaries between policy-making and service-delivery become somewhat blurred when the objective is to define new policy frameworks, which was one of the two main objectives of this track. The definition and implementation of these frameworks will require a mutual and continuous feedback between policy makers and public administrators in charge of service delivery.

The approach based on case studies faces various challenges. First, this approach would involve academic and practitioners sorting out existing data, using interviews, focus groups and questionnaires when investigating each case. These activities are quite labor-intensive, making appropriate funding necessary for the successful completion of these activities. Unfortunately today we are lacking appropriate funding sources for this type of work. Most existing funding sources are geared either toward pure science or product development; they rarely foster the kind of multidisciplinary partnerships required for these case studies. Thus, this work would greatly benefit from new funding models for applied, collaborative projects involving academic scientists, public administrators, and private companies.

Second, the lessons learned in the case studies must be broadly disseminated in order to facilitate widespread adoption of new frameworks for policy-making and governance. A possible mechanism for the dissemination of case-study results is the creation of a national consortium that will review and publicize meritorious case studies. Copyright issues may have an adverse effect as some participants (e.g., for-profit organizations) may be reluctant to share information in the public domain. Privacy issues, including the need to protect individual surveyed in the case studies, must be carefully addressed.

On the positive side, at the time of the workshop a number of related projects had already been started, which addressed some the above issues. These initiatives include the Electronic Hallway project from the Daniel J. Evans School of Public Affairs at the University of Washington; the Harvard Cases online from the Case Program of the John F. Kennedy School of Government at Harvard University; and several Agency Cases from the Center for Technology in Government (CTG) of the University at Albany. These efforts have the potential to move forward successful e-management applications [1—3].

The potential benefits of digital government technologies on e-politics are more uncertain than the case of e-management. On the one hand, the workshop took place in the wake of the November 2000 election, which highlighted the inadequacy, in many cases, of current voting practices. The need to address these inadequacies will probably encourage the adoption of digital government technologies not only for electronic voting, but also for grass-root recruitment and fund-raising during political campaigns, and for promoting advocacy groups. For instance, electronic voting machines could make it easier for voters to double-check the ballots being cast. In addition, automated vote counting would probably lead to fewer errors in the tallying process. Finally, the availability of machines recording and "remembering" votes would create an audit trail that facilitates the detection of electoral fraud.

While digital government technologies have great potential for e-politics, many barriers exist to the adoption of digital government technologies for e-politics. An important technical barrier is *authentication*, that is, making sure that votes are cast by eligible individuals. Reliable scientific methods

for authenticating the identity of voters were conspicuously lacking at the time of the workshop.

Another barrier is the *security* of e-voting systems. While these systems must be available to ordinary citizens casting their ballots, they must also be protected from malicious users attempting to tamper with the voting process. Intrusion attempts into electronic voting systems, whether successful or not, must be promptly detected; corrective action must be taken in the case of vote tampering.

The lack of funding for new voting systems could be an additional barrier. By the standards of government services, voting is a relatively infrequent activity because it typically takes place every two or four years, depending on the purpose of the election. Given that daily government operations usually have a high priority in fund allocation, local government institutions have often been slow in providing funds for improvements in voting systems; this trend is likely to continue in the future. Elections are managed by local government institutions (e.g., states and counties) with little control by the federal government. Control over election practices has been viewed historically as a constitutionally-sanctioned state right, and attempts to impose federal regulations on voting processes are likely to meet resistance at the local levels. In this scenario, it is quite likely that many cash-strapped local institutions will lack the funds needed to incorporate digital government technologies in their voting processes. This problem is part of the digital divide, a will-known obstacle to the widespread adoption of digital government technologies.

Finally, there are also cultural and societal barriers to governance through digital government. Aversion to technology and the lack of required knowledge or skills may cause many prospective users to become disenfranchised. Push-button democracy and impulse voting are additional concerns.

The following are two potential research projects in the area of policy and governance:

1. Title: Assessing public perceptions of online voting.

   Work summary: Collect field data on cultural and societal attitudes toward e-voting; analyze effects of ethnicity, education, and social status; identify public expectations; set standards for voting systems.

   Benefits to stakeholders: User-oriented requirements for digital government applications would benefit local government planners and developers of these applications.

2. Title: Synthesis of strategic plans for adoption of digital government technologies.

   Work summary. Analyze existing case studies on adoption of digital government systems by local governments; Evaluate cultural, organizational and financial barriers and possible solutions to these barriers; synthesize a "guide-book" outlining feasible paths to the adoption of these technologies.

   Benefits to stakeholders: Recipes on how to fund, acquire and deploy digital government applications would benefit government agencies planning to adopt these applications.

3.4 Citizen Trust and Security

Similar to other topics discussed in the workshop the term "computer security" is subject to different interpretations in different disciplines. In the world of computing the term denotes the investigation of techniques for protecting information stored on electronic media from unauthorized access or modification. In the world of the social sciences, security revolves around the definition of assurance levels that meet reasonable expectations of the users of digital government applications.

At the outset the workshop's program committee identified the following topics for discussion in this track: (1) Authenticity—The ability to know the identity of communicating parties, (2) Integrity—The assurance that stored data is not subject to unwanted modifications, (3) Availability—The ability to know when digital government services are available, (4) Blocking—The ability to block unwanted intrusions, and (5) Privacy—The ability to control access to information. The ability to implement secure digital government systems depends on various factors, most notably the availability of appropriate computing technologies (e.g., encryption, redundancy, firewalls) and existing laws and regulations.

The track discussed various themes, such as security threats posed by computer viruses and worms, the reliability of digital signatures for authentication, and the need to maintain privacy and confidentiality of information stored on networked databases and repositories. Track participants recognized the importance of public service organizations such as the CERT Coordination Center at Carnegie-Mellon University in detecting and blocking the spreading of viruses and worms.

Events subsequent to the workshop, including 9/11, dramatically changed the focus of the debate on

citizen trust and security. An array of new issues has emerged since 9/11, including increased use of information technology for law enforcement, the tension between the right to privacy and the need to prevent terrorist attacks, the use of information technologies in handling mass casualty situations, and the need to protect our information infrastructure from terrorist attacks.

Track participants identified various interesting research projects relating to citizen trust and security.

1. Title: Security practices at the urban level.

   Work summary: Identify security standards, policies and procedures that are prevalent at the local government level; investigate how existing policies are implemented in practice; evaluate the effectiveness of current policies; identify factors that affect policies in place today.

   Benefits to stakeholders: Local government agencies would learn about the effectiveness of various security standards and policies; scientific community and academic institutions would benefit from increased knowledge on security practices.

2. Title: Electronic transactions with government through digital signatures.

   Work summary: First collect input from citizen groups regarding their views on privacy and security and the level of assurance that they expect; next, define user-friendly methods for delivering authentication certificates and permission to access protected information.

   Benefits to stakeholders: Local government agencies and developers of digital government applications would learn security standards acceptable to users of these applications.

3. Title: Risk modeling and assessment of critical systems and networks relating to service delivery.

   Work summary: Build upon existing models and practices for critical systems; establish security criteria for critical service systems; focus on continuous service delivery.

   Benefits to stakeholders: Local government agencies and developers of digital government applications would learn new security standards and policies.

4. Title: Taxonomy—Develop common lexicon for information security.

   Work summary: Using models such as the Diagnostic and Statistical Manual of the American Psychological Association as an example, develop commonly-accepted terms and practices for information security and technology professionals.

   Benefits to stakeholders: Multi-disciplinary participants in digital government initiatives will benefit from the establishment of a common lexicon; this would alleviate existing language and cultural barriers among participants.

5. Title: Cyber-security information sharing and analysis.

   Work summary: During first phase identify current best practices for sharing incident information, threat and vulnerability data and investigate agencies using these practices (e.g, Center for Disease Control, CERT Coordination Center at Carnegie-Mellon University, and IT-ISAC, the Information Sharing and Analysis Center for Information Technologies); during second phase develop a model for information sharing among state and local Chief Information Officers.

   Benefits to stakeholders: Beneficiaries will include state, local and industry information security and IT managers, as well as anyone involved in managing threats and vulnerabilities to information systems.

4. Summary of workshops

4.1 Role of digital government in America's cities

The national debate on digital government technologies, including the discussions at both workshops, is based on a number of recognizable benefits that these technologies can provide. These often-unspoken factors will continue to change the social context of information and public participation and to motivate future investments in digital government technologies. Before we summarize the main conclusions of the two workshops, we explicitly list these factors.

- **Connectivity**: Providing new ways of connecting people to government services and vice versa.
- **Accessibility**: Making information that was difficult to reach easily accessible by ordinary citizens
- **Immediacy**: Enabling people in different places to communicate in real-time with each other.

- **Portability**: Allowing large and unwieldy amounts of information to be easily duplicated, modified and transported.
- **Durability:** Making information potentially more accessible and stored more reliably.
- **Quantifiability**: Supporting the definition of quantitative measures (e.g., statistical analyses) of government data.

These qualitative improvements describe the best promise of information technology. Each of these areas poses pitfalls and limits, as well as promise.

As the scale of information systems has increased, two sets of challenges have arisen, which complicate the positive promise of IT. One set of challenges is more recent, and is related to technology's linking of the macro, or universal information, with micro, or local information. This set of challenges is reflected in issues of privacy, human computer interaction, security, user authentication, distributed computing, and is related to the technical and sometimes paradoxical limits of advancing technology. It is easier for local governments to share authenticated public information, than for them to authenticate and secure private information communicated directly by citizens. Computer science can address a number of these challenges.

Another set of challenges predates the onset of digital government and relates to social, political, and resource constraints, which in the present case also limit accessibility and connectivity within urban environments, especially for local governments and their constituents. As the local government functions of representation, adjudication, administration, and service transfer to electronic environments, new problems of access, connection, security, and authentication will arise. Social and structural changes associated with the above advances have particular consequences and pose unique challenges in urban environments.

Dispersal of IT is heterogeneous within urban environments. Urban structure, as reflected by both its physical and social (especially linguistic and literacy) geography, is simultaneously rational, and irrational. Digital divides exist, both between citizens and government, and within single governments from agency to agency. Pressed by the new computerized points of contact with citizens, local governments are already making internal bureaucratic budgetary changes as a result of engagement in e-government, and are being reshaped internally to conform to the logic of IT. Computer science research within the context of urban e-government must search for agenda that is feasible, of sufficient impact, financially and thereby institutionally sustainable, and that can be disseminated by industry.

4.2 Summary of Chicago workshop

The Chicago workshop brought together a diverse audience consisting of academic researchers from various disciplines, developers of commercial software, elected officials, and local government administrators. The social sciences and public administration drew the largest participation; workshop discussions reflected the attendees' background. Thus, the most valuable lesson learned from the workshop was a *customer-oriented* view of the challenges facing computer scientists and developers of digital government applications. Workshop participants approached the computer science themes in the four tracks (e.g., human-computer interaction, computer security) from the perspective of future users of these systems. This kind of information can help academic researchers, computer scientists and software developers in understanding the ultimate requirements of digital government applications.

Workshop discussions also offered a valuable glimpse into the cultural, political, and institutional difficulties that face widespread adoption of digital government technologies in local government. A point that emerged from multiple tracks is that the current organization of townships and state governments (i.e., the stovepipe model) is clearly detrimental to the adoption of digital government technologies. There was genuine hope that technology may soon pave the way for a comprehensive reorganization of local government agencies by replacing the stovepipe model with the more efficient life-event model.

Workshop participants also felt a strong need for federal leadership in providing appropriate legislation and funding for digital government initiatives. The traditional funding models, which are geared primarily toward pure research in a given field, were universally deemed unsuited to promote the kind of multi-disciplinary partnerships required for digital government research. New funding models seeking to create partnerships among public administrators, academic scientists and software organizations are highly desirable. Legislation is needed, for instance, to guarantee privacy and confidentiality of citizen information, for defining appropriate levels of security and for sidestepping the multiple facets of the digital divide.

Along with the traditional view of the digital divide, which is based on socio-economic factors, workshop

participants identified many additional divisions among prospective users of digital government technologies. Ordinary citizens differ in their language and computer skills, in their interests, and in their attitudes toward computing in general and digital government in particular. On the positive side, workshop participants viewed the ubiquitous presence of computers in schools and workplaces as a powerful mechanism for promoting computer literacy and for overcoming the digital divide.

The workshop confirmed once again the existence of significant cultural and lexical gaps among the various disciplines involved in digital government initiatives. Terms such as human-computer interaction", "computer security", "durability of information", and "interoperability" have sharply different meanings in different communities.

Although the workshop did not identify specific computer science research objectives, participants universally agreed that technological developments are needed at least in the following four areas:

1. HCI and data visualization;
2. Computer security and privacy;
3. Software interoperability and networking; and
4. Reliability and durability of the information and storage infrastructure.

These research areas are relevant to different extents to various areas of government. Table 1 shows a correlation between Computer Science research and functional areas of government. To the traditional three areas of policy-making, representation (governance), and service delivery, we have added a fourth area, *compliance*, which is likely to receive significant attention in the post-9/11 world.

The area of policy-making comprises such functions as urban planning, housing, transportation, taxation, and environmental policies. This area is likely to benefit significantly from new developments in data visualization and handling heterogeneous data sources, which explains the "very high" rating in the corresponding table entries. Policy-making is likely to benefit also from improvements in the information infrastructure, for instance, in safe archival and retrieval of government data. The correlation to security and trust is comparatively lower because decision-support systems are generally not available to the general public. Governance encompasses such functions as representation, accountability, voting, citizen participation and advocacy. Being broadly accessible, these functions will benefit significantly from improvements in HCI, computer security, privacy, and interoperability; however, the requirement for a reliable storage infrastructure is likely to be less critical to these functions.

Compliance functions include the storage and retrieval of criminal data, the dissemination of legislation, real-time monitoring of criminal activities, and inmate rehabilitation. Future advancements of digital government technologies in this area will depend critically on our ability to protect sensitive information, resulting in a very-high correlation with security, privacy and trust. Technological improvements in the areas of networking and the storage infrastructure may be needed as well. Finally, service delivery comprises such areas as public administration, public health, education, transportation, revenue collection, and entitlement programs. This area is quite similar to governance; however, there is a higher level of correlation with advancements in the storage infrastructure, because the continuous availability of these government services to the general public must be guaranteed.

4.3 Summary of follow-up workshop

The follow-up workshop in Redondo Beach, California confirmed the basic conclusions of the Chicago workshop. The participants in the follow-up workshop also reaffirmed the difficulties in setting specific computer science research directions already evident in the Chicago workshop. The participants in the follow-up workshop further recognized that substantial empirical work and system building must be performed before a computer-science research agenda can be put into focus.

As with the Chicago workshop, participants in the follow-up workshop also reaffirmed the need for new funding models for digital government research. This research is clearly highly experimental and multidisciplinary. Moreover, the sheer size of digital government systems will inevitably require large up-front investments. Unfortunately, traditional federal funding models have generally skirted this kind of work, and the public agencies would could benefit most from new digital government systems do not have the ability to fund substantial new endeavors. Additional information about the follow-up workshop can be found in the excellent report [5].

In summary, the conclusions of the two workshops are remarkably similar, despite the different disciplines represented at the two workshops. While attendance at the Chicago workshop was drawn mostly from the social sciences and public administration, the follow-up workshop was overwhelmingly attended by computer scientists. The difficulties in setting realistic short-term

	HCI, visualization, universal access	Security, privacy, and trust	Interoperability, networking, modeling, heterogeneous data sources	Reliability, durability, storage infrastructure
Policy making	Very high	Low	Very high	High
Governance	Very high	Very high	High	Low
Compliance	Low	Very high	High	High
Service delivery	Very High	Very high	High	High

Table 1: Correlation table between functional areas of government and computer-science research themes.

objectives for digital government research at both workshops indicate that massive empirical and field work is needed before the technological demands of digital government applications are well understood.

Three years after the workshops took place, an interdisciplinary peer group for the continual development and evaluation of this urban information research agenda still remains to be constructed. Contacts are still limited between information officers in local government agencies and computer scientists. Urban researchers who assist local governments in addressing their problems, such as planners, public management scientists, and other social scientists, have extensive contact with local governments, but limited contacts with computer scientists. All of the above have limited contact with industry, which ultimately sustains the spread of technological improvements.

We recommend the foundation of a research agenda-setting body, comprised of local government information officers, computer scientists, urban affairs researchers, and industry, in association with a national professional organization of city managers, who shall annually propose research priorities for NSF and other government initiatives. This group shall also help recommend standards, common terminology, benchmarks, and best practices for local electronic government.

5. Post-9/11 postscript

Without naming them, there are several scenarios in which a portion of a city or an entire university campus would be forced to evacuate indefinitely after an act of terror.

The intellectual life work—the social and intellectual capital of thousands of persons, faculty, students, and staff—resides within the systems of a university and within other urban institutions. Should these thousands of persons be forced to evacuate quickly due to an act of terror, these persons might be able to pick up their work from another location if they had the foresight to see that a copy of their life's work was safely stored in a secure location far away from their home.

Individuals can take this precaution now—to save their life's work and key personal files on electronic media and send them to friends in other places. Some institutions do back up their critical records in remote geographic locations. But we have yet to see the wide-scale practice of systematically backing up critical civic and institutional records in scattered and remote geographic locations using the resources of the Internet.

In some sad future, we may see that an entire university campus will have to relocate to another place due to an act of terror. For the sake of a future, happier civilization, we do have to think about these things, and make provisions for redundant storage

systems which will preserve not only scientific research, but social, political, property, health, and economic data as well. We recommend further research on developing such redundant storage systems, which can assist in the rebuilding of cities and of critical institutions, if and when these suffer acts of terror.

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Appendix A: Participant list

Eve Ali Boles, University of Illinois at Chicago
Kheir Al-Kodmany, University of Illinois at Chicago
Robert Allen, University of Maryland
John Baldwin, University of Illinois at Chicago
Sharon Baldwin, Chicago, Illinois
John Bertot, Florida State University
Lucy Bisognano, Council for Excellence in Government
Vaughn Blankenship, University of Illinois at Chicago
Lawrence Brandt, National Science Foundation
Ugo Buy, University of Illinois at Chicago
Bill Campbell, University of Massachusetts at Boston
Yu-Che Chen, Indiana University
Melvyn Ciment, The Implementation Group
Marianne Clarke, University of Illinois at Chicago
David Cox, University of Memphis
Anthony Cresswell, University at Albany
Joseph Danek, The Implementation Group
Tom Darling, University of Baltimore
Sharon Dawes, University at Albany
Randy Deshazo, University of Michigan at Ann Arbor
Lester Diamond, US General Accounting Office
Paul Dresler, Department of the Interior
William Dutton, University of Southern California
John Ellis, University of Memphis
Julie Fesenmaier, University of Illinois at Urbana-Champaign
Raymond Figlewicz, Wright State University
Patricia D. Fletcher, University of Maryland Baltimore County
Shelley Fulla, Chicago Police Department
Jon Gant, Indiana University
Thomas Gunther, U.S. Department of the Interior
Ralph Hager, U.S. General Services Administration
Akhlaque Haque, University of Alabama at Birmingham
Bill Henderson, Towson University
Marcin Hiolski, University of Illinois at Chicago
Alfred Ho, Iowa State University
Stephen Holden, Iowa State University
Stan Hyland, University of Memphis
Craig Johnson, Indiana University
Randy Johnson, Commissioner Hennepin County, Minnesota
Leon Kappelman, University of North Texas
Charles Kaylor, University of Michigan at Ann Arbor
Bill Keller, Gartner Group
Beomsoo Kim, University of Illinois at Chicago
Rachel Kincaid, University of New Orleans
Denise Lea, University of Illinois at Chicago
Byungtae Lee, University of Illinois at Chicago
Christopher Lee, City of Mobile, Alabama
Annie Leveritt, University of Illinois at Chicago
Brian Loader, University of Teesside, United Kingdom
Kim Malkin, University of Illinois at Chicago
Joe Mambretti, Northwestern University
Richard Mason, Southern Methodist University
Marco Mazzucco, University of Illinois at Chicago
John McCarthy, Critical Infrastructure Assurance Office and US Coast Guard
Mary McCormick, Fund for the City of New York
Randall Murphy, Chief Information Technology Officer, Lake County, Illinois
Donald Norris, University of Maryland Baltimore County
John O'Looney, University of Georgia
Nancy Olson, City of Milwaukee
Joy Pamintuan, University of Illinois at Chicago
Theresa Pardo, The University at Albany
David Perry, University of Illinois at Chicago
Hannah Podlevsky, Chicago, Illinois
Arkalgud Ramaprasad, University of Illinois at Chicago
Brigid Rauch, University of Illinois at Chicago
Joel Reed, University of Illinois at Chicago
Roger Richman, Old Dominion University
Joseph Schmitz, University of Tulsa
Albert J. Schorsch, III, University of Illinois at Chicago
John Shuler, University of Illinois at Chicago
Andrew Spano, Westchester County
Eugene Szwajkowski, University of Illinois at Chicago
James Thompson, University of Illinois at Chicago
Jodi White, University of Illinois at Chicago
Wim Wiewel, University of Illinois at Chicago
Lee Zeichner, Legal Networks

Appendix B: Accepted papers

Anthony M. Cresswell and Theresa Pardo, “Implications of Legal and Organizational Issues for Urban Digital Government Development”.

Jon Gant, Wilpen Gorr and Danny Fernandez, “Geographic Information Systems and E-Government Services”.

Kheir Al-Kodmani, “Online Tools for Public Participation”.

Akhlaque Haque, “Filling the Digital Divide: Regional Cooperation through Intergovernmental Information Sharing in the Birmingham Metropolitan Area”.

Randy Deshazo, Charles Kaylor, and David van Eck, “Gauging E-Government: A Report on Implementing Services Among Small American Cities”.

Jon Gant and Yu-Che Chen, “Outsourcing Application Services: Transforming Online Public Services Delivery”.

Nancy Olson, “Geographic Information Systems (GIS) in Milwaukee”.

John O’Looney, “Sprawl Decisions: A Simulation and Decision Support Tool for Citizens and Policy Makers”.

Eugene Szwajkowski, Raymond E. Figlewicz, and Deborah K. Jones, “The Urban Stakeholder Forum: An Internet-Based Information Clearinghouse”.

John Baldwin, Sharon Baldwin, and Mark Mazzucco, “Fair, Accurate, and Accountable Voting Systems".

Appendix C: GCU Universities

The following universities are members of the Great Cities Universities (GCU) consortium:

1. University of Alabama at Birmingham
2. University of Cincinnati
3. Cleveland State University
4. Georgia State University
5. University of Houston
6. University of Illinois at Chicago
7. Indiana University-Purdue University, Indianapolis
8. University of Massachusetts at Boston
9. University of Memphis
10. University of Missouri at Kansas City
11. University of Missouri at St. Louis
12. University of New Orleans
13. City University of New York – City College
14. Portland State University
15. Virginia Commonwealth University
16. Wayne State University
17. University of Wisconsin–Milwaukee