e-Government:
Lessons Learned And Challenges Ahead

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1. INTRODUCTION

Since economy suffered stagflation and public perceptions of bureaucracy became more negative in 1980s, a strong demand for government reform has been shared among the public at large in advanced countries as well as Korea. A response to this is e-government. Especially, during the last ten years information technology(IT) has been flourishing, those countries have been pursuing competitively public sector reform through e-government under the New Public Management(NPM) imperatives oriented to small but efficient, i.e., doing more with less, government structure and operation.

Since 1990s, e-government has been adopted as a powerful strategy to apply information technology to public sector reform for facilitating the development of small and efficient government structures. Although e-government is not the panacea for all government failures, it provides a variety of opportunities to correct these failures. In addition, e-government can significantly contribute to correcting market failures, also, by reducing transaction costs that arise from human constraints in time and space.

Different from its superficial successfulness, in reality, most governments have been facing serious problems with large IT investments in the public sector. Korea is not an exception to this trend. Therefore, implications from benchmarking strategies and performances of these countries can contribute to the successful implementation of e-government service in the future.

This paper examines the historical background, present status, and future prospects of e-government initiatives in advanced countries. Especially, it deals with some lessons learned and challenges ahead in the process of implementation of e-government initiatives in Korea.

2. DEFINITION, COMPONENTS, AND MATURITY STAGES

2.1 Questions Raised

Common questions are often raised in terms of e-government. Any nation aiming to establish e-government should be ready to answer to these questions. These can be addressed as follows(OECD, 2002; PCIP, 2002):

- What is e-government and why are we pursuing it?
- Do we have a clear vision and priorities for e-government? Are they integrated into broader policy and public management goals, and broader information society activities?
- Is there enough political will and commitment to lead the e-government effort?
- What kind of e-government are we ready for?
- How should we plan and manage e-government projects?
- What about inter-agency collaboration and financing?
- Are we selecting e-government projects in the best way?
- What should our relationship be with the private sector?
- How will we monitor and evaluate progress? Do we identify the demand, costs, benefits, and impacts of e-government?

2.2 The Meanings of E-Government

E(electronic) means digital technology that enables people to transact with anyone, at any time in any place, using the Internet and other information technologies. E-Government is, therefore, not a goal but a tool to transform a society by enhancing efficiency, effectiveness, empowerment, and economic & social development. Further, it can increase peoples democratic participation in the policy process, and the transparency and accountability of civil servants.

E-Government is understood as an open socio-technical system(STS) with which a variety of factors interact. First of all, as an open system, it interacts with external environment in terms of social and technological issues including privacy, literacy and digital divide, and information and communication technology. Second, social subsystem includes legal, regulatory, and institutional issues in addition to front-office service and internal business process ones. Third, technical subsystem includes multiple dimensions of hardware platform, communications, data, applications, and so forth.

E-Government activities are usually categorized into three forms of interactions: government to citizen(G2C), government to business(G2B), and government to government(G2G). G2C and G2B include transactions between external customers and government officials in the front office aiming to enhance the quality of services, whereas G2G performs internal transactions in the back office concerned with reengineering the internal processes of inter- and intra-agency.

2.3 The Maturity Model of E-Government

E-Government is not a simple application of IT to government activities. An important lesson learned from the past is that, without reforming government structure and processes across agencies, IT does not guarantee expected effects. OECD(2001), Accenture(2000), and UN/ASPA(2002) suggest three or five-stage e-government maturity model, ranging from emerging to matured level. The higher the maturity level, the more benefits, but the higher risks, are expected.

The maturation implies the transformation of stove-piped functions and processes within an agency into seamless integration across agencies, with intensive reform activities of abolishing and merging unnecessary and overlapping functions, and streamlining and linking administrative processes at all levels of government.

<Table 1> Maturity Stages of E-Government

Level	OECD	Accenture	UN/ASPA
1	Access to information	Publish	Emerging
2	Consultation/feedback	Interaction	Enhanced
3	Active participation	Transact	Interactive
4			Transactional
5			Seamless integration

3. BENCHMARKING E-GOVERNMENT

3.1 Maturity Level of Countries

Learning best practices from leading countries is one of very important strategies in successful implementation of e-government(UK CITU, 2000:13). Research on e-government maturity level among countries has been performed recently by UN/ASPA, Accenture, and Brown University.

UNDPEPA and ASPA undertake a research study analyzing the approach, progress and commitment of the 190 UN member states, using e-government index consisting of national government websites, and information and communication technology infrastructure and human capital capacity. It classifies UN member nations into four categories: high, medium, minimal, and deficient e-government capacity. The results of the e-government index tend to reflect a countrys level of socio-economic and political development. USA, Australia, New Zealand, Singapore, Norway, Canada, UK, Netherlands, Demark, Germany are nations leading e-government around the world.

Accenture classifies e-government performance of 23 countries into 4 groups in 2002: innovative leaders(Canada, Singapore, US), visionary challengers(Australia, Denmark, UK, Finland, Hong Kong, Germany, Ireland, Netherlands, France, Norway), emerging performers (New Zealand, Spain, Belgium, Japan), and platform builders(Portugal, Brazil, Malaysia, Italy, South Africa, Mexico).

Brown University announced the ranking of government web portal service to citizens and businesses in which Taiwan and Korea lead the world.

3.2 Benchmarking E-Government Strategies

According to the benchmarking reports(UK CITU, 2000; 2001), e-government activities are classified into four categories.

- Demand: government services meet the needs of the public by consultation with citizens and businesses. Singapore, UK, USA.
- Supply(front office): provision of government services using innovative and sophisticated applications. Australia, Canada, France, USA
- Change: commitment to information society activities and drivers of change. Australia, UK

- Capability(back office): enabling government infrastructure. Finland, Netherlands, Singapore, Sweden.

The reports indicate that a number of countries have established electronic service delivery(ESD) targets as part of their strategic plans for information age government for which measurement of progress against ESD is crucial. In addition, among 13 lessons learned are that, ESD raises expectation and technology needs to be fast and robust; successful front-line ESD applications depend upon robust and reliable back-office capability, needing with re-engineer business process; conventional counter services in person as well as ESD channels should be preserved to ensure social inclusion; ESD must be suitably secure and reliable; pilot project goes first for affordable mistakes; undertaking research to find out what customers want fro ESD; and so on(UK CITU, 2000).

4. COUNTRY STUDIES

4.1 United States

As soon as President Clinton took office in 1993, he initiated National Performance Review(NPR) and National Information Infrastructure(NII), with an idea of reengineering business process through information technology. These two agendas are evaluated successful for economic prosperity for ten years.

President Bush made public the Presidents Management Agenda(PMA) prepared by the Office of Management and Budget(OMB) in 2002. His vision for government reform is guided by three principles: citizen-centered, results-oriented, and market-based. Expanded electronic government is included among five PMAs government-wide initiatives.

E-Government Strategy, prioritizing 24 initiatives, is classified into four types of E-Government activities.

- G2C(Government to Citizen): Use the web for accessing services such as benefits, loans, recreational sites & educational material.
- G2B(Government to Business): Reduce burden on businesses by adopting processes that enable collecting data once for multiple uses & streamlining redundant data.
- G2G(Government to Government): Share & integrate federal, state & local data.

- IEE(internal efficiency and effectiveness): Adopt commercial best practices in government operation such supply chain management and human resource document workflow.

Special effort for E-Government has been invested in a Federal Enterprise Architecture (FEA), which was first introduced in the Information Technology Management Reform Act of 1996(ITMRA) in order to keep a comprehensive view of what an organization does, how it does it, and how IT supports it in E-Government initiatives. The FEA makes possible horizontal(cross-Federal) and vertical(Federal, state, and local governments) collaboration and communication with respect to IT investments by facilitating the Office of Management and Budget(OMB) and other federal agencies to monitor, analyze, and control federal investments in IT. The FEA provides the following value to IT management(OMB, 2003:13):

- Improves decisions about IT systems investments
- Aligns IT support with business objectives and drivers
- Reduces redundancy
- Improves interoperability between processes and systems
- Supports realization of economies of scale.

In addition, the E-Government Act of 2002 under the expectation of improving government through electronic means was enacted. According to the legislation, the Director of the Office of E-Government and IT newly established under the OMB authorizes several initiatives; sponsors ongoing dialogue with state, local and tribal governments, as well as the general public, the private, and non-profit sectors; and establishes an E-Government Fund to support IT projects.

The series of legislative, administrative, and technical activities provide a strong driving force to the U.S. Government to accelerate e-government. Further, according to milestones for goals for E-Government and IT, OMB set the performance criteria for the e-government portion of the agency scorecard.

4.2 United Kingdom

In The UK, Prime Minister Tommy Blair has regarded E-Government as one of main agendas for public sector reform. Since 1997, he established the E-Government as a strategy for public services in the information age in his Modernising Government framework. E-Government has four guiding principles.

- building services around citizens choices
- making government and its services more accessible
- social inclusion
- using information better.

The Central IT UNIT(CITU) and the Office of the E-Envoy under the Cabinet Office in 2000, set a target of all services being provided on line by 2008. The deadline of crucial services was advanced by 2005.

In order to attain the goals, the UK Government promotes strategic building blocks in areas of access(framework policies for access technologies, portal services), e-business components(delivery channels, security, authentication, smart cards, privacy and data sharing), and interoperability(government gateway, information management, government secure intranet, common knowledge base for call centers).

According to UK online 2002 shows that over half of government services are online; over a million Britons now subscribe to broadband; more than 6,000 UK online centers have been opened nation-wide; and independent research shows that the UK is considered the second best environment in the world for e-commerce(Office of the e-Envoy, 2002).

4.3 Canada

Canada is one of pioneers in E-Government since 1990s. Canadian E-Government initiative Connecting Canadians is to provide Canadians with electronic access to all federal programs and services by 2005. It focuses on the importance of grouping online services around citizens needs and priorities.

The Government Online(GOL) program is centrally coordinated by the Treasury Board, which is effective to draw collaborative activities across agencies. Canada benefits from an uninterrupted confluence of technology, human capital and government resourcefulness (UN/ASPA, 2002:36).

4.4 Japan

Japanese Government established 「Japan Plan」 in 2001 in order to attain the global leader in IT within five years. The Plan includes electronic provision of administrative information, e-applications, e-documentation, and information sharing.

In July 2003, the Government made public 「Japan Plan II」 003-2005). Its goals are, first, providing user-friendly administrative services and, second, establishing simple government through budget efficiency. Basic principles include the following items.

- Providing high-quality administrative service to people who can use and know easily
- Providing the transparent policy process, accountable explanation to people, and expanding peoples opportunity of participation
- Securing universal design(whoever can use)
- Pursuing perfect efficiency
- Utilizing civil vitality
- secure and reliable information systems, and protection of privacy
- Inter-agency collaboration and international cooperation
- Implementing vigorous society

According to these principles and goals, the Japanese Government implements the action plan for E-Government in areas of front-office services to citizens and businesses, by eliminating and streamlining internal business process, and improving common environment for e-government.

5. E-GOVERNMENT IN KOREA

5.1 Before E-Government

Since mid-1980s, the Korean Government took several steps to create the foundation for e-government by compiling five key national databases: resident, vehicle, real estate registrations, finance, and tax. In 1990s, with the successful building of broadband network across the nation, e-government services were promoted to develop at an individual agency level such as patent filing, real estate registrations, procurement, and customs.

Along with the proliferation of the Internet in late 1990s, which enables people to transact with anyone at any time in any place, citizen-centered e-government service becomes an imperative as a part of public sector reform. After accomplishing hardware-based reform such as organizational reshuffling and manpower reductions to a degree in 2000, Kim Dae-jung Administration replaced it with software-based strategies including e-government and continued to finish by the end of his presidency.

5.2 The First E-Government Plan

Kim Administration organized Presidential Special Committee for E-Government under the Presidential Committee on Government Innovation in January 2001 and selected 11 e-government projects, most of which need inter-agency collaboration and coordination from the top. The vision and goals of e-government is enhancing services to citizens, providing the optimal entrepreneurial climate for business, and improving efficiency, effectiveness, and transparency of government administration.

Three types were prioritized in areas of 4 front-office, 4 back-office, and 3 e-government infrastructure projects. Most of them need with inter-agency collaboration and coordination for full-scale implementation. Eleven projects were designed to reach the most complex state with the highest expected values by developing whole life cycle of the service, providing Internet-based two-way transactions including electronic payment. The performance of E-Government Initiatives in Korea under Kim Administration is evaluated, on the whole, a success. E-Procurement system won the first UN Public Service Award(UNPSA) in June 2003, and e-government ranking has risen to 13th in UN/ASPA research.

Nevertheless, some weaknesses are found in the First E-Government Plan. In some cases, only partial stages are developed online, and the remaining stages such as payment still dealt with offline. The main reason for this is that problems of e-payment and verification of personal identification remain unsolved. G4C offers guidance for 4,000 types of civil applications, and makes it possible to file 393 types online. Among them, few can be dealt with online across their whole life cycle from filing to issuance. This results in a decrease in utilization rate of G4C, reflecting the trough of disillusionment stage just after high expectations stage at Gartners IT Hype Cycle. If Gartner model is right, e-government utilization including G4C will get gradually into the matured stage through slope of enlightenment.

<Table 2> Eleven E-Government Projects

Category	Project	Agency in charge
G2C, G2B	Government for Citizen (G4C) Home Tax Service (NTS) Social Insurance Info Sharing System E-Procurement System (GePS)	MOGAHA NTS MHW/MOL SA
G2G	National Finance Info Sys (NAFIS) Personnel Policy Support Sys (PPSS) National Education Info Sys (NEIS) Local Admin Info System (LGAIS)	MOFE CSC MEHRD MOGAHA
Infra-structure	E-Approval & E-Document E-Signature and e-Seal System Consolidated Information Resources	MOGAHA MOGAHA MOGAHA/MIC/MPB

5.3 The Second E-Government Plan

Roh Administration opened to the public the Roadmap to E-Government in August 2003 prepared by E-Government Task Force under the Presidential Committee on Government Innovation and Decentralization.

The Roadmap declares its vision and goals of e-government as innovating service delivery (network government), enhancing efficiency and transparency(knowledge government), and accelerating participation(participatory government), through which Korea will become the global leader in e-government. The directions of e-government projects are to innovate business processes and practices, service to citizens and business, and information resources management.

The Roadmap to E-Government includes 31 projects in 10 areas, according to their priorities.

<Table 3> The Second E-Government Plan

Category	Agenda	No Proj
G2G	1. Establishing E-Transaction 2. Expanding administrative information sharing 3. Service-oriented BPR	9 1 1
G2C, G2B	4. Enhancing E-Service to citizens 5. Enhancing E-Service to business 6. Expanding citizens e-participation	8 5 1
Infra-structure	7. Consolidated information resources 8. Strengthening information security problem 9. Strengthening IT manpower and organization	3 1 1
Law	10. Legal and institutional rearrangements	1
4 areas	10 agendas	31

According to the Roadmap, the Second Plan sets a somewhat different priority in e-government. It seems to change its course from front-office service to back-office management. Main focus is put on introducing information technology architecture(ITA) including business reference model(BRM), data reference model(DRA), and consolidated information resources management. As e-government goes to matured level, the problem of islands of automation is recognized as a critical barrier to e-government(US OMB, 2002). The more local governments or individual central government agencies construct their own systems and build their own hardware, the greater is the change that the systems cannot easily linked(Kettl, 2002:45). Without constructing the common institutional and technical base, information sharing among agencies for providing one-stop/non-stop service to citizens through seamless integration is severely constrained. Therefore, centralized coordination and collaboration from the top is indispensable to make things work seamlessly at the bottom.

6. GIS AND E-GOVERNMENT

Geographic Information System(GIS) is exploited in various areas of water, sewage, road, and catastrophe management as well as urban planning at government at all levels.

However, GIS has been managed in a dispersed and fragmented way among agencies because of institutional and technical reasons. It is important to share geographic information among agencies and manage the integrated system on a national level in order to prevent redundant investment and save government budget. Recognizing its importance, the Ministry of Construction and Transportation(MOCT) has initiated two-stage National GIS Sharing Projects since 2000 and now implements its services.

Unfortunately, the two E-Government Plans have not reflected the importance of space-related projects into their agendas so far. It is desirable to integrate and link GIS into the nation-wide G4C and other e-government services. There is room for reflecting the demand for GIS on revised E-Government Roadmap in the near future.

7. GUIDING PRINCIPLES FOR SUCCESS

A variety of factors are recognized for the success in e-government. Attention should be focused on a number of issues addressed: vision and political will(leadership and commitment, integration of policy goals), common framework and cooperation(inter-agency collaboration, financing), customer focus(access, choice, citizen engagement, privacy), and responsibility(accountability, monitoring and evaluation) (OECD, 2003; Song, 2002). Factors for successful e-government learned from Koreas experience are as follows:

- Top-down approach: recognized as Presidents policy agenda and strong empowerment and resource mobilization
- Linking with government reform: E-Government Committee under Presidential Committee on Government Innovation and integration of e-government vision into broader policy goals and information society activities.
- Supply-side considerations: Identifying customers needs and expectations, and monitoring and evaluation
- Public/private partnership: E-Government Committee operation and system development & maintenance
- Legal and budget supports: e-government acts and budget allocation

On the other hand, there exist several barriers and threats to successful e-government. Among them are unclear program performance value, weak technology leverage, islands of automation, and resistance to change(US OMB, 2002:5). In addition, large e-government investments can pose great political risks of which politicians are afraid. They are accountable for the failures of e-government projects and the accompanying waste of taxpayer money(OECD, 2001). Without sufficient consideration of these barriers and threats, large e-government projects are prone to falter.

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Spatially Enabled e-Government

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1. INTRODUCTION

e-Government can be defined as Connecting Citizens, Employees and Business through an Integrated Suite of e-Applications(Oracle 2000). This implies the delivery of the required applications that are simple to use, meet the requirements of the users and are agile and adaptable.

The roadmap to success for e-Government lies in the integration of business applications that connect the citizen, government employees and associated business in a single homogeneous environment. Underlying these applications there needs to be a stable, well integrated technology platform. This platform is required for the integration, management and delivery of all the required information types to the e-Government applications.

Government organizations are rapidly moving to Internet and Intranet technologies to delivery applications to all users in an effective and secure way. It is therefore critically important for organizations to deploy a single modern Internet enabled architecture to support e-Government initiatives. This architecture should support the delivery of application to any users, at any time irrespective of where they are or what Internet enabled devise they are using. Modern governments are therefore rapidly moving to the use of network centric architecture that can support the following critical requirements:

- Nth Tier architectures which support server based computing and low network bandwidth delivery of applications and information.

- The delivery of the required applications within a platform independent architecture. This means that organizations are not restricted to the use of any specific operating system or hardware platform.
- In the Internet world security plays an important role. Protecting both applications and information is critical to the success of e-Government. Therefore when implementing e-Government systems, access control, encryption of data and information security is a critical aspect.

2. THE VALUE OF GEOGRAPHIC INFORMATION IN e-GOVERNMENT

Still today geographic information is not seen as a critical mainstream information asset for organizations. Geographical Information Systems(GIS) are normally departmentally based and are used for specific geographic centric tasks for which they have been bought. GIS data is highly specific to the GIS systems and is rarely available to support the decision-making processes of critical e-Government applications. In a 1999 report published by the Independent Data Corporation they defined the value of geographic information to various users as follows:

- For GIS users, geography is the most valuable information that they manage, and that sets GIS apart from other information systems.
- From a spatial technology perspective, all Business Spatial Systems have one thing in common: geography is not the most valuable piece of information that they manage. Rather, spatial information complements and augments business processes.

Certain trends are driving organizations to gain more value out of their investment in spatial data hence putting pressure on industry and GIS departments to provide integration into the mainstream. These trends can be summarized as the following:

- The increased use by, and the demand for location based decision-making.
- The increasing use of spatial data by non-traditional users. This means that non-GIS professionals have a requirement to GIS type systems and spatial data in their every day work.

- The ability to spatially enable any application: With the advent of open standards and modernized systems it has become easier to embed spatial data and processes into mainstream IT applications.
- The need to deliver high-end spatial functional and processes to mobile users. This need is been driven by 911 and homeland security requirements.
- As more and more accurate spatial data becomes available, non-tradition users are becoming more confident to include this data in their decision-making processes.

One of the major challenges facing organizations today is the choice they have in developing a policy that either drives them to deploying Enterprise GIS or that of a Spatially Enabled Enterprise. With enterprise GIS the focus on the delivery of web-based GIS applications to many users. This is still a GIS focus, using GIS tools to deliver GIS applications as well as using GIS development tools to build these applications. If an organization chooses the route of a spatially enabled enterprise, this implies the total integration of spatial data and processes into mainstream applications. Further this opens up the ability to use open standard development tools to build business applications that contain a spatial component.

Once a government organization has decided on a policy of a Spatially Enabled Enterprise this them will open the doors to the use of spatially enabled applications through out all e-government processes. Spatial data and processes can be used to interact with citizens, improve proficiently within government and increase productivity for the delivery of services between government, business and citizens.

3. THE POWER OF THE SPATIALLY ENABLED DATABASE

In support of building a Spatially Enabled Enterprises some database vendor companies have provided the capability to store, manage and query spatial data within the database itself. Oracle has been at the forefront of delivering this capability to its customers. Once spatial data has been stored in an open standards database it opens up new fields of use for this important data type within an organization. The value of using a database for the repository for spatial data is as follows:

- The enhanced database features and functions such as security, backup and recovery, replication can be applied to spatial data.

- The database has been designed for large volumes of users and data. This infrastructure provides the required scalability for large volumes of users using spatially enabled applications.
- The database also provides the capability to add a location component to any database table. This provides the capability to query business type data by location.
- One of the most important factors of storing spatial data in the database is the interoperability it provides. The database is one of the only mechanisms that provides full interoperability between various GIS products as well as interoperability into mainstream computing. Interoperability into mainstream computing via access to spatial data by open programming standards such as SQL and JAVA.
- The database provides the common storage and access mechanism for all of an organizations business data. Thus providing the ease of integration between business processes and data with the more complex spatial date types and processes.

4. WHAT SHOULD BE EXPECTED OF A SPATIAL DATABASE

For organizations to fully utilize and become more confident in the use and power of a spatially enabled database the database should provide the following:

- The ability to store all spatial data types. This means all vector geometry types, and various types of raster data.
- Provide integration between vector and raster data types.
- Provide the ability to query these data types via the SQL query language.
- Provide the ability to perform complex spatial queries within the database itself.

Given the above spatial capabilities the database is the core component for the technology platform on which to build a Spatially enabled e-Government infrastructure. In looking at an enterprise spatial platform the spatial database together with an application server form the core platform for the deployment and delivery of spatially enabled e-government applications. It is this technology platform that provides the basis of delivering spatially enabled applications to any user, anywhere.

5. SPATIAL REQUIREMENTS OF e-GOVERNMENT

A number of challenges still exist in deploying spatial data and functionality into mainstream business applications. These challenges have to do mainly with the capabilities of deploying high-end spatial functionality to web clients across a network centric architecture. Traditionally to obtain high-end GIS functionality users must use a desktop or high-end GIS tool. GIS vendors in deploying GIS functionality to the web have delivered a sub-set of less complex GIS functionality with their web tools. In developing multiple spatially enabled e-government applications developers should have the capability to embed whatever GIS functionality required to do the job on hand. It can therefore be expected that modern day spatial tools will have the following challenges:

- Provide the required levels of interoperability via open standards within business systems from day one.
- Developed using open standards.
- Accessible to any application. Does it require proprietary middleware?
- Provides the same level of security and access as business systems.
- Support the requirement of f spatial data. Support the concept of spatial functionality and data. Provide the end user the information they want when they want it to any device
- Support thin clients with rich spatial functionality, this includes data capture and editing.
- Support Intranet, Internet and wireless deployment in a single architecture.
- Deliver spatial functionality as web services to operational applications and processes.
- Fully employ backend computing, which makes full use of an enterprise strength database tier to provide the required integration, scalability, security (including encryption), information assurance and collaboration.

6. CONCLUSION

The true value of a fully operational Spatially Enabled e-Government is still to be realized. Many government organizations have toyed with this idea but have only gone partially down the road of fully integrating the spatial component into their e-Government IT strategy. To create a fully functional Spatially Enabled e-Government the following hurdles need to be overcome:

- Clear and measurable objectives of including spatial into the e-government IT strategy need to be developed.
- A solid business case needs to be developed which has the buy in and commitment of senior management.
- The focus must be on the overall IT strategy rather one for an enterprise GIS.
- The IT strategy should be focussed on the totally integrated solution rather than technology.

Until governments, both from an IT and GIS perspective realize the true value of spatial data integration into mainstream IT, Spatially Enabled e-Government will not become a reality. Spatial data and processes need to be fully integrated as a component of any e-Government application that can benefit from spatially enable decision-making.

Integration Strategies for e-Government and GIS in Korea

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1. ABSTRACT

The Korean e-Government project and the National GIS project are actively in progress. In spite of their integration possibilities, both projects are not so much related, so far. Objectives of the both are also same: (1) to increase administrative efficiency, and (2) to provide higher quality services for the Korean citizen.

This study hypothesizes that integration of e-Government and GIS can create greater synergic effects for the objectives mentioned. To verify the hypothesis, cases of advanced e-Governments in the foreign countries and progress of the Korean e-Government project are analyzed and compared in a GIS perspective. The comparison becomes a basis for the later suggestion of integration strategies which is the purpose of this study. By identifying the recent challenges and relevant components of e-Government from the case study, a frame for the integration strategies of e-Government and GIS can be established. On this frame, the current status of the National GIS project is evaluated for the future integration. From the evaluation, the integration strategies could be suggested for the implementation of e-Government and GIS. The strategies are aggregated as the following directions : establishment of information infrastructure for the new integration, innovation of the institutional environments, enhancement of intergovernmental partnerships, and development of a variety of geospatial information services.

2. INTRODUCTION

The Korean e-Government launched in November 2001 is being implemented under ambitious plan. The Korean National GIS project, initiated in 1995, is in the second phase now. In addition to the quantitative expansion of the both projects so far, effectiveness begins to be an important issue for the projects.

For the implementation of desirable digital governments which can provide citizen-centered information services for whoever, whenever and wherever, integration of GIS technology and e-Government is essential for the overall governmental perspective.

"Government is spatial"[1] implicates the importance of spatial data in e-Government. Comparing with other e-Government projects in the foreign countries, it can be identified that spatial information are being actively utilized in their e-Governments.

It is assumed that intergovernmental sharing and wider use of geospatial information can increase efficiency of governmental administration creatively and seamless one-stop access to the geospatial e-Government can provide higher quality services for more citizens.

As opposed to the assumption mentioned, in the current Korean e-Government implementation geospatial element is not included and the project has only focused on the text-based services for the citizen. While Government for Citizens(G4C) services have been one of the core areas in the Korean e-Government, the most part of the Korean National GIS project has mainly supported "Government for Government(G4G)" services. In spite of their clear connectivity, the two projects are conceptually separated and implemented individually.

For the successful implementation of e-Government, the both projects must be integrated in a more comprehensive perspective. This study hypothesizes that the integration of e-Government and GIS can create greater synergic effects for the improved citizen-centered services and for the increased efficiency of governmental administration. To verify the hypothesis, cases of advanced e-Governments in the foreign countries and progress of Korean e-Government project are analyzed. Result of the foreign becomes a basis for the later suggestion of integration strategies. By identifying the recent challenges and components of e-Government, a frame for the integration of e-Government and GIS can be established. On this frame, the current status of the National GIS project is examined for the future integration. From the results of these analyses, implementation strategies for the

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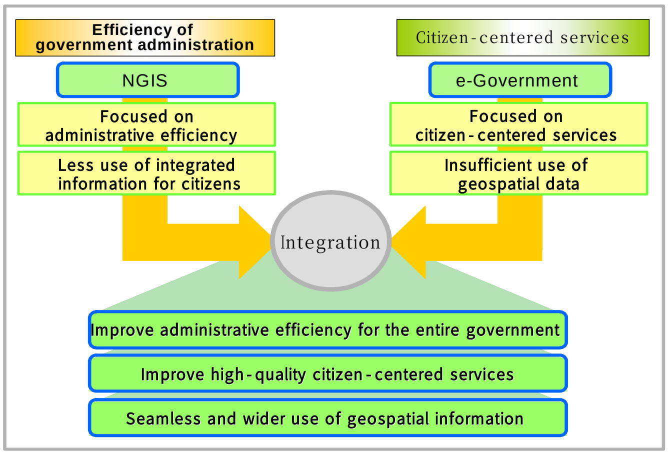
1) Earl Bossard, "Envisioning Neighborhoods GIS Information Design", URISA 2003

integration of e-Government and GIS are suggested.

<Figure 1> Necessity of the integration of e-Government and GIS



2. CASE STUDY ON ADVANCED IMPLEMENTATION OF e-GOVERNMENTS

From the case of the advanced e-Government implementations in USA, UK and Canada, it is learned that national spatial data infrastructure is being actively used at all levels of the e-Governments.

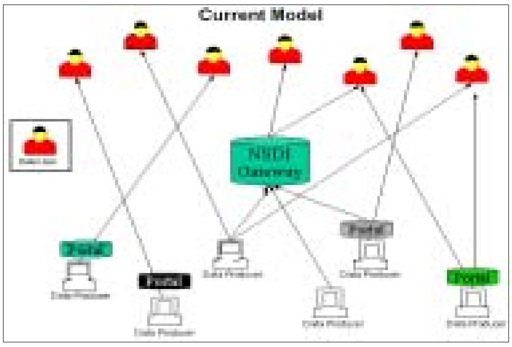
In USA, to utilize and share spatial data and to evolve the existing national spatial data clearinghouse, the Geospatial One-Stop project is included as one of the US President's 24 e-Government initiatives. In the UK, Online Citizen's Portal provides simple and speedy public services, including spatial services, and Canada e-Government focuses on citizen-centered service using GIS technology.

In the case of USA, Geospatial One-Stop(GOS) can provide a single access to the federal government's spatial information and help citizens to make state and local spatial information more accessible.[2] Consolidation and coordination of various spatial information is critical for other e-Government initiatives. The results of the efforts can improve efficiency of government administration by eliminating redundant data collection and

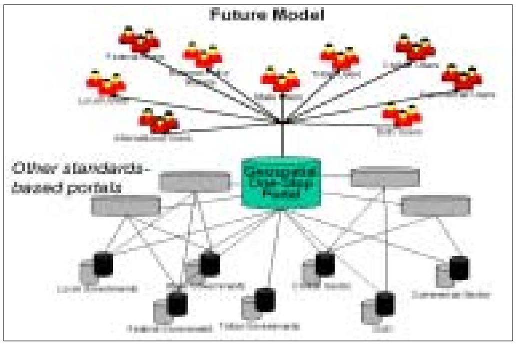
2) http://www.geo-one-stop.gov/

increase opportunities for cost-sharing partnerships. The GOS project will play an important role for collaborative partnerships across inter-government jurisdictional boundaries.

<Figure2> Current model of Geospatial clearinghouse



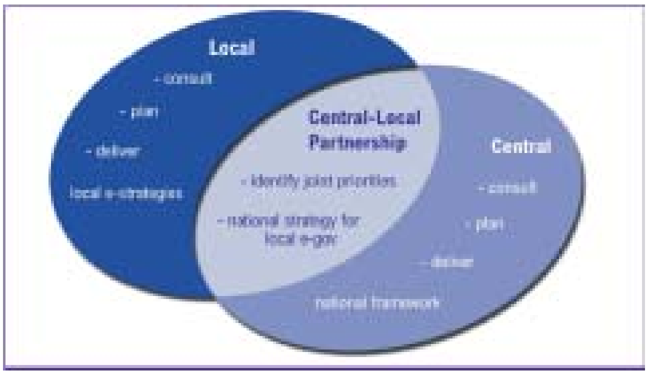
<Figure3> Future model based on GOS



The UK e-Government strategy includes GIS technology as a fundamental element in the "Modernsing Government" programme by Office of the Deputy Prime Minister. It focuses on better services for citizens and businesses, and on more effective use of the government's information resources[3]. In the UK case, partnership between central and local government is identified as a distinguished characteristic. The Improvement and Development Agency(IDeA) is driving significant national initiatives, such as the National Land and Property Gazetteer(NLPG), National Land Information Service(NLIS), and the Local Authorities Secure Electoral Register(LASER), with the cooperation of the local governments[4].

3) http://www.egovernment-uk.com/
4) http://www.idea.gov.uk
Office of th Deputy Prime Minister, "e-gov@local Towards a national strategy for local e-government," 2002. 4

<Figure 4> Partnership between central and local e-Government in the UK



Government On-Line(GOL) for Canadians is providing a new way of high quality services to Canadians. For more convenient services and more accessible government, GOL is directly linked with GeoConnections, that is Canadian Geospatial Data Infrastructure(CGDI), and makes Canada's geospatial databases, tools and services readily accessible through on-line theme portals and local networks[5].

<Table 1> Integration of e-Government and GIS in USA, UK and Canada

		USA	UK	Canada
How is GIS included in e-Government	e-Gov.	Focused on G2G (Government to Government)	Focused on G2C (Government to Citizen)	Focused on G2C (Government to Citizen)
	GIS	• ›ospatial One Stop initiative • S for Disaster Assistance and Crisis Response	• 'ollaborative partnerships • IPLG, NLIS & NLUD etc.	•)L with GeoConnection • ›ospatial data
characteristics		- GOS - Data sharing between inter-Governmental agencies	- Central-local e-Government Partnership - Various delivery mechanisms(multi-channel)	- GOL with GeoConnection - GIS for life cycle event

In addition, recent technological development and new multi-channel delivery mechanism, such as Kiosk in Boston e-Government and Electronic Service Delivery(ESD) in Ottawa, might accelerate integration of e-Government and GIS. Such trend indicates that more

5) http://www.gc.ca/main_e.html
http://www.geoconnections.org/english/index.html

mechanisms will be utilized for better geographic information services in e-Government.

Furthermore, introduction of Location Based Service technology and various mobile devices can create a new pattern of m-Government. The trend implicates convergence of the technologies will create ubiquitous information society in the future and integration of GIS with other mechanisms and devices can make the vision more realizable.

3. ANALYSIS FOR THE INTEGRATION POSSIBILITIES OF e-GOVERNMENT AND GIS

For integration of e-Government and GIS, it is necessary to review what are recent challenges and elements for the implementation of e-Government.

3.1 Challenges for the implementation of e-Government

In the first stage of e-Government project, a main concern was how to move from off-line to on-line. Now, a keyword of e-Government is "One-Stop Portal". "To implement the Portal", 5 challenges of e-Government are adopted as the following <Table 4>.

<Table 2> Challenges of e-Government

Key challenges		Contents
Divide	Digital Divide	• ients are diverse in their needs and access to technology
	Financial Divide	• ıblic sector budgets vary dramatically
	Organizational Divide	• › "Silos"-act as an enterprise... policies & standards must harmonize
	Jurisdictional Divide and governance	• e need for a single, integrated public service "portal"/delivery channel
Prioritizing Government Services		• social housing more important than e-Government technology? -24 hours * 7 days availability -self service, better access -not location dependant -immediate service and results -do more for less -customer focused -better, faster & cheaper -customized service

<Table 2> Challenges of e-Government(continue)

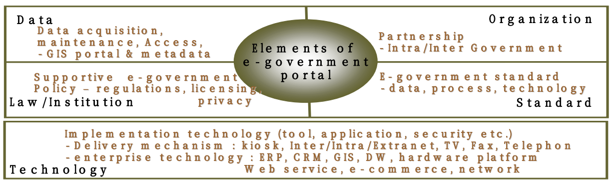
Key challenges	Contents
Open Government versus Protection of Privacy & Security	• :licate balance between legislation, service delivery & security • pen government & FOI(Freedom of Information) is an inherent right and a key to good public service • ivacy is a more daunting issue for e-Government • curity of any communications an transactions within an e-Government environment is expected to be secure
Re-engineering existing business processes	• itus quo is not acceptable, good enough is NOT good enough - people issues
Resources challenge	• oney, technology, skills & intellectual capital

* Source: Jury Konga, "e-Government: The New Reality", URISA 2003 Workshop, modified

3.2 Components for the implementation of e-Government

To implement a desirable e-Government, fundamental infrastructure is required. The components of the infrastructure are identified as data, organization, law/institution, standard and technology.[6]

<Figure 5> Core Elements for e-Government Implementation



- Data : For seamless on-line portal service, intergovernmental data sharing and utilization are needed. Also, metadata is a prerequisite for data acquisition, access and integration.

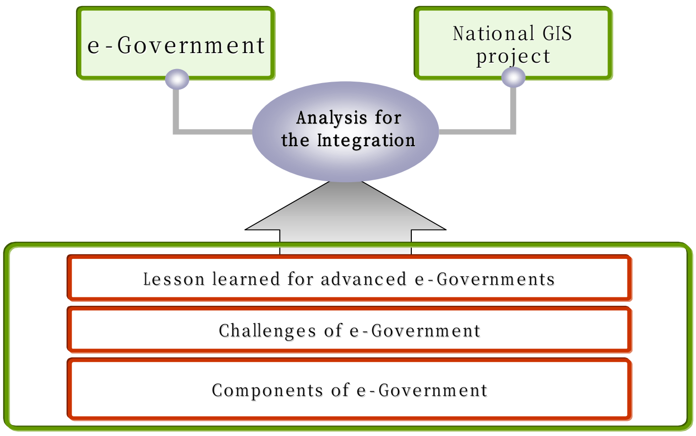
6) Jury Konga, "GoveVolution, Vision, Models & Challenges", URISA Workshop 2003, modified.

- Organization: To encourage e-Government portal, intergovernmental partnership and collaboration between and across governmental lines are required.
- Law/Institution : The policy will support e-Government, such as control and assignment of governmental agencies's role, preparation of regulations, coordinations between privacy and open government policy, and licensing.
- Standard: e-Government standards are fundamental for consistent seamless one-line e-Government portal.
- Technology : In implemented practices, technologies and infrastructure are mandatory for to e-Government. Electronic service delivery tool and enterprise technology can be included.

3.3 Analysis of the current integration of e-Government and GIS in Korea

To analyze the relationship between e-Government and GIS technology in Korea, three aspects are reviewed: case study of the advanced e-Governments, recent challenges and components of e-Government mentioned.

<Figure 6> Analysis of the Integration



Items in <Table 3> adopted from <Table 1>, <Table 2> and <Figure 5>, will serve as assessment criteria for the integration of e-Government and GIS.

<Table 3> Assessment criteria for the integration of e-Government and GIS

Lessons learned from advanced e-Government projects	Challenges of e-Government	Components of e-Government
• ›ospatial data portal service • ıta access and sharing • ıtergovernmental collaboration • ırious delivery mechanisms (multi-channel) • tizen-centered service	• gital Divide • ioritizing Government Services • ›en Government versus Protection of Privacy & Security • ›-engineering existing business processes • sources challenge	• ıta • ·ganization • w/Institution • ındard • chnology

<Table 4>, <Table 5> and <Table 6> show results of the analysis, which will become a basis of the integration strategies in the following section.

<Table 4> Analysis in terms of lessons learned from advanced e-Government projects

Lessons learned from advanced e-Government projects	Status of the current National GIS project
Geospatial data portal service	• isting on-line web-GIS service, such as www.ngic.go.kr in central and local web-GIS for every-day life • › geospatial data portal service
Data access and sharing	• dividual data access • mited data access for citizens in spite of open information policies
Information integration	• parated information, not integrated • ıch less integration of GIS and existing MIS
Intergovernmental collaboration and integration	• ck of the central-local and local-local partnership • parated GIS projects in local e-Governments
Various delivery mechanisms (multi-channel)	• tranet-based GIS applications • › multi-channel delivery mechanism for GIS services
Citizen-centered service	• ›vernment agency-centered services • me research on public participant GIS services, but no implemented case for citizen-centered services

<Table 5> Analysis in terms of challenges of e-Government

Challenges of e-Government		Status of the current National GIS project
Divide	Digital Divide	• ss consideration for data and technologies in the user perspective • ainly use of digital map, not enough geographic information for the practical use
	Financial Divide	• quire a budget for the integration of e-Government and GIS
	Organizational Divide	• ed a corporate harmonization and data sharing
	Jurisdictional Divide and governance	• › regulations for the integration e-Government and GIS
Prioritizing Government Services		• t, focus on "system", not "service". • : first, prepare the environment for prioritizing government services
Open Government versus Protection of Privacy & Security		• mited data for citizens • ed an actual open government policy
Re-engineering existing business processes		• cause of no re-engineering of existing business processes, low GIS B/C rate after system implementation
Resources challenge		• mited budget and skilled people

<Table 6> Analysis in terms of components of e-Government

Components of e-Government		Status of the current National GIS project
Data	Acquisition	• gitalizing paper map, and utilities information for administrative business • ›t enough data for meeting various citizen demands
	Maintenance	• w utilization of established geospatial information because of no timely maintenance • ed the maintenance systems in enterprise perspective
	Access	• ı going implementation of geospatial distribution systems, but not at the US GOS portal level
Organization	Partnership	• ed common GIS projects in the central and local governments • ed supportive policy for collaborative partnership
Law/ Institution	Regulations	• › regulations for utilization of geospatial data in e-Government law • me discrepancies in National GIS law and survey law
	Licensing	• ıly for GIS staffs in the public sector
	Privacy	• process of LBS legislation for privacy • › regulated protections for privacy in the GIS perspective

<Table 6> Analysis in terms of components of e-Government(continue)

Components of e-Government		Status of the current National GIS project
Standard		• process of standard for geospatial data and technology, but not for e-Government itself • ed to develop the standards for the integration e-Government and GIS
Technology	Delivery Mechanism	• ternet/intranet GIS only • ed multi-channel information delivery mechanism
	Enterprise technology	• ospatial Datawarehouse • quires enterprise technology for e-Government
	Application	• veloping various applications in administrative sectors • ed more wider and creative use in the administration

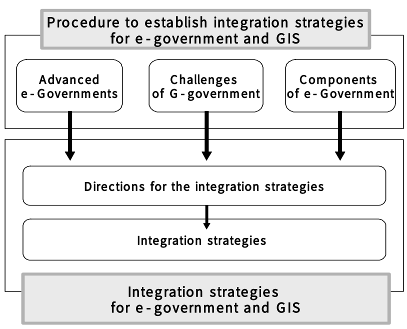
From the analysed results, it is easy to understand that many tasks remain for the integration of e-Government and GIS. For the tasks, strategic plan and institutional collaboration can obtain first priority for the integration.

4. Integration Strategies for e-Government and GIS

4.1 Procedure to establish integration strategies in a GIS perspective

Based on the analysis results in the previous section, the integration strategies for e-Government and GIS are established by the following procedure in <Figure 7>:

<Figure 7> Procedure for the integration strategies



4.2 Directions for the integration strategies in a GIS perspective

To implement e-Government in a GIS perspective, some considerations are suggested, based on the assessment criteria in the previous section.

<Table 7> Considerations for the implementation of e-Government in the GIS perspective

Assessment criteria			Considerations
Advanced e-Gov projects	Geospatial data portal services		• tablish GIS portals based on customer-centered demand • ake more citizen-centered geospatial data available
	Data access and sharing		• onstruct system with a single national geospatial data distribution one-stop data access • nplement Enterprise GIS
	Information integration		• evelop technologies for combination of MIS and GIS
	Intergovernmental collaboration and integration		• evelop new foundation for intergovernmental collaborative partnership
	Various delivery mechanisms (multi-channel)		• eed GIS technology improvement with various delivery mechanisms
	Citizen-centered service		• evelop citizen-centered services with easy GIS interfaces • evelop public participation GIS services
Challenges of e-Gov	Divide	Digital Divide	• oduce variable geospatial data and efficient data sharing
		Financial Divide	• ost-saving and effective projects management with an enterprise approach
		Jurisdictional Divide	• nend legislative and institutional policies for the integration of e-Government with GIS
		Organizational Divide	• engthen intergovernmental partnership to overcome the jurisdictional divide
	Prioritizing Government Services		• evelop customer-centered GIS services prioritized • evelop various GIS services
	Open Government versus Protection of Privacy & Security		• eed policy improvement for more active use of geospatial information
	Re-engineering existing business processes		• -engineer existing business processes
	Resources challenge		• ore collaboration/partnership
Components of e-Gov	Data		• ncourage the reusability of established geospatial data • frastructure for collaborative utilization of geospatial data
	Organization		• hance intergovernmental coordinative partnership
	Law/Institution		• epare fundamental regulations for the integration of e-Gov and GIS • ake policies to maximize information usability • tablish new items for GIS privacy in the law
	Standard		• evelop GIS standards for information integration • tive application of the developed standards
	Technology	Delivery Mechanism	• evelop GIS technologies with service delivery mechanism
		Enterprise technology	• evelop technologies for enterprise GIS
		Application	• Develop and provide the easy to use common applications

Considerations are aggregated into several directions for the integration as the following

<Table 8>.

<Table 8> Directions for the integration strategies for e-Government and GIS

Criteria from advanced e-Gov projects	Criteria from challenges of e-Gov	Criteria from components of e-Gov	Directions aggregated from the considerations
• ospatial data portal service • ormation integration • ta access and sharing	• ancial Divide • -engineering • gital Divide • en Government versus Security	Data/Technology/Standard	• ablish information infrastructure for the integration
• ergovernmental collaboration and integration	• Organizational Divide	Organization	• hance partnership for the integration
-	• Jurisdictional Divide and governance • sources challenge	Law/Institution	• ovate institutional environments for the integration
• rious delivery mechanisms (multi-channel) • izen-centered service	• oritizing Government Services	-	• velop and provide various GIS services

- Establish information infrastructure for the integration : To establish new information infrastructure becomes very important for the integration of e-Government and GIS. Geospatial One-Stop portal in the US e-Government is a good example for Korean e-Government.
- Innovate institutional environments for the integration : There is no description for utilization of geospatial data in Korean e-Government law and no specific guideline for intergovernmental data sharing.
- Enhance partnership for the integration: The central-central, central-local and local-local government partnerships are essential for the establishment of seamless geospatial data infrastructure.
- Develop and provide various GIS services : Development and diffusion of new GIS services is needed for meeting a variety of customer demands.

4.3 Integration Strategies for e-Government and GIS

From the directions mentioned as a larger theme, the considerations can be organized and developed toward integration strategies in detail as follows:

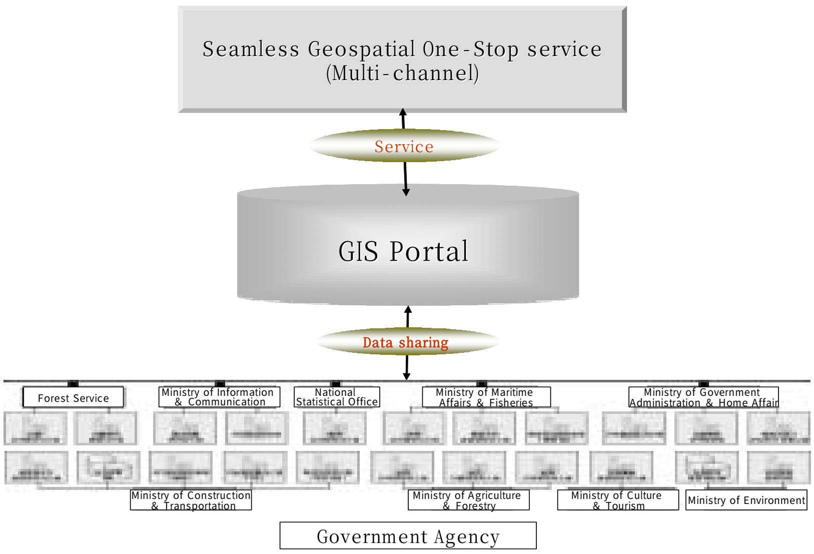
1) Establish information infrastructure for the new integration

A. Implementation of GIS portal for e-Government

- ○ Like GOS(Geospatial One Stop) in the US, the present Korean clearinghouse for geosaptial information need to accommodate a new concept of GIS portal and the further development can be the next task.

- ○ The GIS portal should provide an access to geospatial information beyond jurisdictional boundaries.

<Figure 8> Concept of GIS Portal



B. Expand sharing and utilization of geospatial data

- Geospatial data sharing eliminates redundant data collection and increases the opportunities for cost-saving. It is important to identify barriers and solutions for efficient sharing of spatial data and to establish foundation in a legislative perspective.

C. Develop GIS technologies for e-Government's network

- GIS technologies developed for e-Government's network can contribute to administrative efficiency in e-Government. For example, adoption of LBS technologies can lead to a more convenient m(mobile)-Government. It is desirable that the present m-Government plan need to consider new GIS technologies for the implementation of m-Government.

D. Develop technologies for the information integration

- So far, the National GIS project has focused on the specific sector applications, such as facilities management, land-use planning, transportation, environment, and water resources. As opposed to the traditional GIS applications mentioned, GIS need to expand the boundaries of existing applications to, so called, MIS(Management Information System) areas, such as construction, trade, fire fighting, clothing, electron, and machine[7].

- Enterprise technologies such as ERP, CRM, and SCM can be integrated with GIS technology to take advantage of geospatial information and will provide a new aspect of e-Government toward better administrative efficiency and industrial vitalization.

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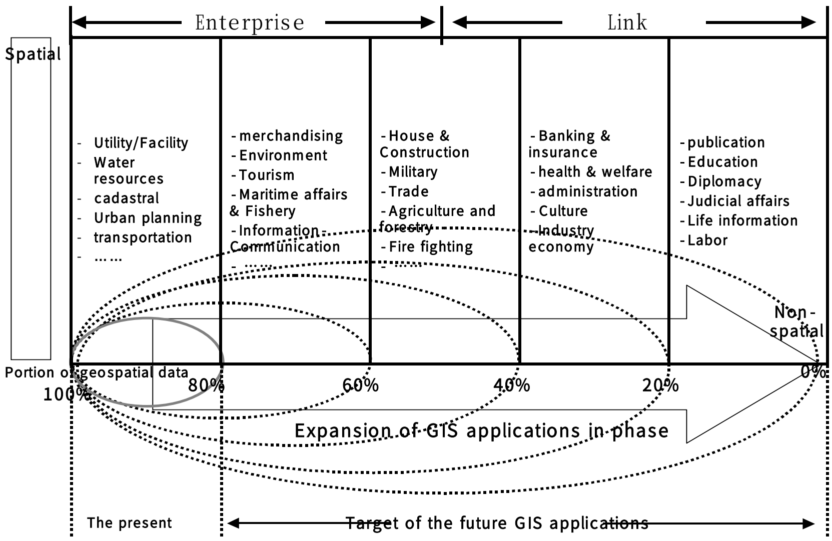
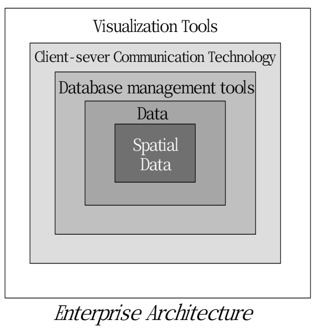
7) Eun-Hyung Kim, "Study on Integration Strategies for ERP and GIS," 2001

<Figure 9> Wider use of geospatial information in the future



○ <Figure 10> shows a desirable GIS architecture considering spatial data as a core, it becomes more important to embed GIS functions to existing MIS areas and GIS component software will play a critical role for the implementation of e-Government.

<Figure 10> Enterprise GIS Architecture



E. Develop and adopt standards for information integration

○ For the desirable e-Government, different types of information, technologies, and services need to be integrated for the enterprise architecture mentioned.

○ Interoperability for consistent service development is required and standards will be a mandatory element for the efficient integration.

○ More active adoption and development of international and Korean standards becomes a critical issue. Standards for the future e-Government will include information integration in addition to existing GIS/IT standards.

<Table 9> Major tasks for the new integration

Directions	Major tasks	Contents
	Implementation of GIS portal for e-Government	• lopt the GOS concept for Korean geospatial information clearinghouse • oduce and manage framework data in the GOS perspective • nsolidate and link each institution's geospatial data catalogues • velop more geospatial information services for the citizens
	Expand sharing and utilization of geospatial data	• operative data sharing by metadata • velop technologies for the efficient update for geospatial information (ex: update by Mobile GIS)
Establish information infrastructure for the new integration	Develop GIS technologies for e-Government's network	• velop mobile GIS technology for m-Government • S technology for e-Government services
	Develop technologies for the information integration	• e enterprise GIS technology for the wider integration • velop embeddable GIS technologies that can promote the use of geospatial information in e-Government • velop common usable GIS software that can easily link other information
	Develop and adopt standards for the information integration	• velop GIS standards for the information integration • undardization of business processes re-engineered • ake the use of standard mandatory for the public sector

2) Innovate the institutional environments for the integration

A. Harmonize related laws for the integration

○ For the integration of e-Government and the National GIS project in Korea, harmonization of related laws and new regulations is needed.

B. Amend existing policies to maximize the use of geospatial information

○ To maximize information usability and increase data availability in a GIS perspective, existing policies, such as for free access and open information rules, need to be amended and evolved for the new aspects.

○ Incentives will serve as a good motivation to encourage the use of GIS in e-Government and need to be reflected in related regulations.

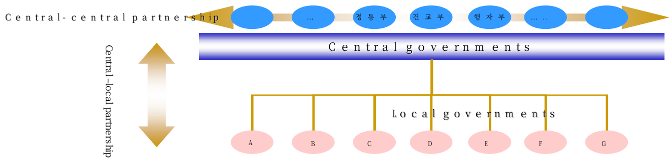
<Table 10> Major tasks to "innovate the institutional environments for the integration"

Directions	Major tasks	Contents
Innovate the institutional environments for the integration	Harmonized related laws for the integration	• tablish ISP for the integration e-Government and GIS • rmonize legislative activities in e-Government and GIS
	Amend existing policies to maximize the use of spatial information	• -engineer existing business processes • censing and second data ownership • otection of privacy • S staff management • range regulations for wider GIS utilization

3) Enhance collaborative partnership for the integration

○ Central-central, central-local and local-local government partnerships are essential for the establishment of seamless geospatial data infrastructure. It can create time-and-cost-saving effects by preventing dual-investments.

<Figure 11> Types of Intergovernmental partnerships for e-Government



○ Intergovernmental partnership can be categorized in two types: (1) horizontal cooperative partnership among central governments and among local governments, (2) vertical cooperative partnership across center and local governments.

- Horizontal cooperative partnership: between the National GIS project and the e-Government project.
- Vertical cooperative partnership: needs channels and organizations for the communication between the center and local governments

<Table 11> Major tasks to "enhance partnership for the integration"

Directions	Major tasks	Contents
Enhance partnership for the integration	Horizontal cooperative partnership	• Government committee connected with the NGIS project • int projects for the integration
	Vertical cooperative partnership	• cal governments-driven partnership • operation programs with center and local governments

4) Provide a variety of geospatial information services

A. Develop citizen-centered GIS services

○ Because the final recipients of services from e-Government implementation are citizens, the present NGIS projects need to provide more geospatial services for citizens and e-Government projects need to include a geospatial component for the better services in the present architecture.

○ The future e-Government requires to develop citizen-centered GIS services. For example, GIS services for the public participations can monitor and feedback about government's policies, and collect citizen's opinions.

<Figure 12> Citizen-centered GIS services

B. Develop more administration services using geospatial information in the e-Government project

○ By using multi-channel delivery mechanisms such as mobile devices, kiosk and internet, a variety of services can be developed and the public can have wider accessibility for geospatial information.

○ Combined use of LBS, Mobile GIS and GPS technology, for example, will create greater synergic effects, and integrated technologies need to be used for e-Government.

<Table 12> Major tasks to "provide a variety of geospatial information services"

Directions	Major tasks	Contents
Provide a variety of geospatial information services	Citizen-centered GIS services	• velop public participation GIS services in each administrative field • pand GIS services for everyday life events • velop interactive and online mapping system for citizens • velop the on-line community-based services
	Develop more administration services using geospatial information in the e-Government projects	• ore accesses with various delivery mechanisms for geospatial information • mbine GIS and wireless technologies for e-Government

5. CONCLUSION

To implement the integration strategies suggested, driving forces and roles need to be identified. It may be difficult to get into details for the identification without considering each government agency's subtle situation and to some extent it remains beyond the scope of this study. However, some roles for related agencies can be suggested as follows :

○ Ministry of Information and Communication

- expand the use of geospatial information in the 11 subjects finished for the first-phase implementation of e-Government and in another 31 subjects for the next phase.
- GIS technology should be a part of the implementation architecture of e-Government.

○ Ministry of Construction and Transportation

- Create more subjects and research topics for the citizen-centered services in a GIS perspective
- Reinforcement of the NGIS role in the future implementation of e-Government
- The third-phase ISP for the NGIS project needs to be complemented in the perspective of e-Government implementation.

○ Ministry of Government Administration and Home Affairs

- Reflection of GIS and geospatial information as an important element in the law for e-Government

○ Local Governments and Other government agencies

- Increase administrative efficiency by implementing Enterprise information system in which GIS and MIS are harmoniously combined.
- Develop various user-centered services by linking geospatial information with other related information.

Integration strategies suggested are some kind of problem statement in a GIS perspective for the future e-Government implementation rather than solutions. For the desirable implementation of e-Government, boundaries between government agencies shouldn't be a stumbling block and high quality services for citizens should take the highest priority. From cost benefit analysis about existing e-Government information systems, it can be identified that main reasons for much less effectiveness of the systems than their investments are the driving forces' narrow perspective and weak motivation and their insensitive response to the required amendment of existing regulations rather than technological difficulties. The most important element for the implementation of e-Government based on might be driving forces' awareness of clear purpose and innovative attitude based on a longer perspective.

With increasing expectation from citizens, government agencies will confront problems of limited budgets and insufficient resources soon. It might be inevitable for government agencies to communicate, cooperate and collaborate to solve the problems.

This study presented integration possibilities for the NGIS project which is mainly focussing on traditional GIS applications and the e-Government project having only focused on text information so far. By the integration of the tow projects, a dialectic development can be accomplished. When GIS and geospatial information becomes an essential element of e-Government in Korea, the goals of e-Government, higher administrative efficiency and higher quality citizen-centered services, can be archived.

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Geospatial One-Stop (GOS): Accelerating the Building of a Common Geography Infrastructure for the U.S.

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1. ABSTRACT

Geospatial One-Stop is one of the U.S. Presidential initiatives designed to improve the effectiveness, efficiency, and customer service throughout the Federal Government. The vision of the project is to make it easier, faster and less expensive for all levels of government and the public to access geospatial information. Geospatial One-Stop will improve the ability of government to utilize geospatial information to support the business of government and support decision-making. By providing the building blocks for a common geography infrastructure, also known as the National Spatial Data Infrastructure (NSDI), Geospatial One-Stop will; provide one stop web access to geospatial information through development of a portal; encourage collaborative planning for future investments in geospatial data; expand partnerships that help leverage investments and reduce duplication, facilitate partnerships and collaborative approaches in the sharing and stewardship of data. The availability of up-to-date and accessible information helps leverage resources and support programs such as economic development, environmental quality and homeland security.

2. INTRODUCTION

Geospatial Information One-Stop is part of the Presidents Management Agenda item called Expanding e-Government. It focuses on moving to a citizen-centered way of providing information and services to constituents. Geospatial Information One-Stop will provide a geographic component for use in all e-Government activities. Geographic information(GI) is a national asset, an essential requirement for just about every program at every level of government, and one of the key elements underlying the Presidents Management Reform Agenda.

Using the available tools and technical capabilities of E-government, we can expedite and improve the business of government, reform government management, eliminate redundancy, save money, increase agency productivity gains from technology, and provide citizen-centered information and services. Geospatial information is one of our most important, but underutilized, tools. To implement the Presidents e-government objectives, we need to focus on geospatial information.

Geospatial One-Stop is an important element in the overall national effort of achieving a common vision of accurate, accessible geospatial information for the nation that will transform the way government at all levels addresses the increasingly complex issues of the 21st century by using geographic information to:

- Simplify and unify business processes
- Respond to the information needs of citizens, producers and users of GI everywhere
- Integrate and engage the coordinated effort of government at all levels, and the private sector
- Align resources and foster co-investment in GI among all levels of government
- Collect data once and uses it many times
- Provide easy and secure access 24/7 to current, accurate GI
- Enable timely and improved decision making for everything from Homeland Security to economic development to health and public safety

This is a federal initiative with strong state and local input. Together, Federal, State and local agencies invest billions of dollars in geospatial information. Greater collaboration and easier access to available information helps avoid multiple investments and allows for sharing of information across jurisdictions to support decision-making. With this in mind the Geospatial One-Stop(GOS) project has been designed to serve the broader intergovernmental community through receiving guidance from an intergovernmental Board of Directors. Two Thirds of the vote on the Board of Directors is held by its non-federal members. The Department of the Interior is the Managing Partner for the initiative.

The implementation of the Geospatial One-Stop will:

- Provide an online access portal to geospatial data.
- Provide standards and models to support the exchange of framework datasets to facilitate web services;
- Provide an interactive index to geospatial data holdings at the Federal and non-Federal levels; and
- Promote partnerships among Federal, state, and local agencies for planned geospatial data collections;

3. BUILDING UPON EXISTING ASSETS

The Geospatial One-Stop builds upon existing capabilities to accelerate the development of the NSDI, technology, policies, and standards that support access to the Federal governments geospatial data assets. It will benefit all spatial data customers including Federal, state, local, and other governments, as well as private citizens, by providing a common, consistent source of geospatial data. It will save all parties money by providing a market for data acquisition partnership opportunities and by making data more accessible. By providing easier and faster access to data required for government decision-making, it will enhance decision support systems and delivery of services to the public.

There are many geospatial community assets to draw on:

- Dynamic technology created by the spatial technology industry
- Public and private sector organizations in many cities, counties and states as well as Tribal and Federal organizations that have adopted GI in their business processes
- A wealth of spatial data produced at every level of government and other sectors
- Interoperability specifications so GI technologies work together

- Long-term relationships and partnerships among Federal agencies, state and local governments, and the private sector

The Office of Management and Budget through a variety of efforts is addressing needs for increased leveraging of geospatial information and technology investments. Major Agency program initiatives such as Census Modernization, National Map, the National Integrated Land System, FEMA Multi-Hazard Mapping and others are promoting new strategies for multi-party data development that contribute to our common geography infrastructure. Data produced in compliance with policies, practices and standards becomes part of the common infrastructure and increases the value of Americas data resources.

4. A NATIONAL STANDARDS EFFORT

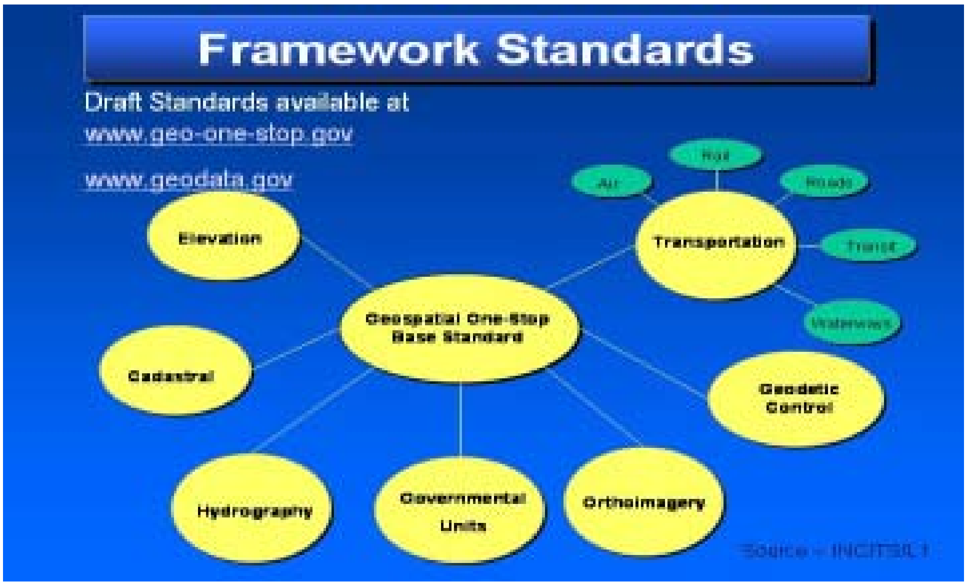
While specific applications of geographic data vary greatly, users have a recurring need for seven basic themes of data that are the foundation or framework for almost all applications. Framework data are characterized by a minimal number of attributes needed to identify and describe features such that they can form the foundation or framework of many applications. Geospatial One-Stops standards effort focused on seven framework themes and their associated subparts: Transportation, Hydrography, Elevation, Cadastral, Geodetic Control, Governmental Units, and Orthoimagery. The standards that are being developed are minimal data content standards designed to facilitate data exchange.

To ensure its standards efforts were not viewed only from a federal prospective, Geospatial One-Stop, has aggressively solicited national input from all stakeholders through its Board of Directors, the FGDC and their various outreach vehicles(newsletters, conferences, email lists and existing GIS working groups). This effort was successful in encouraging involvement from the Boards constituents with Over 500 participants from Federal, State, local, tribal and the private sector sighing up to help write, review or comment on the developing draft standards.

The Geospatial One-Stop project and the FGDC has embraced the development and implementation of the American National Standards Institute(ANSI) and International Standards Organization(ISO) standards. This project is an effort to further implement the ANSI National Standards Strategy for geospatial data, and forge stronger relationships with the National Institute of Standards and Technology(NIST). Federal agencies are required to make geospatial data comply with existing FGDC-endorsed standards and make that data available to the public, however Geospatial One-Stop is taking the steps to develop a national standard through ANSI first that then have it be adopted by the FGDC.

The Geospatial One-Stop project will result in the publication and adoption of specific framework data models promoting interoperability of framework data themes. At a minimum within the federal establishment, these data models will support consistent data exchange among framework data partners. Geospatial One-Stop will facilitate community participation in the evaluation of relevant standards. Individual agencies will be responsible for providing these standard geographic data services online.

Currently harmonized drafts of the standards have been submitted to the Geographic Information Systems Subcommittee of the InterNational Committee for Information Technology Standards(INCITS-L1) for review and submittal to ANSI later this year. The project anticipates having the final ANSI published standards available around the end of 2004.



Geospatial One-Stop will improve access to standardized framework data held by governments at all levels, academic institutions, private sector entities, and other organizations. Establishing reliable and standardized framework data services on the web will foster the production of virtually seamless, nationally consistent geographic information that is collected once, and shared many times. In so doing, it will enable organizations at the federal, state, and local levels to share production and maintenance of data that satisfy common data needs, and serve as a foundation or infrastructure for other e-government initiatives. Furthermore, the Geospatial One-Stop will establish the practices and techniques that will be used as the building blocks for additional data themes.

5. A Data Inventory and the Creation of Virtual Geospatial Data Market Place

Geospatial One-Stop performed an initial inventory of the Federal governments existing (legacy) framework data through the use of metadata on Federal clearinghouse nodes. Metadata is information about data, such as content, source, vintage, accuracy, condition, projection, responsible party, contact telephone number, method of collection, and other characteristics or descriptions. Reliable metadata, structured in a standardized manner, are essential to enabling geospatial data to be used appropriately, and to ensure that any resulting analysis is credible. Metadata can be used to facilitate the search for and access of data sets catalogued within a clearinghouse.

Geospatial One-Stop will also promote such inventories in the non-Federal sectors. These data will be accessible through the Geospatial One-Stop Portal providing a to identify current spatial data held by, or on behalf of, Federal and non-Federal agencies. Most of this will be achieved through agreements with existing clearinghouses where the portal will actually use harvesting techniques to collect and centralize a copy of the metadata that exist on clearinghouse nodes at regular intervals to populate the portal. This centralized metadata database will speed the search and discovery of geospatial data.

The development of a searchable database, using FGDC metadata and the NSDI Clearinghouse network, will enable governments at all levels, and the private sector, to identify agency data collection plans through a web portal. This initiative will also encourage state and local governments to identify at this portal their data collection plans. This will allow state and local governments, many of whom are aggressively using the NSDI Clearinghouse network, to coordinate data acquisition strategies with the Federal government, and to manage their data activities more efficiently and effectively and thereby create a virtual market place for geospatial data.

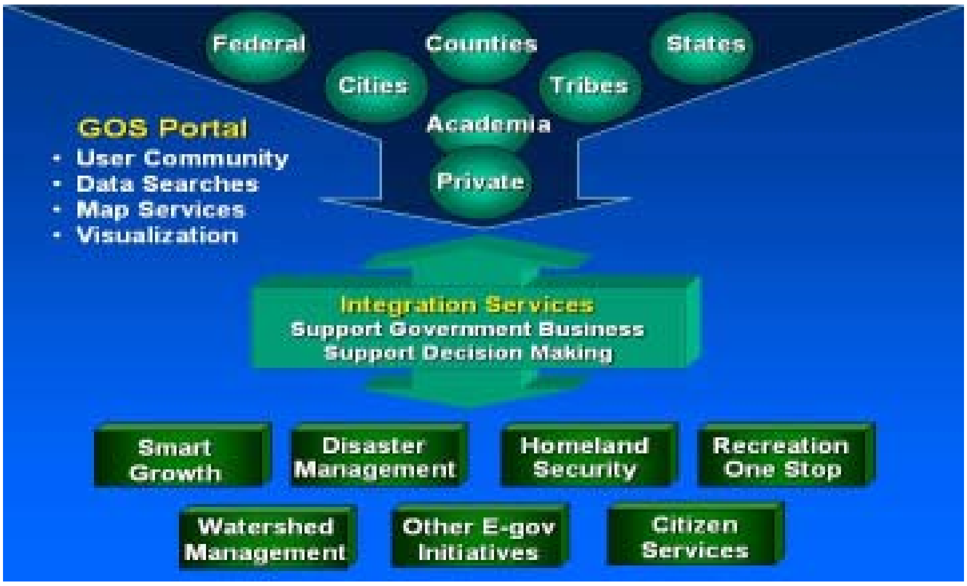
6. PARTNERSHIPS AND INCENTIVES

Geo-Partnerships to build local capacity will be required for the successful construction of a common geographic architecture. Geospatial One-Stop working through its Board of Directors and Federal Partners to help accelerate building new intergovernmental partnerships, and enhance existing ones, with real expectations, containing shared benefits, shared risk and mutual respect. These partnerships must be made with expectations that national standards for data creation and metadata will be followed, and that the partner will actively steward their data. Incentives can include; tools, training, software and grants.

Currently, Geospatial One-Stop, the Federal Geographic Data Committee and The National Map have a pilot proposal to plan complementary goals and combine their FY04 grant funds to help leverage federal resources in building local capacity and furthering coordination. They will work with the States to define a common set of expectations, invite the private sector and coordinate with the U.S. E-Grants initiative.

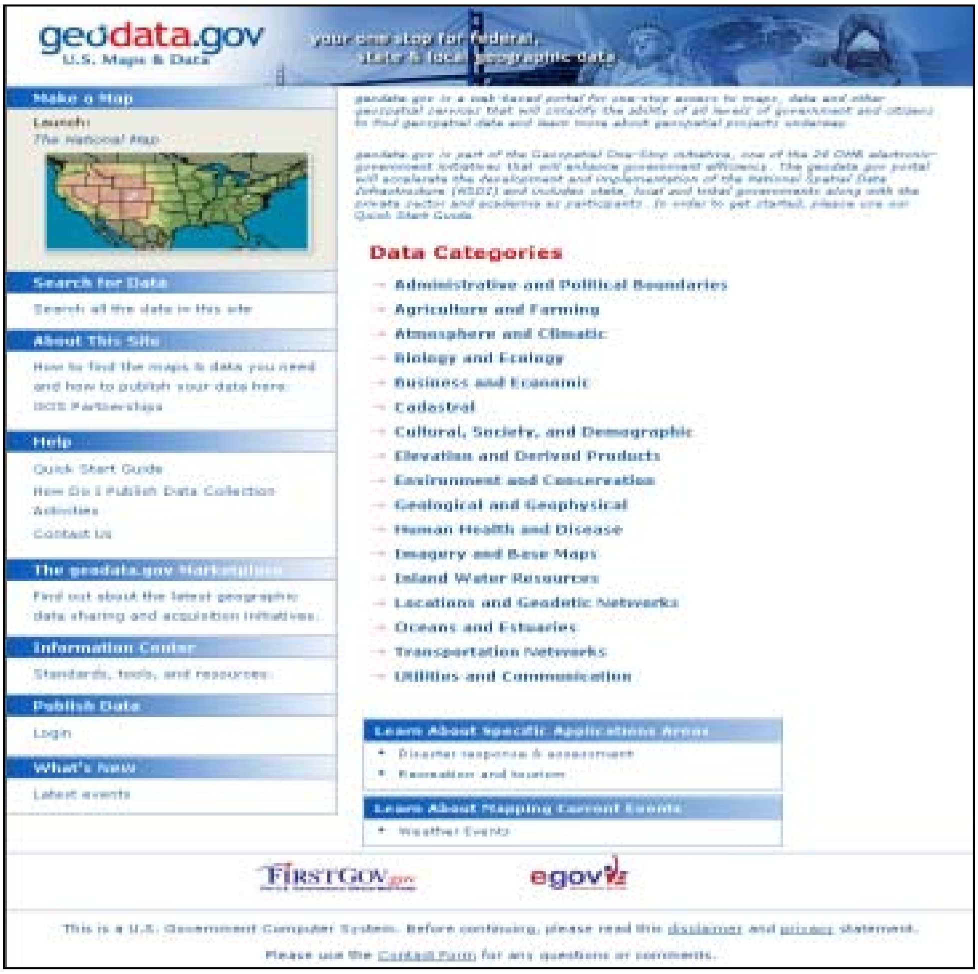
7. THE PORTAL

The portal can be looked at as a window or funnel to locate and view distributed geospatial data holdings from key communities or stakeholders such as the federal, state, local, tribal, acedemic and private sectors. This data coupled with geospatial data integration and services can be used to support the businesss of government with enhanced decesion making tools.



The centerpiece of the Geospatial One Stop strategy is geodata.gov, the initial implementation of the Portal designed to facilitate publishing and searching of metadata, and enable viewing live web mapping services, is known as GeoData.Gov, and will feature intergovernmental and private sector collaboration. GeoData.Gov will support "one stop" access to geospatial information and resources from multiple sources, allow multiple users to share and access the same information and support improved decision making through the availability of map services live from multiple sources, using The National Map, led by the U.S. Geological Survey, as a starting point. It will allow easy searches for existing and planned data with a goal of "two clicks to content." One of the key features for improved collaboration will be the "GeoData Marketplace." This innovative approach to leveraging government resources and investments will give advanced notice of geospatial investments by all levels of government and promote collaborative partnerships for future investments.

The portal is based on a distributed architecture allowing all the data to remain with the data owner. However, metadata from NSDI Clearinghouse Nodes will be harvested and copied to a centralized database for faster search and retrival. In addition a central inventory of live web map services will be published in the portal and made available for viewing.



The portal is an Internet-based organizational umbrella for federal agency data categories or channels addressing geospatial activities. Data Category teams or stewards from the communities of interest are forming to actively seek and monitor available thematic geospatial data products and services, assess and promote premier thematic data products, and showcase real success stories.

8. FUTURE DEVELOPMENTS

Over the next six months the current operational portal capabilities will be enhanced and the content and number of network providers of metadata will grow significantly as active metadata harvesting begins. In addition, a schedule for purchasing interoperable portal components will be developed by the Geospatial One-Stop team and released by the Government Services Administration(GSA).

Governments at all levels are major providers and consumers of geospatial data and information. They have long sought to facilitate interoperability among Geographic Information Systems. The U.S. Federal Government has recent experience in specifying Geospatial Portal Software, especially as part of Geospatial One-Stop.

The experience gained is being used to create a contract for Interoperable Geospatial Portal Components. That contract will be available for organizations at all levels of government to acquire interoperable, standards-based geospatial components for use in portals and other applications. This objective is aligned with the E-Government Act, the information technology strategy of the Federal Government, the movement to a Federal Enterprise Architecture, and the OMB policy on creating the National Spatial Data Infrastructure.

9. CONCLUSION

The Geospatial One-Stop program is the foundation for building a GIS for the nation: a realization of the National Spatial Data Infrastructure. The Geospatial One-Stop program is responding to a variety of federal business drivers demanding better service to citizens, more collaboration, improved efficiency, an improved homeland security. The entire GIS user community is encouraged to participate and help us foster a consistent implementation of the common practices and standards developed for the nation with active participation by all Agencies to enable us to link programs, practices, information and services in a citizen-centered geospatial delivery system for the nation.

Envisioning Cyber-geospace toward the Ubiquitous World

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1. INTRODUCTION

In the past decade, we have been experiencing the digital revolution and societal changes throughout the societies in the world, according to the rapid progress of internet and information and communication technologies(ICT). The global village has become an 'one-second information circulation sphere' and whoever has a computer can be a member of the global community through the internet.

There exist innumerable cyberspaces, in the internet, which are invisible worlds. Such cyberspaces in the internet make it easy for ones connected with it to interchange informations, knowledges and technologies through the cyberspace exploration. So, different from the past, they make it to overcome the spatial restrictions and difficulties of a real space. In other words, we can be beyond the spatio-temporal restrictions of physical space by using the highly advanced networks of information and communication. Therefore, we have entered e-community age by opening doors to new lives and activities throughout all the society. With such rapid changes of societal paradigm, recently Korean leading groups on the fields of ICT as well as geographic information system(GIS) are very interested in a cyber-geospace and a ubiquitous technology.

Accordingly, envisioning the information technology trend and cyber-geospace toward the ubiquitous world, the objectives of this paper are firstly to define the concept of a cyber-geospace clearly, secondly to offer a promotional strategy needed by the Korean government for the establishment of a cyber-geospace (Korean cyber-territory), and thirdly to propose how to establish a cyber-geospace for the entire country in detail.

2. The PROGRESS OF IT : Integrating Space, Time and Man

2.1. System and STM

All things in the universe are restricted by the axes of time and space. In addition to the time(時間 空間 人間 In-Kan) in the universe who can recognize them. So space, time and man(STM) have been called three fundamental elements(三間 three Kan) of the universe in the Eastern classic philosophy.[1)]

Meeting requirements of STM, all the systems can be perfect as the universe is. Information and communication technologies are the same as the other systems.

However, as shown in <Table 1>, development of information technologies had been focused on handling static and non-spatial information up to the middle of 1980s. After then, from the late of 1980s, with rapid progress of GIS technology, spatial related technologies have advanced rapidly. But they are not more than static and spatial technologies. On the other hand, main stream of internet related technologies in 1990s has been focused on dynamic but non-spatial related ones.

But, from now on, information and communication technologies will progress in spatio-temporal-human integrated perspectives. And GIS will be a foundation technology to integrate three fundamental elements of space, time and man.

<Table 1> Past and Future of Information Technology Progress

SPACE / TIME	NON-SPATIAL	SPATIAL
STATIC	[ ] ındling non-graphic data	[ ] rdinary GIS
DYNAMIC	[ ] igital Activities on Internet	[ ] ıtegration of STM

1) In the words of Huai Nan Tzu(淮南子 a chinese philosophical book, which was written 2,100 years ago by King Huai Nan with his subjects, the cosmos(宇宙 Wu-Zu) was defined as follows. Wu(宇 四方上下曰宇 宙 is time networked by past-present-future(古往今來曰宙 That is, the cosmos is a house which is composed of space and time. On the one hand, God's creation during six days at the beginning of the world in the Genesis of the Old Testment are also STM. God created time on the first day, space and all thing during the next four days, and finally man on the sixth day. And on the other hand, to sum up, the core of Buddha's spiritual enlightenment is Karma, namely cause and occasion. Karma is classified into 'All is variable vanity' in the time aspect and 'All has cosmic web' in the space aspect.

2.2. A Transition Stage from Internet Age to Evernet Age

Virtually all of the individual households in Korea own personal computers with ready access to the internet. From students to homemakers, the use of the internet is becoming an integral part of their lifestyles. Many services provided through the internet including on-line shopping, on-line transactions, on-line studies, on-line application for various certified documents, sale of financial merchandises, and medical service provisions are changing the basics of our lifestyle and our spending patterns.

And with the widespread use of the internet and mobile devices, cyber communities formed by regions, classes, and groups of people with similar interests are appearing in numerable portal sites. The active participation in these cyber communities is creating a new culture within our society.

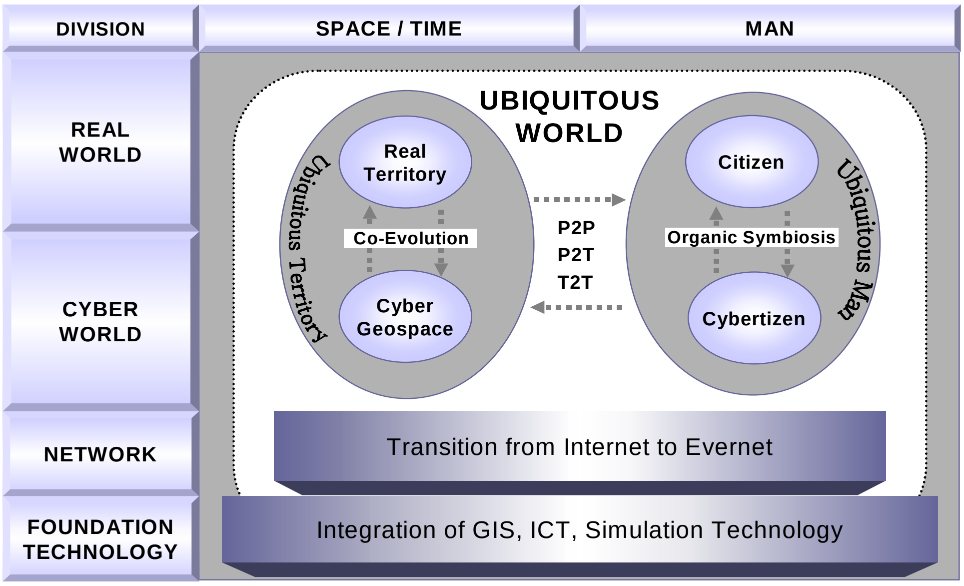
In the recent, such an internet is at the turning point. People(Whoever) want to get efficiently whatever they like, wherever they are, whenever they need it. So, in this paper, the network supporting their needs is called 'Evernet' instead of 'Internet'. Evernet is more advanced network concept. In addition, considering the current speed of development in information technology, the dawning of a cyberspace age, is forecasted in the near future. With the emerging cyberspace age, a great change in the spatial concept for an optimal fusion of the physical land space and the cyberspace is expected to unfold.

2.3 The Advent of the Ubiquitous World

The Evernet Age will head the information oriented society towards the ubiquitous world ultimately. In this paper, the ubiquitous world is defined as a world where all the communications of 'person to person(P2P)', 'person to things (P2T)', ' things to things (T2T)' would be able to be unrestricted with perfect freedom in the future, as shown in <Figure 1>. In the ubiquitous world, smart roads and intelligence cars will appear and communications among driver, car and road will be possible on real time one another. Also it seems to be practically possible for us to realize digital dream home in the near future by networking all household electric appliances inside home, and by remotely controlling them from outside home with mobile phone. In addition, it would be daily event for us to care health condition on real time with remote medical examination technology.

To make a country come to the ubiquitous world, first of all, they should put built in sensor of 'system on chip' in geographic features, important locations and facilities on the physical territory. Besides, they should build a cyber-geospace, similar to the physical territory, which will be filled with every possible information about the features, location and facilities.

<Figure 1> A Conceptual Diagram of the Ubiquitous World



Source : Young-Pyo Kim. 2003. 9. 8. "Cyber-geospace Construction toward the Ubiquitous World". 「RIHS Policy Brief」 Kyonggi Korea : Korea Research Institute for Human Settlements.

3. CYBERSPACE AND CYBER-GEOSPACE

3.1 Real Space

The substantial concept of reality has been a subject of philosophical arguments endlessly for long time through the history of philosophy. Generally symbolic logicians say, "Reality is the world as it is outside oneself and simultaneously what is made by human imagination". On the contrary, in the meaning that reality is built up by special cognition and social relation, anthropologists think, "Reality is the world which has a special meaning culturally."

On the other hand, in general, spatial world is said to be three dimensional Euclidean space where matters move according to the law of motion and follow the law of nature.

Summing up, therefore, real space can be defined as three dimensional Euclidean space which exists outside oneself and has a special meaning culturally. Such a real space is material, visible and touchable, and concretely exists as a physical territory in a country.

3.2 Cyberspace

The word 'cyber' came from classical Greek 'Kyberman'. Originally it meant to steer or to control. Tracing 'cyber' to its origin, the meaning of cyberspace is related to the flow and control of information. It has passed around 50 years to reuse the word 'cyber' in these modern days. Norbert Wiener, a scientist, reused a word 'cybernetics' in 1948. After then, a prefix 'cyber' has been started to use for terminologies related to a robot or a computer.

Physically a cyberspace is all the connections between computers in different places, considered as a real place where information, messages, picture etc. exist. In other worlds, logically, a cyberspace is the place where digital information is related with human knowledge and the world where various network systems, economic systems and cultural systems are combined through the Internet. Such a cyberspace is a space where new types of communication, business transaction, educational interaction, other transactions, and entertainment are engaged and is a territory for people seeking a new culture different from the one in the current society.

There are some terminologies similar to cyberspace. That is, artificial reality, virtual realit y[1)], virtual world, virtual environment, microworld, etc..

Considering a cyberspace as the most comprehensive concept among such terminologies, this paper defines a virtual reality by the cyberspace which reflects a real space tangibly and call territory expressed with virtual reality techniques by cyber-geospace. That is, a cyber-territory is a cyberspace that is organically grafted to the real world.

3.3 Cyber-Geospace

Most figures of Korean territory circulated in the geographic information market on the internet, as shown in <Figure 2>, is a type of 2-dimensional flat map. However, such a 2-dimensional figure is quite different expression from the 3-dimensional one in the real world. That is why 2-dimensional map is easier for users to understand than 3-dimensional one. Besides, so far, we have lots of technical restrictions to express 3-dimensional figures on a plane in the map production process. But nowadays, according to the technical progress, we can make and show 3-dimensional cyber-geospace even in the internet, as shown in <Figure 3>.

In this paper, we define formally cyber-geospace as "the dynamic second territory of

1) Virtual reality is an cyber-environment produced by a computer that surrounds the person looking at it and seems almost real but not real physically.

Korea not only to manage the land systematically and deal with administrative services for the people in aspect of public sector, but also to contain economic activities of corporations and the citizens' everyday lives in aspect of private sector, in a virtual reality made by digitizing various facilities and buildings as well as the entire territory including ground, underground and even the sea."

Therefore, such a cyber-geospace will be a fundamental national information infrastructure for the ubiquitous world in the near future.

<Figure 2> An Example of 2D Map Circulated in Market

<Figure 3> An Example of 3D Cyber-Geospace (Pusan, Korea)

4. STRATEGIES FOR CYBER-GEOSPACE

4.1 New Digital World of Integrating STM

Human being has continuously challenged to new technology and knowledge. Its history is a long way of opening new frontiers. During the last decade, human being has created 'invisible continent', i.e. cyber space, by computer and Internet technologies. Human being now accumulates all information, knowledge, technology, and even goods in the cyber space.

People who discovered new continent of America in the fifteenth century now lead world's development. In the future, people who discover another new continent will take a leading role of world's history. In the coming Evernet era, people who build and utilize cyber territory will have great influences on real territory. Thus, there will be a harsh competition among nations to preoccupy cyber territories.

If a foreign country preoccupies our cyber-geospace before we do, we will lose arena for digital activities necessary for preparing Evernet era. We might encounter cyber colonial periods if we fail to have our own cyber-geospace. Thus, it is time to prepare appropriate strategies for building cyber-geospace with national vision.

4.2 Creating Space for All Digital Activities

Cyber-geospace has both of spatial and temporal elements. In this reason, cyber-geospace has a great capacity on adopting and integrating related information. Cyber-geospace accepts all kinds of existing digital activities from administrative works in public sector to productive ones in private sector. In this sense, building cyber-geospace is, after all, construction of cyber infrastructure for newly coming digital economy. Although cyber-geospace is inevitable movement towards future, there are also some problems to be solved. Those include privacy, security, and copy right and also require careful approaches.

4.3 Another National Territory Enabling Simulation

Cyber-geospace overcomes time and space limitation in physical real world and makes possible to deal with virtual reality. It can simulate our physical real world. Once after temporal GIS technology becomes widely available, cyber-geospace in the computer will evolve from static space to dynamic one. Then we can embody diverse spatial plans we have in mind in the cyber-geospace. We can predict how physical real space will be changed through simulating it in the cyber-geospace. It will help us to shape our physical real world in most desirable forms by allowing various simulations.

4.4 Leading Cyber Global Village by Cyber-geospace

Some countries are now concerned about cyber-geospace or cyber cities, but most of them are just at the very beginning. Although physical real space of Korea is somewhat lagging behind than that of advanced country, Korea can have advanced cyber-geospace if it goes ahead of other countries. It is not a difficult job once Korea reaches national consensus. Korea already has well-prepared information infrastructure, such as broadband internet and high possession ratio of PC per household. Meanwhile, in near future most countries will start to build cyber-geospace, and such efforts together will shape cyber global village. Korean government should begin to build cyber-geospace as soon as possible and take a leading role of building cyber global village.

4.5 Cyber-geospace Technology for Future Momentum

Rapidly growing information technologies are ultimately pursuing the integration of space, time, and man, namely STM. The most useful and appropriate technology for integrating STM is GIS. Cyber-geospace is built on this GIS technology and mirrors physical real world on it. Again, cyber-geospace integrates STM, compromises all existing digital activities, and provides another national territory enabling simulations. Because of complex nature of cyber-geospace, a new synthesized technology including all individual information technologies is essential for building cyber-geospace. Thus, building cyber-geospace also provides a new opportunity for advancing information technology. New technology for cyber-geospace will be a great growth potential for the future. In addition, it will be an important judgment criterion for international competitiveness.

5. POLICY MEASURES FOR CYBER-GEOSPACE

Cyber-geospace project covers entire nation and also includes citizen's everyday activities on it. In this reason, the project should be conducted under long-range plan. It is desirable that the project is propelled under the directorship of "Cyber-geospace Committee." The "Master Plan of Cyber-geospace" is also required to guide the project systemically and step by step. Total times for the project will be about 10 years for the 4 phases of plan, prototype, diffusion, and integration. The estimated cost of building cyber-geospace is about a trillion won[2]. Funding problem can be solved by sharing expenses among central governments, local governments and private participants. Private firms making an investment might have a right for site lease or information distribution. In addition, some supporting measures are also required for successful implementation of cyber-geospace project, like consolidation of related laws, promotion of related industries, and reinforcement of public relations and educations.

5.1 Measures by phase

To achieve long-range goals of cyber-geospace project, a step-by-step approach is necessary. The suggested strategy consists of four phases-plan, prototype, diffusion, and integration. First, in the plan phase, the first Master Plan of Cyber-geospace is established. The plan specifies overall goals and objectives for the project. Second, in the prototype phase, an sample of model system is designed for one mid-sized city. It aims at preparing guidelines and standards to minimize trial and error in next phase. Third, in the diffusion phase, projects for the rest of 231 municipalities are carried out successively. Fourth, in the integration phase, a integrated system for all 232 municipalities are built up. Then, the cyber-geospace project for the entire nation is completed. Details are shown in the <Table 2>.

2) 1 trillion won is approximately 830 million dollars (1 dollar is about 1,200 won as of November 2003).

<Table 2> Phases and Scopes of Cyber-geospace Project

Phase	Year	Milestone	Area
Plan	PY0	Establishment of 1^{st} Master Plan for Cyber-gospace Establishment of cyber-geospace committee	Entire nation
Prototype	PY1	Preparation of guidelines and standards Establishment of 1^{st} Action Plan	1 mid-size city
Diffusion	PY2	Notification of guidelines and standards Beginning of 7 metropolitan area projects	7 metropolitan areas
	PY3	Consolidation of related laws Beginning of 9 province area projects	7 metropolitan areas 9 provincial areas
	PY4	Building Strategies for technology export	7 metropolitan areas 10 cities and counties
	PY5	Establishment of 2^{nd} Master Plan for Cyber-gospace	7 metropolitan areas 15 cities and counties
	PY6	Establishment of 2^{nd} Action Plan	7 metropolitan areas 14 cities and counties
	PY7	R & D for new technology and policy base	7 metropolitan areas 30 cities and counties
	PY8	Consolidation of guideline, standard, and policy	40 cities and counties
	PY9	R & D for system integration	40 cities and counties
Integration	PY10	Integrated systems of 232 municipalities Completion of cyber-geospace	Entire nation

5.2 Cost

The total costs for building cyber-geospace are approximately 1.3 trillion won. However, if national framework data is constructed as it planned and utilized for cyber-geospace, about 450 billion won[3] will be saved. In this case, the total costs for cyber-geospace becomes 885 billion won.

3) Young-Pyo Kim, Shun-Hee Han, Mi-Jeong Kim. 2001.12. 「Cyber Territory Construction in Digital Age」 Kyonggi Korea : Korea Research Institute for Human Settlements.

<Table 3> Costs of Cyber-geospace Project by Plan Year

(Unit: Billion Won)

Prototype	Diffusion								Integration	Sum	R&D, Project Management	Total
PY1	PY2	PY3	PY4	PY5	PY6	PY7	PY8	PY9	PY10			
6	22	89	113	145	158	220	253	260	5	1,271	64	1,335

5.3 Organization

Cyber-geospace project should be conducted on national level with long range plan. So, first of all, an appropriate organization should be established. The suggested Cyber-geospace Committee is inter-organizational committee that aims at promoting and managing cyber-geospace project. It is composed of steering committee, coordination group, advisory board, and sub committees. It also has adjunct organizations, such as policy and technology research center and cyber-geospace management center. The committee not only include public sector players but also various private participants.

6. CONCLUSION

Cyber-geospace presents national territory and facilities on it vividly. This makes possible to encompass diverse digital activities and thus brings the effect of territorial enlargement. Three-dimensional cyber-geospace can embrace all digital activities like economical, political, social, and cultural affairs. Citizen's digital activities will meet a turning point in near future. Cyber-geospace is opened to the world, and it is an arena for socio-economic interchange between Korean and all people in the world.

Cyber-geospace is not a real territory and thus enables us to simulate various spatial situations. It can collect information from physical space and embodies it on the cyber space. It can help us to create diverse virtual realities. For instance, solutions for many planning issues, such as Kyungbu express rail, Bukhan mountain tennel, Saemankum, in Korea can be generated and evaluated beforehand in the cyber-geospace.

Cyber-geospace will accelerate the advent of ubiquitous world that allows free communication among "P2P", "P2T", and "T2T" to happen. Individual information technologies like wireless electronic tag, GIS, GPS, ITS will be fused each other. It is no longer mere imaginations that parcels with wireless electronic tags are traced from gathering points to delivering points in real time and that goods with chips are managed from production lines to dump sites. Cyber-geospace is a foundation for this future. To make ubiquitous world possible, i.e. U-home, U-education, U-health, U-post, U-robot, and U-campus, we need a container of related information like cyber-geospace.

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GIS Technology for Cyber-Geospace

- Implementing a Metadata Catalog Portal in a GIS Network -

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1. SECTION 1

1.1 What is NSDI?

There is widespread recognition that the data layers and tables in most geographic information system(GIS) databases come from multiple organizations. Each GIS organization will develop some, but not all, of its data content, and other layers will come from external sources. This results in a system in which GIS data management is distributed among many users.

GIS users are hungry for quality geographic information; therefore, there is a fundamental need for users to share their data. Vast resources of information are available today, but the task of finding exactly what you need and knowing the quality and currency of the information can be daunting.

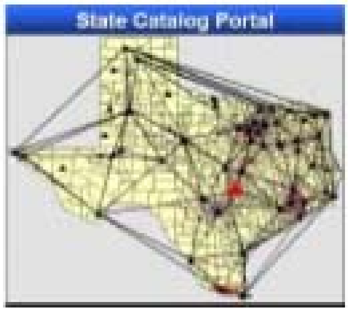
Furthermore, users often duplicate data collection work. While collaborative efforts are often used, massive duplication of GIS datasets is quite common and costly.

Bottom line: GIS users need a mechanism to efficiently catalog and search for available geographic information and to openly share this information.

1.2 The NSDI and GSDI Vision

The NSDI, or National Spatial Data Infrastructure, is a concept developed by the United States federal government and other state and local governments. The Global Spatial Data Infrastructure (GSDI) is a nonprofit organization composed of individuals, industries, and more than 50 countries whose mission is to support ready global access to geographic information. The NSDI and GSDI promote the vision of a framework for GIS users to openly share geographic information and to collaborate on data development (Figure 1).

<Figure 1> The vision of a National Spatial Data Infrastructure is based on GIS users openly sharing key sets of GIS information and the ability of users to search for and discover information sets across the World Wide Web. Users should also be able to access datasets through a variety of mechanismsfor example, via connections to data streaming services, access to map services, and data downloads in numerous desired formats.



1.3 How does an SDI work?

The Spatial Data Infrastructure(SDI) concept describes requirements for computer technologies, policies, and people necessary to promote the sharing of geographic information throughout all levels of government, private industry, Non-Governmental Organizations(NGOs), and the academic community. The SDI interconnects GIS nodes across the Internetand, in many cases, over secure networksto share information with one another openly(i.e., based on the best available set of working, widely adopted practices and methods). These and other types of GIS portals are being built at national, state, and local levels for geographic information access and sharing. It is expected that many of these portals will be central sites that users can readily access and search.

A recent Federal Geographic Data Committee(FGDC) slide summarized many of these key visions:

- One-stop shop search system for geospatial data.
- Data is described through metadata and made searchable through many local catalogs known as Clearinghouse Nodes. ! Each catalog is registered with the FGDC.
- Ability to search any node.

- Includes free and for-fee data.
- An open, global network for GIS users, government, business, NGOs, etc.

At its most basic level, an SDI is realized through catalogs holding documentation(metadata) about available GIS datasets and Web services. This is similar in function to the role of the card catalog in a library that references and organizes all library holdings. For example, GIS holdings can include static and interactive maps, map layers, applications, analytical models, reports, datasets and databases, and GIS Web services. Each of these documents can be documented using standards-based metadata.

Figure 2 shows three key activities of an SDI:

- GIS data publishers document and register their datasets in a metadata catalog;
- Users search for data at GIS catalog portals to find potential datasets for use. This is similar in concept to a library catalog search; and
- Users directly connect to a GIS data service or download datasets for use in their application. Intensive data investigation(via live GIS data services) is often a crucial step before advanced GIS use.

<Figure 2> The building blocks of the NSDI and GSDI architecture, containing the GIS catalog portal and GIS network concepts.

1.4 About this document

A Spatial Data Infrastructure requires:

- Catalogs of GIS data holdings(the building and hosting of a series of GIS catalog search portals)
- Content standards(adoption by user communities of common, multipurpose GIS data models)
- A commitment by data publishers to ensure a persistent trusted source of GIS information and services at their Web sites(the

Portals require much more than a metadata catalog that can be searched on the World Wide Web and a data delivery framework. This technical paper focuses on the first requirement: GIS catalog portals. As presented in this paper, catalog portals require a complete information system for geography, tools for data import and export, tools to validate data, tools to serve metadata catalogs and data, search and discovery tools, tools to explore and use data, and tools to build and manage GIS data.

In this paper, a framework for building open, interoperable GIS catalog portals will be presented. It covers the capabilities of the ArcGIS software currently available from ESRI and how these tools can be used in the critical aspects of building, serving, and using GIS catalogs in an SDI.

This document will also share some thoughts on practical methods that might be applied across the GIS profession to build such portals. The topics presented here are based on the results of a series of case studies developed through implementing the Geography NetworkSM and a number of GIS catalog portals at user sites.

2. SECTION 2

2.1 What is a GIS catalog portal?

A metadata catalog for a GIS plays the same role as a card catalog in a library. The card catalog in a library has a record for each holding. All catalog records are compiled into one comprehensive catalog and indexed by author, subject, and title(and other keywords) so that the catalog can be searched. In a GIS, each dataset has a metadata document. The concept behind a GIS catalog portal is that these metadata documents are collected into a comprehensive metadata catalog that can be indexed by various means, such as by geographic location. The catalog portal can then be searched to find candidate datasets for use. Just as in a library search, each metadata record in a GIS catalog portal search can be viewed. Optionally, users can connect to and explore the actual dataset to make a decision about its potential use. This is a critical function necessary for advanced GIS applications.

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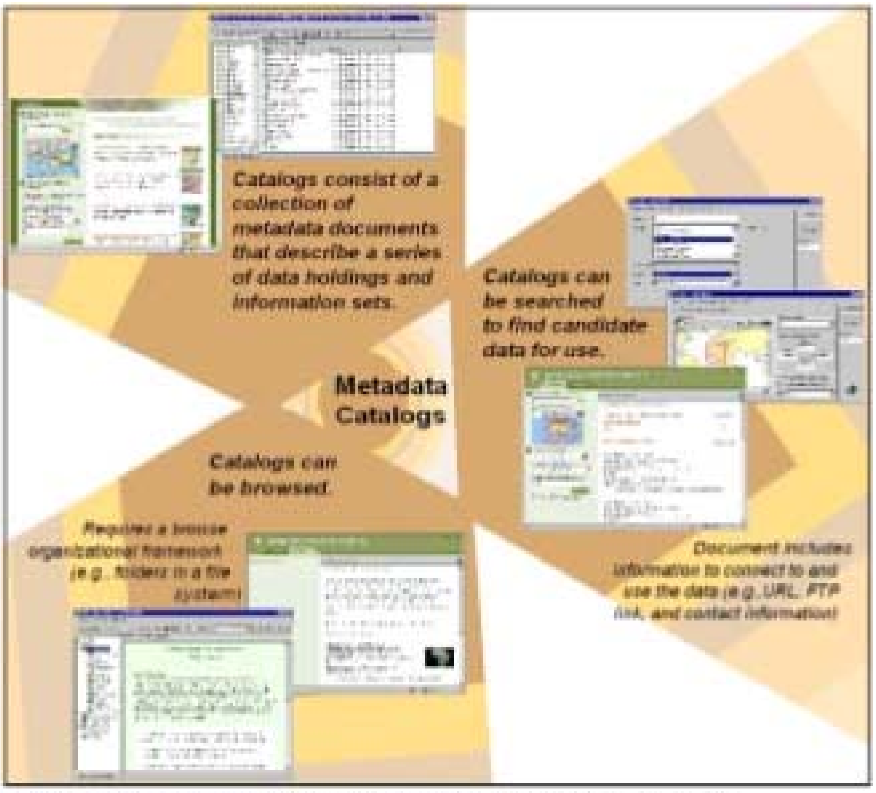
<Figure 3> A metadata catalog contains data that can be searched or browsed



It is also important to note that a library catalog references books as well as many other types of holdings. In turn, the information holdings in a GIS should include more than datasets, and each should be documented, indexed, and cataloged for searching and sharing. For example, GIS holdings can include:

- Static and interactive maps
- Map layers
- Three-dimensional scenes
- Applications
- Analytical models(e.g., geoprocessing scripts)
- Reports
- Datasets and databases

- Tables
- GIS Web services
- Activities and events
- And much more

The GIS metadata catalog can be thought of as the organizing framework for a GIS just as the card catalog reflects the organization of the library as a system, such as the organization of its shelves. Similarly, a GIS network and its catalog portals can be thought of as the organizing framework for a multiorganization GIS(e.g., a state or national GIS). Each GIS requires a catalog that documents its data holdings and provides fast access to them. The goal of metadata must be to create consistent documentation for these holdings so that searches work across GIS systems.

There are already many examples of catalog portalsmany of which provide GIS data - that support information search and discovery. A short review of a few very typical Web portals provides a helpful context to gain a broader understanding of whats available, how they work, and some of the key characteristics that will be important to build a working, practical Spatial Data Infrastructure.

General Web Searches	
www.google.com www.yahoo.com www.alltheweb.com www.lycos.com www.askjeeves.com	Commonly used World Wide Web search engines for Web content. Web searches are ad hocquite free form and designed to support many unforeseen purposes. As everyone has experienced, keyword searches for Web sites are hit and miss.
Library Catalog Searches	
http://catalog.loc.gov/	The Library of Congress Catalog search Web site. Library catalog searches are based on well developed cataloging principles from the field of library science(e.g., standardized keyword lists, detailed cataloging guidelines, and ability to copy MARC records from publishers into each library catalog). This paper discusses the potential use of library science methods for building consistent GIS catalogs.

GIS Portals	
http://130.11.52.184/	The URL of the FGDC Clearinghouse, which is a collection of GIS sites, known as Clearinghouse Nodes. To search many catalogs, you perform a distributed search across selected nodes. The distributed search method has not worked well in practice for numerous reasons(e.g., search sites may not be online so no guaranteed results; each site takes a performance hit for every search; there is one result set to investigate for each search node, making comparisons difficult; performance is dismal). Recent studies indicate that search users connect directly to selected nodes and browse for data, which is also quite inefficient.
www.geographynetwork.com	ESRI's central catalog portal, where users can search for, discover, and directly connect to numerous GIS Web services and Data Download sites. The Geography Network references datasets and services for volunteer GIS participants. Additional sites have been added over time to help ESRI learn about best practices and methods. ESRI also uses this to better understand user requirements and better design capabilities in its commercial software.
www.geocommunicator.gov	The GIS catalog portal for the U.S. Bureau of Land Management and the U.S. Forest Service is built using the same technology as the Geography Network. Its goal is to provide an access portal to Federal Lands information including the Public Land Survey System (PLSS).
www.deli.dnr.state.mn.us	Browsing each Web site with its own unique layout and design is the most typical access method used today for finding GIS data. This is the State of Minnesota' site for GIS data search and acquisition. Most GIS use at such sites is to search for data by browsing the Web pages at this site.
http://www.datamil.udel.edu/nationalmappilot http://www.tnris.org/explorer/index.htm	The State of Delaware' DataMIL site is an example Web site for searching and delivering data layers as part of the USGS National Map. Also listed is the State of Texas Geography Network portal for searching and finding GIS data State-wide. These are two in a series of GIS sites that provide modern GIS catalog services for searching.

UDDI Web Services Portals	
http://uddi.microsoft.com/default.aspx http://www-3.ibm.com/services/uddi http://uddi.sap.com	The links listed here are examples of UDDI registries where Microsoft® IBM® and SAP provide search portals for SOAP-based Web services. UDDI, or Universal Description, Discovery and Integration, is a standards-based specification for registering and discovering SOAP-based Web services on the Web. UDDI is similar in concept to NSDI. UDDI is part of a computing industry initiative to create a platform independent, open framework for describing services, discovering businesses, and integrating business services using the Internet. Each registry contains descriptions of businesses and Web services and will be used by entities to make information available about businesses and their service offerings. Generally speaking, UDDI registries are immature compared to GIS industry work on catalogs. However, the catalog of businesses and entities at these Web sites is worthy of continual review as Web services mature over time.
Commercial Search Portals	
http://www.amazon.com	A nice example of a search and discovery Web site that provides useful overview information and recommendations. It's easy to find what you need and to discover more candidates based on your use history(e.g., "The page you made", "Customers who bought this title also bought").

2.2 Characteristics of successful GIS catalog portals

Ideally, GIS catalogs should support a search and discovery experience that more closely resembles a library search than an ad hoc Web search mechanism in broad use today and the current GIS data Web pages.

For an SDI to be practical, searches must work consistently and efficiently from site to site, datasets must be easy to document and the metadata documentation must be consistent, and catalogs must be easy to build and maintain and must support widely used GIS datasets and formats. Catalog records must communicate clearly and be easy to understand. GIS catalog portals must also be built using widely adopted information technology(IT) and GIS technologies(e.g., database management system [DBMS], Web services, HTML, XML, and GIS formats).

Here are some useful criteria to think about when building a GIS catalog portal:

- Datasets should be consistently documented and discovered through standard searches from site to site. This requires that metadata documents be consistent from site to site.

Notion: In addition to adhering to metadata content standards, catalog records(i.e., metadata) should be built using widely adopted library science principles.

- Portals should support searching against a single server, not many servers via distributed searches.
- Searches must be fast and efficient.
- Servers should control access levels to each catalog and its contents. Sensitive information must be private and secure. Accepted IT strategies must be employed to manage security, access levels of availability, and keep track of to whom each dataset is accessible.
- There should not be a big load(a "tax") on servers that host a participating metadata
- catalog in an SDI. Searches should only hit the targeted server.
- Portals should allow you to view metadata records to determine if a candidate dataset is suitable for the intended use.
- Portals should allow you to access and view geographic data and Web services directly through a GIS catalog portal when available. Maps should be viewable in the users Web browser or with GIS software to display multiple data sources along with data from local sources.
- Search results should include up-to-date quality and summary information, which should be held in the catalog as standard metadata.
- Portals should be built using widely adopted information technology(e.g., DBMS, works through firewalls, supports Web service standards, and utilizes commercial off-the-shelf [COTS] GIS tools).
- Portals should always be available for reliable access and searching.
- Portals should support key IT and GIS standards(e.g., Web services frameworks, International Organization for Standardization [ISO]/FGDC metadata, most commonly used GIS file formats and Web application program interfaces).
- Portals should be practical to implement and maintain.
- Portals require more than publish and search tools. They must also provide exploration tools to learn more about candidate datasets. Users need to explore more details of many datasets to determine the suitability of the dataset for their specific use.
- Portals should support a range of methods for online data delivery(e.g., live data

streaming, commonly used data formats, FTP download, and CDROM). Long-term data delivery should be through guaranteed highly available and high-performance data streaming services.

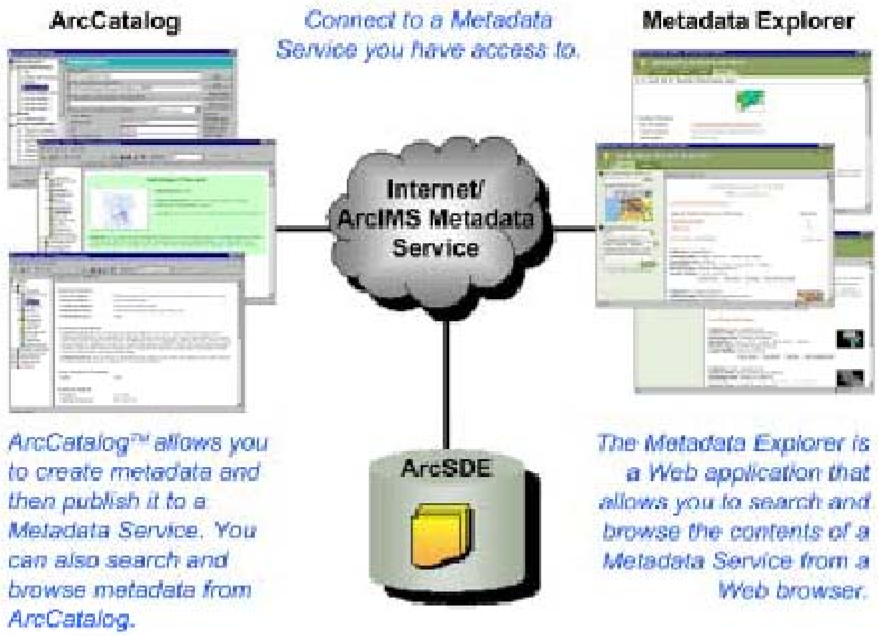
- Common data representations and essential content standards are important for collaborative efforts to assemble data from many federal, state, and local partners. Data content should employ generic types(e.g., OGC-compliant simple features) whenever practical. Data content must be multipurpose, designed to support most common GIS applications.
- Portals should support the ability to when new or updated data, maps, activities, references, and so forth, have been added to a favorite search area.
- Some central portalsoften referred to as Clearinghouse Nodesshould enable selected users the ability to publish(register) map services, images, geographic datasets, geoservices, spatial solutions, geographic and land reference material, and geographic activities or events to share with others through submission of online forms. Data providers should have the ability to update their metadata submissions to reflect edits and updates over time.

3. SECTION 3

3.1 How to build a GIS catalog portal

GIS catalog portals require much more than a Web page and a metadata standard. They also require complete tools for a GIS and the best methods and practices currently available to apply these GIS tools.

<Figure 4> Overview of how ArcGIS is used to build, serve, and use a GIS catalog portal.



GIS users will perform the following tasks to build a GIS portal:

- Create GIS data holdings and agree to make selected datasets available to other users.
- Document these datasets with standards-based metadata.
- Compile the individual metadata documents into a metadata catalog.
- Publish the metadata catalog as a Web Service that users can search.
- Build a custom gazetteer for geographies covered by the GIS database so that meaningful geographic searches can be performed against local place names.
- Build a Search Tool, most typically a Web browser application for searching and browsing the metadata catalog.

3.2 Building a central GIS Catalog portal

Many have a vision for central portals at state, local, and national levels. There is a common vision for one central GIS portal in each state and one in the federal government.

Many believe that the central federal portal is the role of GeoSpatial OneStop, which will be further explained in Section 5. Many expect that numerous large local governments(such as a regional council of governments [COG]) will also host central GIS portals.

Two common strategies for building central portals include:

- Perform distributed searches from a centralized Web site (e.g., the current FGDC Clearinghouse implementation); or
- Harvest catalogs into one central catalog database for focused search and access.

3.3 Distributed search

Through a series of pilot projects and prototypes, ESRI discovered numerous challenges with each approach but determined that the distributed search method was problematic. Some of the problems encountered with distributed search portals included:

- Performance hit by each GIS portal for every search through the distributed framework.
- Bad performance.
- Result sets were very difficult to interpret.
- Results were dependent on online available services. Many portals were frequently down or offline.

3.4 Harvesting

A recent study on the use of the FGDC Clearinghouse discovered that most users do not perform distributed searches at this site due to such problems. Instead, users went to specific GIS portals and browsed their Web site to find datasets relevant to their GIS projects.

The second strategy for central GIS catalog portals is one of harvesting. The concept is that a number of collaborating GIS sites would periodically share their catalogs with one another. One central site would harvest these catalogs and compile them into one comprehensive catalog that could be searched. GIS users would connect to and search these central GIS catalog portals. Since GIS users already share GIS datasets, harvesting appears to be a practical solution that will work (Figure 4).

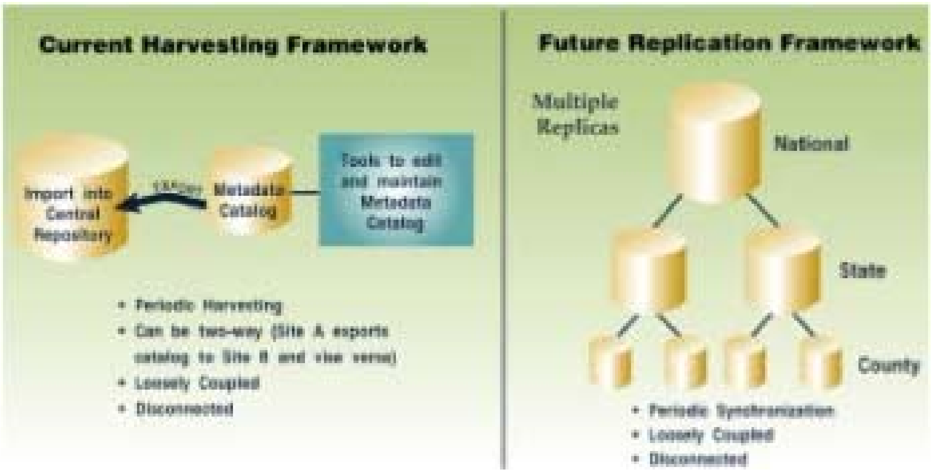
<Figure 5> The concept of a central catalog portal where GIS users can search for and find GIS information relevant for their use. Periodically, the central portal site harvests catalogs from a collection of participating sites to publish one central GIS Catalog. The GIS Catalog can reference data holdings contained at its site as well as at other sites.

In cases where central portals are to be built, harvesting and sharing tasks include:

- Harvest catalogs of collaborating organizations to allow for a single centralized GIS portal.
- Export catalogs to include in other central GIS portals.
- Scheduled synchronization of shared metadata repositories(Figures 6 and 7).

This requires a formalized structure for multiorganizational collaboration.

<Figure 6> Harvesting frameworks for metadata catalogs will require high-end database sharing tools and methods. A major challenge will be to ensure that each metadata catalog is synchronized with the others. Current GIS tools support capabilities to import and export entire catalogs. This can be managed on a regular schedule to maintain synchronicity. Future methods will include loosely coupled replication, allowing for efficient, periodic change-only updates to be shared.



<Figure 7> Each GIS catalog portal must support standard searches. Portals often contain support for various search mechanisms, including standard Web portal searches as well as Z39.50.

3.5 How to use a GIS catalog portal

Users need to find GIS data for use in their applications. They need to explore datasets and often perform further geoprocessing on the data to make it usable(and often simply just to certify that the dataset is appropriate for use in their applications).

Users perform the following tasks to discover available information at GIS catalog portals:

- Connect to and search specific portals(e.g., connect to Delaware DataMIL).
- Discover and investigate candidate data to find appropriate datasets for specific purposes. This may be as simple as reviewing the metadata record for a dataset or as involved as further geoprocessing on the data for validation. Advanced exploration typically occurs in concert with steps 3 and 4.
- Connect to live data services (e.g., a GIS Web service), download data (e.g., from an FTP node), or contact the provider for the data.
- Integrate and use the selected data in the application.

4. SECTION 4

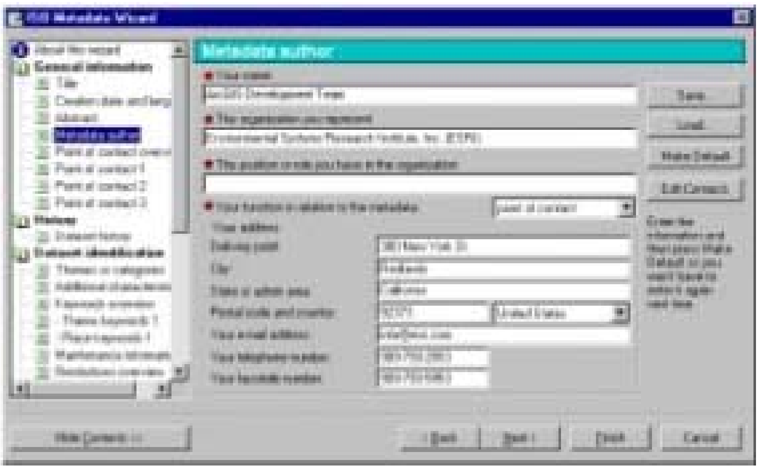
4.1 How is ArcGIS used for SDI?

ArcGIS tools can be used for SDI in the following ways:

- Client access. ArcIMS® includes a range of client applications to connect to and use standards-based Metadata Services and GIS portals. ArcIMS clients used in a portal can include the Metadata Explorer, various HTML- and Java ased Web-mapping clients, and other GIS desktops. Additional GIS desktops from ESRI include ArcReader ArcView® ArcEditor MapObjects® or Java, and ArcPad®
- Create, manage, and serve metadata. With ArcGIS, users can create and update FGDC- and ISO-compliant metadata (Figures 8 and 9). Using the standards-based ArcIMS Metadata Service and ArcSDE® users can manage and serve metadata catalogs on a local network, a secure network, or the World Wide Web. The ArcIMS Metadata Service can be accessed through standards-based ArcIMS services and through Open GIS protocols, such as Z39.50.

- Create, manage, and serve GIS information. GIS users build and manage their geographic data and information using ArcGIS and ArcSDE. They can openly serve data, metadata, online maps, and other information using ArcIMS. ArcIMS services can be accessed with a wide range of clients via GIS and XML-based Web services standards.

<**Figure 8**> A complete metadata document can be created for datasets using the ArcCatalog interview-style metadata editor. This helps users create and maintain ISO-compliant metadata documentation. Required items are tagged with a red star to help you complete the necessary fields.



<**Figure 9**> ArcCatalog automates much of the work in documenting data. Simply point ArcCatalog at the data to automatically populate its inherent metadata properties (e.g., coordinate system, feature class, and attribute field names).

While a broad collection of new GIS capabilities is required to meet the specialized needs for information cataloging and searching, all the key tools used for building a complete GIS are also necessary for building and maintaining a catalog portal. ESRI provides full support for these in its ArcGIS product line:

○ ?ractical database designs implemented with full-function GIS

- A formal, standards-compliant data model for GIS data. The geodatabase is an object relational data model that manages information in any number of DBMS architectures and adheres to the OGC and ISO simple features specification for multipurpose GIS data.
- A formal, standards-compliant design for metadata documentation that supports discovery methods that, ideally, are consistent from site to site. Searches must be more like a library search than a World Wide Web search (i.e., GIS cataloging methods should be based on widely adopted library science principles and methods).
- A metadata catalog database for all published data holdings.
- Common content standards. ESRI publishes essential data models used in practical real-world GIS implementations. See http://support.esri.com/datamodels for more detailsfor more details

○ ArcEditor and ArcInfo. These advanced GIS seats include database construction tools used to assemble and maintain multipurpose, generic GIS datasets.

- Comprehensive editing
- Data conversion
- Data automation
- Geoprocessing and validation

○ Geoprocessing tools. A comprehensive collection of geoprocessing tools must be available that work on all GIS data types to support format conversions, topology construction, coordinate management, tabular and attribute manipulation, generalization, GIS scripts for repeatable validation and quality assessment procedures, analysis to derive new information, and many data manipulation tasks.

○ Efficient metadata documentation tools. The ArcCatalog application that comes with ArcView, ArcEditor, and ArcInfo has a full suite of documentation (metadata) tools.

○ ArcCatalog is a standards-based tool for documenting each dataset. It is highly efficient and automates much of the work by sensing all the properties inherent in a dataset. It will automatically populate these metadata fields for you. ArcCatalog also supports full import, export, and metadata format conversion. Users can start with standard metadata abstracts so that many organizations catalog their datasets consistently.

○ Tools for assembling a metadata catalog, including tools to build, manage, update, and replicate the GIS metadata catalog. Three technologiesArcGIS, ArcIMS, and ArcSDEsupport these functions. ArcCatalog, along with ArcSDE, provides support for building a metadata catalog in any commercial DBMS. ArcIMS provides a Metadata Catalog Service to orchestrate this effort among collaborating organizations. These tools help you easily build a metadata catalog. Its much like building a directory of files and folders. This also includes the following:

- Tools to build, maintain, and update the metadata catalog database.
- Tools to manage catalogs, associate documents with one another, organize catalogs for easier browsing and searching, and so forth.
- Tools to harvest and share metadata catalogs.
- Tools to replicate catalogs(coming in ArcGIS 9).

○ Gazetteer tools

- Tools to build and maintain a custom Gazetteer database. You can add place names and locations from any feature class for your local geographies. Your gazetteer can be fully integrated with the geographic features in your GIS database. For example, your Gazetteer tables can be managed as a comprehensive names database that is fully integrated with all of the feature classes in your database.
- Gazetteer Search tools. For example, find a place name and see an ordered list of matches.

○ The ArcIMS Metadata Service. Web tools for publishing and searching the metadata catalog.

- Tools to publish GIS catalogs as a set of search and browse services.

- Tools to serve data and map services for published datasets(optional).
- Web site management tools to maintain high availability to both the catalog and data services.
- Tools that support all modern catalog services standards.

○ Metadata Explorer. Web-based search and discovery tools.

- Metadata Explorer is an HTML, browser-based application that includes a set of discovery and search tools that enable users to connect to and search and browse the GIS catalog. This tool can also be used to search any Z39.50-compliant portal.

○ Data dissemination tools in ArcIMS.

- Tools to directly connect to and use GIS data.
- Tools to download data in any number of common GIS formats(e.g., clip-zipship or FTP nodes).

○ Database management tools to allow transactions and updates against all information sets, including metadata documentation.

5. SECTION 5

5.1 Key metadata concepts and methods

The role of metadata is the key to the SDI vision. Thus, it is critical to recognize the appropriate role of metadata within this context. It is important to simplify the metadata discussion to fundamental goals about data sharing.

Metadata is documentation about a GIS dataset and is used to:

- Support catalog searches.
- Provide simple high-level descriptions.
- Provide details to determine appropriate uses for a datasetespecially when the user cannot directly connect to and browse the dataset to infer those details.

A number of metadata content standards exist. Each provides an overwhelming list of required and optional fields, which tends to cloud peoples perceptions of the work involved. As presented in previous sections, COTS software tools exist that simplify the work involved.

5.2 Strategies for cataloging GIS data

Numerous metadata content standards have been adopted worldwide, including FGDC, and Comité Europé ı de Normalisation. Most have a huge number of properties that can be used to document each GIS dataset. What are all of these fields, and why are they there? There are four primary roles for this content:

- Fields that help to describe the GIS dataset in much the same way that a card catalog record describes a library holding. What is this thing, what is it about, etc. These are the fields that enable consistent searches.
- Fields that describe some of the dataset properties that are inherent in the data(its map projection, its feature presentation, its attribute fields and types, how many features, etc.). Recall that these can be automatically sensed and recorded for each dataset using ArcCatalog.
- User-defined information that expresses accuracy, use, relevant scales, data sources, currency, contact information, and so forth, of each dataset. These are often very critical details that help other users determine the suitability of each dataset for their use.
- Consistent catalog and search information, such as keywords (based on library science methods and practices).

While each metadata record seemingly contains an unmanageable amount of information on each of these four topics, the task of documenting each dataset according to standards neednt be complex or manually intensive. The following table presents some strategies for compiling consistent, searchable metadata documentation across a wide range of GIS databases.

Metadata Contents	Available Tools	Responsibility	Strategy
Standard content descriptions and catalog properties, common keyword lists	ArcGIS data models will contain examples of shared metadata templates for selected data models, including keyword lists.	For the layers in standard data models, state and federal librarians working with data model authors could write one consistent set of records that can be shared.	Write one description for content (e.g., national map layers, census layers, etc.). 1 Share this as a MARC-like abstract as part of a common data model. Users can import Standard descriptions into their metadata documents.
Properties inherent in each GIS dataset	ArcCatalog	Dataset author simply points ArcCatalog at the dataset to capture as well as to update and maintain this information.	Use automated tools to capture and maintain this information. ArcCatalog is a great productivity tool.
Use, currency, data sources, contact information	ArcCatalog	Dataset author	Follow content standard guidelines to record these properties.

- This is similar in concept to the Machine Readable Cataloging (MARC) record for sharing digital catalog records in the library community. Book publishers write a MARC record for each new publication that libraries download into their individual catalogs, ensuring a consistent catalog record for each publication.

Cataloging of GIS datasets is different than cataloging books in a library. MARC records are completely self-contained card catalog records for library holdings, while each GIS dataset has some properties unique to each instance. GIS datasets differ from site to site (e.g., in their area of coverage, attributes). Yet each dataset that is based on a common data model will share a number of common properties with other datasets.

The common data model should include a common metadata abstract and template for that data model as the starting point to document each instance of a dataset. Library scientists could help GIS users prepare useful abstracts that will support more consistent and reliable searches if adopted by the GIS industry.

6. SECTION 6

6.1 A possible vision for building a national GIS network

Most state and federal GIS organizations are interested in Web dissemination of GIS information using portal sites. Each major government agency responsible for GIS data content should provide access to this information and in many cases is required to do so. Further, there is a shared vision that each state and federal agency will host sites that act as GIS repositories for sharing and maintaining key geographic datasets for access by other users.

Each repository would house GIS information as well as a metadata catalog that describes the data holdings available at the repository. Optionally, each catalog could also reference data holdings on external servers. In the 1990s, such portal sites were often referred to as Clearinghouse Nodes.

There is broad acceptance and excitement about this vision, and it is being widely adopted. For example, this concept forms the basis of the USGS National Map; the FGDCs Geospatial One-Stop; and the U.S. Bureau of Land Managements Geo Communicator Web portal. Most states are developing similar portals, such as the Delaware DataMIL, the State of Texas Strat Map, and the State of Utahs State-wide Geographic Information Database. Many other GIS portals exist or are in development across the country and around the globe. There is no doubt that numerous portals will come online in the coming months that allow easy access to their GIS data holdings.

Yet if the GIS community does not quickly come to terms with common metadata descriptions for each dataset instance, GIS catalog searches will be inconsistent across nodes.

6.2 What organizations should participate in assembling the National Spatial Data Infrastructure for the United States?

The U.S. FGDC has a concept called the GeoSpatial One-Stop for organizing information access for the key federal agencies that are responsible for various layers of GeoSpatial information.

Each organization that creates and shares key GIS datasets with other users should participate. This includes strategic sites in each state as well as federal partners. Each of the 50 states that comprise the United States as well as key federal agencies who own the responsibility for key thematic layers of GeoSpatial information should participate in building GeoSpatial One-Stop portals for the country.

The NSDI vision for the United States is to interconnect the constellation of state and federal Web Portals as well as the set of focused sites referenced within each catalog portal. Many states are moving ahead on their plans for GIS catalog portals. In the federal government, a critical part of the NSDI vision is the deployment of a federal GeoSpatial One-Stopone comprehensive search portal for federal geographic data.

Why will this idea work? The United States works very well for this concept of distributed responsibilities. The 50 states and six territories are a manageable collection of government bodies. Each state is well known and easy to remember. Many governing functions are the responsibility ofthat is, distributed toeach state. Most fully manage their GIS data stewardship responsibilities and coordinate GIS activities with their neighboring states, local governments, and collaborating federal agencies. In many, if not most, states, federal GIS organizations have begun to define their main connect point to find GeoSpatial information for the state(e.g., the Utah Automated Geographic Reference Center, Delaware DataMIL, Texas Geography Network).

Since the name of each state is known, every GIS user can readily identify each state and thus should be able to visit the states main GIS catalog portal. From this portal, it should be very easy to find data as well as to jump to other key portals within the state, such as a regional COG or a municipal GIS portal. Perhaps we should promote the use of common URL conventions to be used by GIS :atalog portals, such as www.nsdi.tx.gov for Texas and www.nsdi.ca.gov for California.

6.3 GeoSpatial One-Stop

The federal government has a similar vision for a common one-stop portal. Just as a user could visit any state site as a jumping off point, GeoSpatial One-Stop can be the jump point for all federal GIS datasets.

This collective vision means that there would be 50 state portals and one main federal portal as initial access points for all government GIS datasets in the United States. The federal one-stop portal should also provide access to the major database stewards in federal agencies, such as the U.S. Bureau of Land Managements portal (http://www.geocommunicator.gov/).

There is broad support for the GeoSpatial One-Stop and the GIS community insists that this portal is crucial to build. Most professionals recognize that this can be implemented today using available commercial GIS tools.

The current technical vision for the GeoSpatial One-Stop has been focused on interoperability research for future use and by theoretical debates on whats needed. The United States should focus on real implementations using todays widely adopted GIS technology and evolve its implementation over time based on practical implementation experience.

Its important to recognize that this work is achievable now; it has already been implemented in numerous organizations at all government levels. Building the GeoSpatial One-Stop should use best-known practices and methods. Implementation would also lead to better knowledge of the appropriate practices and methods and a practical vision for its future evolution.

6.4 Potential collaboration with librarians

While the FGDC and ISO metadata content standards are a great start, they did not go far enough in establishing a uniform approach to information cataloging. Library science professionals need to be used to establish uniform methods for documenting metadata content so it is searchable and consistent across all implementations. Otherwise, searches at GIS catalog portals will be more like Web searches and less like library catalog searches. The NSDI can provide a vision for federal and state agencies to collaborate with librarians on the development of these methods.

- A framework to work with librarians(e.g., in each state and at the federal level) to help the GIS profession develop a common methodology for metadata documentation and indexing.
- Common metadata records for key GIS datasetsthe GIS MARC records. These records can be a standard part of the common data model efforts under way. They could be imported into the metadata document for each GIS dataset at user sites. This would support more consistent searching across all GIS catalog portals.

6.5 Additional Topics

Below is a list of topics that are worthy of further exploration. They are outside the scope of this document but are also important topics for further work. Most could be debatable in a theoretical setting but are perhaps best answered by performing real implementations.

○ What is the role of common content standards(i.e., standard data models) in NSDI? What comprises a common data model? Can a common data model that works across GIS systems be defined?

○ What role do standard schemas play? What are the data model schemas, and how are they shared?

○ What are some key goals for data content standards?

- Build data using multipurpose designs.
- Follow common content standards, best/accepted practices.

○ Why is the use of COTS software superior to exotic one-of-a-kind implementations?

○ What should the methodology be to build consistent searchable metadata catalogs? And how can library scientists help the GIS community?

○ What are the data sharing mechanisms that will be used to download and disseminate GIS datasets?

○ How should states organize their work?

○ How should federal agencies organize their work?

GIS and Cyberspace:
Virtual London and the e-Society

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1. ABSTRACT

New Information and Communication Technologies(NICTs) open up exciting prospects for enhanced visualisation and communication of city environments. This paper reviews current and recent research at the Centre for Advanced Spatial Analysis, University College London, that is helping to facilitate and enable planning and e-government. We also describe complementary research that is helping to identify the social and geographical implications of NICTs in the developing panoply of applications.

2. INTRODUCTION

In this paper and the accompanying presentation, we identify some ways in which new technology and cyberspace is stretching the remit of spatial planning and extending our ability to measure and monitor spatial systems. We discuss these developments in the context of ongoing research at University College London(UCL)s Centre for Advanced Spatial Analysis(CASA). Our primary focus is upon the ways in which GIS can better facilitate human interaction with online systems, and we discuss a range of ways in which such interactions are actively developing. In important respects, however, an important complementary perspective examines the ways in which citizens are likely to react to the future course of interactions in the e-society. Recent history has shown how some of the uses of new information and communication technologies(NICTs) have been unanticipated, and thus our own analysis of the possible effects of technology change is, inevitably, speculative. Nevertheless, we hope to show, through example, how use of new media, technology and visualization tools is diffusing and dispersing from professional uses to popular communication.

We thus begin by discussing the ways in which developments in networking and GIS are bringing digital representations to a wide range of non-specialist users. This leads us to examine some of the ways in which such developments are enabling communities to engage in problem solving and policy formulation. We address these themes by describing a range of projects that are currently underway in CASA, and which have been funded from a wide variety of sources. At one end of this spectrum, there are conventional academic research projects, won competitively in national programmes and driven by scientific curiosity. At the other end, we will discuss work that has been funded entirely to meet particular end user needs in specific project settings. In practice, most of this research is driven by a combination of issues, and their recursive and reinforcing effects can be identified over the life courses of some of our projects. Much of the context to developments in methodology and application is provided by the move towards e-government. This raises issues of understanding the existing and envisaged use of NICTs between peers and in interactions with government, and we conclude with a discussion of our efforts to classify NICT usage in e-government.

3. Visualisation, virtual structures and virtual communities

CASAs longest-established research on virtual environments has arisen in projects that have used remote access to visual information in order to help communities to engage in problem solving and policy formulation. Visualisation is moving far beyond the conventional 2-D maps that are the staple of GIS applications, and we are at the beginning of an era in which visual communication through new representational forms is set to dominate social communication in many communities and contexts. Such communication may be peer to peer(e.g. personal communications, business to business purchases etc), government to other(e.g. government online) or other to government(e.g. on-line voting, or on-line governance: see www.london.edu/e-society).

In practice, this often entails an ability to map the widest range of physical and socio-economic phenomena in novel and engaging ways not least in the third dimension.

This is not a new message but one that remains powerful nevertheless. The paper map, with its fixed scale and fixed range of attributes, is a special case of spatial representation that dominated the pre-digital age. GIS revolutionized the way that we think of building and using two-dimensional representations. We are presently at the start of a further revolution in which many of the assumptions about how we interact with machines are being turned on their heads, and this has profound implications for the development and deployment of GIS applications. Indeed a lot of the work that is currently underway at CASA does not look much like GIS to many and this may be an entirely good thing.

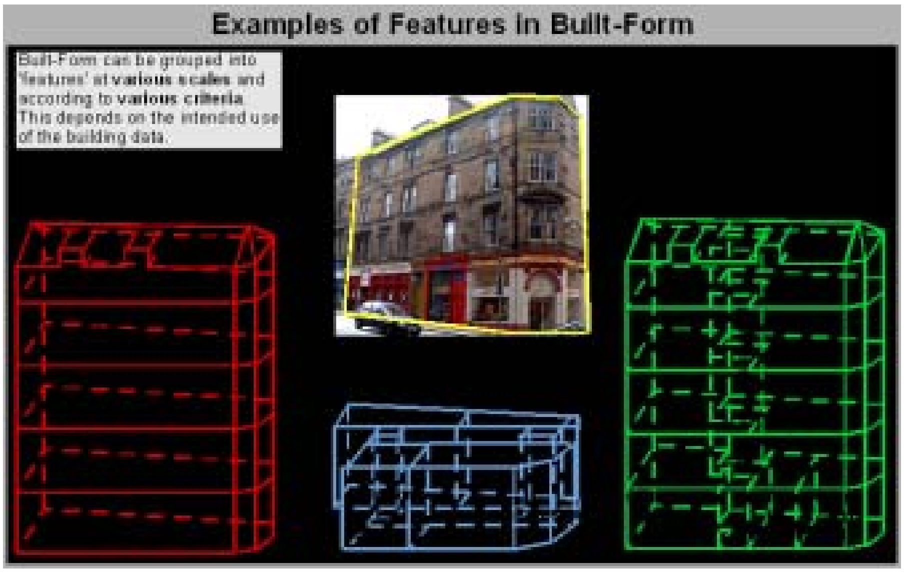
The presentation upon which this paper is based will begin by illustrating a range of work that we have undertaken on different kinds of representations in GIS. These include representations of cyberspace(Dodge and Kitchin 2002), museum catalogues and reconstructions of past environments(http://www.casa.ucl.ac.uk/research/egypt.htm), and the various threads that have built towards the Virtual London project. Specific examples concern work on: Londons bridges; the Teviot Centre; Brickfields; the Hackney Building Exploratory; and the Woodberry Down Experiment. This work is culminating in Hudson-Smith and Evans(2003) Virtual London project, funded by the Greater London Authority.

The roots to the work on Virtual London can be traced back to 1996, when the development of imagery first made it routinely possible to visualize more two dimensions. Batty et al(1998) discuss the ways in which the development of virtual reality systems in the 1990s came to encompass a wide array of virtual worlds, many of which had immediate applicability to understanding urban issues. From the outset, there have been important distinctions between immersive, semi-immersive and remote environments, and different ways of navigating each. Early exemplars that were developed at CASA included: a multi-user Internet GIS for London with extensive links to 3-D, video, text and related media; an exploration of optimal retail location using a semi-immersive visualisation in which experts could explore a range of problems; a virtual urban world in which remote users as avatars could manipulate urban designs; and an approach to simulating such virtual worlds through morphological modelling based on the digital record of the entire decision-making process through which such worlds are built. Some of the graphics from this work will be illustrated in the presentation.

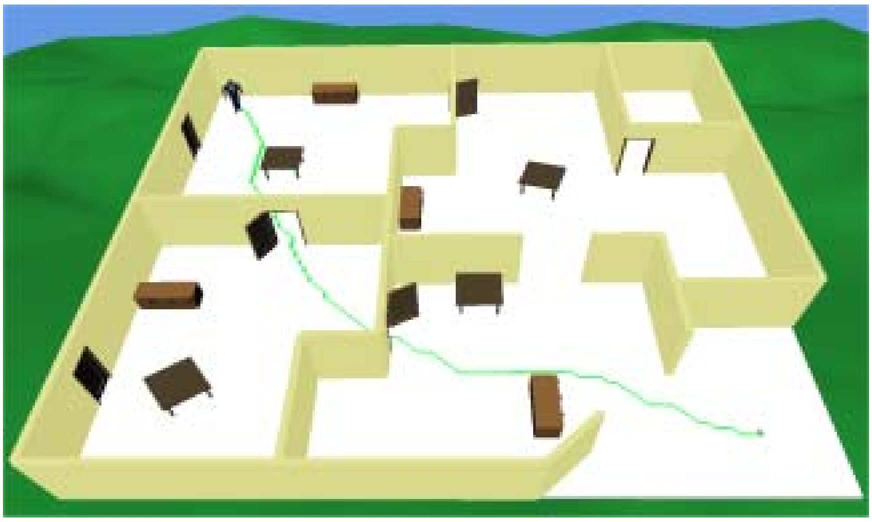
Many of these early ideas have subsequently been developed very considerably through advances in photorealism, digital panoramas, fast CAD, 3D GIS, remotely sensed imagery, LiDAR, and so on. In large part, these early applications were designed, on the one hand, to complement mathematical models of cities and, on the other, as an extension of GIS into the third dimension. These two motivations have to some extent converged over time, as we have become able to enrich 3-D representations of city forms with data about human movements and activity patterns. For example, Aidan Slingsby is currently researching the ways in which usable 3-D models can be built from reusable 3-D primitives(Figure 1), and Mike de Smith has examined the use of distance transforms and routing algorithms in relation to 2-D and 3-D structures(Figure 2 and de Smith 2003; see also

http://www.desmith.com/MJdS/DT1.htm)

<Figure 1> 3-D buildings can be reassembled from reusable 3-D primitives, although existing maps of property ownership or cadastres may be incomplete or ambiguous (images courtesy Aidan Slingsby).

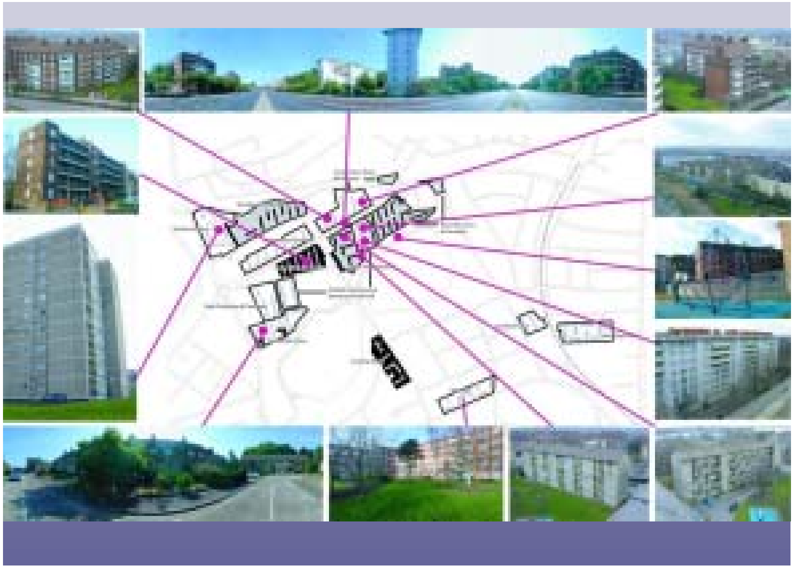


<Figure 2> Use of computationally intense but fast search procedures to navigate a robot to a target point without colliding with obstacles (image courtesy Mike de Smith).



3-D extruded block representations were used in the Woodberry Down project to deliver information across a community. The 2500 properties on the Woodberry Down estate house some of the most deprived residents in Greater London. The estate was built in the early 1970s, and is now run down and heavily vandalised, with high rates of crime, of drug misuse, and of deprivation - all the indicators of inner city decay at its worst. A massive rolling programme of regeneration and whole scale redevelopment is beginning, that will take a number of years to complete. CASAs work(coordinated by Andy Hudson-Smith and Steve Evans) has been concerned with communicating the effects of the rolling redevelopment to the residents of the estate(Figure 3).

<Figure 3> The present day built environment of the Woodberry Down estate, Hackney, London(images courtesy Andy Hudson-Smith).



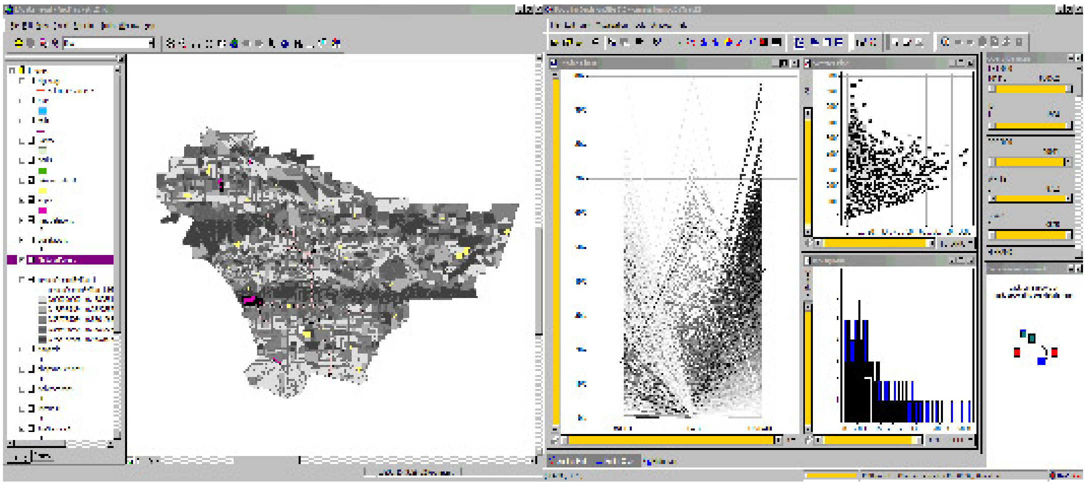
In a new project for the Greater London Authority(GLA), again coordinated by Andy Hudson-Smith, we are beginning to merge many of these techniques to provide a much more all-encompassing experience for users(Figure 4). This is part of an e-democracy project financed by the GLA, and initiates the construction of Virtual London that we have been attempting to get funded for many years. Our plans are to develop 3-D fly throughs, panoramic imagery and zoomable information maps, and to build upon Andy Hudson-Smiths work on virtual exhibition spaces. The work thus far is for a restricted area around the Pool of London, but our hope is that it will be extended to larger areas of London as well as other UK towns and cities. The data for the research have been integrated from a wide range of sources including Ordnance Survey(Great Britain: Mastermap for georeferencing), Cities Revealed(2-D backcloth), and LiDAR data (3-D rendering).

<Figure 4> Elements of Virtual London (images courtesy Andy Hudson-Smith)

4. Context: e-government and engagement of the e-society

Given the rapid pace of development of this research, it is increasingly appropriate to examine the context to user engagement. Research by Muki Haklay and Carolina Tobon(e.g. Haklay and Tobon 2003; Tobon and Haklay 2003) has examined a range of GIS usability issues, principally with reference to the intelligibility of GIS to a wide range of existing and potential users(Figure 5). Much of this research has entailed exploration and secondary analysis of descriptive statistics that pertain to 2-D map displays in GIS, coupled to other statistical software. A logical extension to this work, that exploits the immediacy of 3-D visualisations is in the work of Chao Li(Li and Maguire, 2003). Here, research in urban cognition is being developed through 3-D GIS to better understand the cognitive abilities of GIS users. This research acknowledges that the GIS users of tomorrow are likely to encounter GIS in a wide variety of forms, ranging from immersive virtual environments to stripped down hand-held devices. These different environments are each being evaluated in current research on urban wayfinding(Figure 6).

<Figure 5> Coupling of SPOTFIRE software to ArcGIS in order to enable exploration of zonal characteristics (image courtesy Carolina Tobon).



<Figure 6> Use of general and bespoke 3-D models for urban wayfinding experiments (image courtesy Chao Li)

Both of these research strands belong to the active tradition of behavioural geography(Thrift 1981), which emphasise the role of cognitive processes and human decision-making in understanding behaviour in(cyber) space. By contrast, the reactive tradition of the subject emphasises the role of constraints or impediments upon behaviour. This latter approach is receiving attention in a current CASA project to investigate the restructuring of practices and institutions as people produce, utilise and consume NICTs. As the e-society matures, so the key distinction of the 1990s through which society was classified into the digital haves and have-nots has come to appear simplistic(Samuelson 2002). Most people in the UK, for example, now have access to some digital technology, whether through devices that they own or simply through usage in public places (Batty and Miller 2000). Mobile phone penetration is now running at well over 80% of the population and around 57% of all households have some access to the Internet. Recent research suggests that over 80% of all US households now have Internet access and that access amongst the most underprivileged groups such as Blacks and Hispanics is over 50% and rising by 8% per year(Samuelson 2002). In these changed circumstances, variation in awareness and usage is no longer best represented as the crisp and well-defined digital divides that were posited a decade ago. Todays key issues, in developed countries at least, concern emergent patterns of digital differentiation within the population(Baker 2001). Such differentiation is becoming manifest in terms of access to different types of goods and services, in the speed and convenience of access, and the availability of new technologies in public and private domains. In new and subtle ways, high-speed networks, new hand-held and desktop devices, interface and system design and Internet service providers are having important impacts upon productivity, work and social interaction(Longley et al 2001: 174-180).

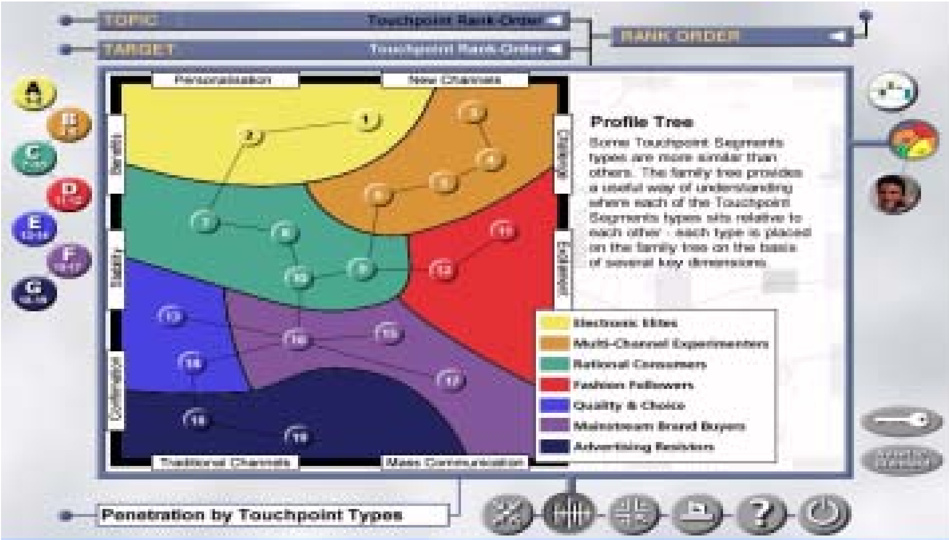
Our tentative thesis is that there is an emerging number of new and subtle polarities, which now differentiate developed societies in information and communication technology(ICT) adoption and routine usage. These are material to the diffusion and dispersion of NICT usage from professional to popular usage. Ongoing GIS research at CASA is developing a detailed nationwide analysis of consumer access to NICTs, a classification of households in terms of their type of use and access to digital technologies, and areal profiling of where different groups reside and the kinds of services that they require.

With the increasing differentiation of ICT usage between different groups there is a general need, in social science and in government, for a review of the dimensions that are presently used to generalise about attitudes to consumption, information provision and citizen participation(Brown 1998). In all likelihood this will suggest directions for developing new conceptual dimensions that are empirically generalisable, for use where existing dimensions prove not to be effective discriminators. Our own analysis(Li et al 2002: see also Jorgensen et al 1997; Maguire 2001) suggest that NICTs presently mediate three domains of private life: they allow users access to information, pertaining to private and public goods; they allow users to undertake transactions concerning private goods; and they allow users to participate in decision making and collective consumption. The latter has some important implications for citizenship. The Internet in particular shifts informational power from the seller to the consumer, and an understanding of the nuances of this effect will be important in developing policies that give consumers greater power(e.g. the planning support systems developed by Carver et al 2001; Smith and Evans 2002). The ability of the Internet to allow customers to communicate with each other may at its most extreme destabilise existing commercial and public service structures.

These categories are neither immutable nor mutually exclusive, and there is evidence (Webber 1999; Webber et al 2000) that adoption of NICTs in one domain leads to subsequent usage in other categories although there is as yet little generalised empirical evidence of transition probabilities.

Our research is developing a classification of individuals and households according to their present profile of usage of ICTs for information, transactions and participation. In methodological terms, our approach is similar to that already successfully used in the private sector by organisations such as Experian Ltd.(see Figure 7). We anticipate that this classification may be used to gauge the impact of NICTs upon human capital formation in the workforce and quality of life amongst citizens and consumers. This classification will also make it possible to assess the impacts of ICT development and adoption upon social exclusion, both at a household and at a neighbourhood level. The past holds the key to the present: we hope that our classification will enable us to identify the change dynamics within each population segment with regard to cultural attitudes and the consumption of goods and services, and thence develop understanding of Great Britains evolving geographic structures. The presentation will examine the potential use of this classification as a tool to guide urban and regional policy, as a geographically sensitive marketing device, and as a tool for understanding social polarisation and social capital.

<Figure 7> 'Touchpoint' consumer segmentation system (courtesy and copyright, Experian Ltd.)



5. CONCLUSIONS

Taken together, these diverse applications and exemplars of GIS in e-government services illustrate some of the many ways in which GIS software, data and networks can be used to facilitate and enable planning through e-government. Used intelligently, enhancements in our ability to communicate and to visualise are set to gradually add to the effectiveness of planning and enable us to develop much wider kinds of participation in society and in government. Complementary research is also needed, however, to identify the social and geographical implications of NICTs in the developing panoply of applications.

6. ACKNOWLEDGEMENTS

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Cyber-geospace as an Infrastructure for e-Government

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1. ABSTRACT

Korean e-government site is now providing more than 390 civil services through the Internet and Korean government recently made public a Road map to E-Government. As the technologies for building cyber-geospace, such as 3D GIS, become mature, it is now possible to develop a fully integrated e-government, which utilizes the cyber-geospace as a common basis for information organization and service integration. The goal of this paper is to provide the necessary policy recommendations for building cyber-geospace as an infrastructure for e-government. To bring out the policy recommendations, this paper examines the meaning of e-government in terms of cyber-geospace and redefines the concept of e-government. The relationship between cyber-geospace and e-government is also identified. Lastly, this paper examines how the cyber-geospace can function as the infrastructure for e-government.

2. INTRODUCTION

Constructing an integrated e-government is regarded as one of the core works in the information-oriented society. Korean government recognized the importance of e-government early on and started building key national databases such as resident, taxation, and vehicle registration since mid 1980s. As Korean society became more information oriented and nation-wide digital networks were firmly established, the efforts to construct an integrated e-government gained a significant momentum, the results of which are the first and second

E-Government Plan. Currently, the e-government services are in the course of continuous upgrading and updating to achieve a complete and full-fledged stage of development, which will include digital information distribution, full-scale electronic commerce, digital baking and financing, and cultural activities offered in cyber space, among others.

The construction of the KII(Korea Information Infrastructure) provides the necessary information network upon which cyber-geospace can be constructed. The research and development activities in various fields with regard to the technological as well as policy requirements for building cyber-geospace have made it plausible to build cyber cities and cyber communities in the foreseeable future. As the technologies for building cyber-geospace, such as 3D GIS, become mature, it is now possible to develop a fully integrated e-government, which utilizes the cyber-geospace as a common basis for information organization and service integration. In other words, the cyber-geospace can be viewed an infrastructure through which all e-government activities take place. If this can be achieved, the cyber-geospace will become another essential space that has real meaning and importance in our everyday life.

The goal of this paper is to provide the necessary policy recommendations for building cyber-geospace as an infrastructure for e-government. To bring out the policy recommendations, this paper first examines the meaning of e-government in terms of cyber-geospace and redefines the concept of e-government. The relationship between cyber-geospace and e-government is also identified. Lastly this paper examines how the cyber-geospace can function as the infrastructure for e-government.

3. REDEFINING THE CONCEPT OF e-GOVERNMENT

3.1 The current status of e-government

Korean e-government can be characterized by four concepts: the Government of Online Service, the Paperless Government, the Knowledge-based Government and the transparent Government. More specifically, Korean e-government has the following goals:

- Realization of the online civil services
- Maximization of the efficiency and transparency of government to business(G2B) services

- Maximization of the productivity and transparency of administrative works
- Construction of a safe and reliable information distribution infrastructure

Currently, the major tasks of e-government can be classified into three categories, which are services for citizens, services for government, and infrastructure building. Major tasks involved in services for citizens are as follows: provide citizen-oriented service via one-stop window; establish an integrated information system of the four major types of insurance (unemployment, health, work-related injury, and pension); establish a comprehensive service for national taxes via the Internet; and establish an Integrated Electronic Government Procurement system. For government services, the tasks include: develop a national financial information system; enhance the information on administrative districts; set up a standard personnel management system; introduce electronic documentation; and establish educational administration information system. Infrastructure building include the establishment of government high-speed network, constructing local administrative networks, the establishment of electronic signature system, and setting up of an integrated, trans-agency information network.

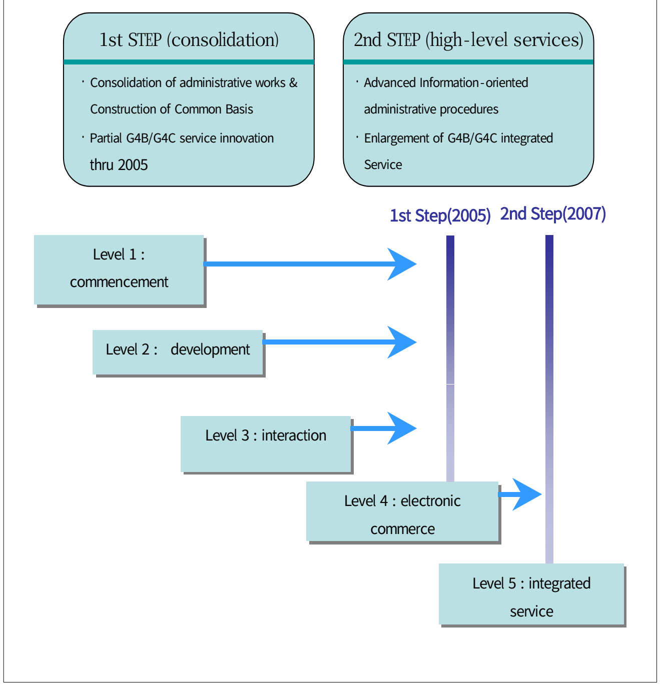
In particular, Government for Citizens(G4C) has been established as one of the core projects of the Korean e-Government. Services are provided in the five most frequently used fields: residents, real estate, vehicle, business and taxation. Service consists of 12 areas based on user convenience. Guides are provided for the 4,000 services that appear in the Civil Service Standards List. A total of 393 services can be accessed online. Some examples of services are listed in the following table.

<Table 1> Contents of civil services

	Service Coverage	Related Outside Agencies & Systems
Personnel & Family	Birth/Education/Resident Information/Military Service/Reports of marriage/Adoption/Death	Seoul Annual Statistical Report System Open System of the central/local government's service results
Real Estate	Land/Housing/Construction/Farmland/Real Estate Brokerage/Development/Registry	Ministry of Construction & Transportation(MOCT) Court Auction System Korea Housing Association
Vehicle & Transportation	Cars/Driver's licenses/Bus lanes/Used cars	Road Traffic Safety Authority MOCT Traffic Information Center Korea Highway Corporation
Tax	Income/Local/Corporation/National/Property/ Traffic taxes	National Tax Service Korea Federation of Taxpayers
Business & Economy	Corporations in general(profit/non-profit)/ Wholesale & Retail, Agriculture/Mining	Ministry of Finance and Economy Ministry of Planning and budget
Travel & Immigration	Travel abroad/National tourist attractions/Special local Products	Ministry of Culture & Tourism Immigration Bureau
Defense & Inter-Korea relations	Unification/Inter-Korea exchange visits	Defense Security Command Emergency Planning Commission
education & employment	School/Job search/Certificates a qualification/ Employment insurance	Educational Statistics System The Homepage of CareerNet
Social security & Health	Meritorious Awards/Food hygiene/Worker services /Insurance/Livelihood welfare protection	Communicable Disease Information System Ministry of Patriots & Veterans Affairs
Arts & Culture	Cultural properties/Cultural facilities/Movie industry/Copyrights/Libraries/Museums	Ministry of Culture & Tourism National Institute of Korean History
Recreation & Sports	Sports facility business/Youth training facilities/ Gambling industry	The National Fitness Center Korea Sports Training Association
Environment	Environment/Conservation/Improvement of water purity control/Management of rivers	Cyber Environmental Education Institute Ministry of Environment

The e-government site is regarded as well-designed and highly appreciated abroad. However, it was also recognized that the utilization of e-government services has been less than expected. To increase the use of e-government services, more vigorous public campaign and the continuous improvement and upgrade of services are currently underway. The government also established a roadmap as part of the second e-government plan. The roadmap identifies 31 projects in 4 categories (G2G, G2C/B, Infrastructure, Legislation).

<Figure 1> Future Plan for e-government



Current e-government activities are primarily focused on streamlining administrative processes and providing civil services. The second e-government plan does not include initiatives that utilize GIS technology to increase the efficiency of administrative works. However, it is well-known that about 70% of administrative works of government are related with spatial information. It is therefore quite reasonable to expect that the tie between e-government and GIS will become increasingly stronger in order to provide better civil services by taking full advantage of advanced spatial information handling technology. In this context, it is encouraging to know that the Ministry of Government Administration and Home Affairs(MOGAHA) has a plan to launch a project to draw up an Information Strategy Plan to develop GIS-based e-government.

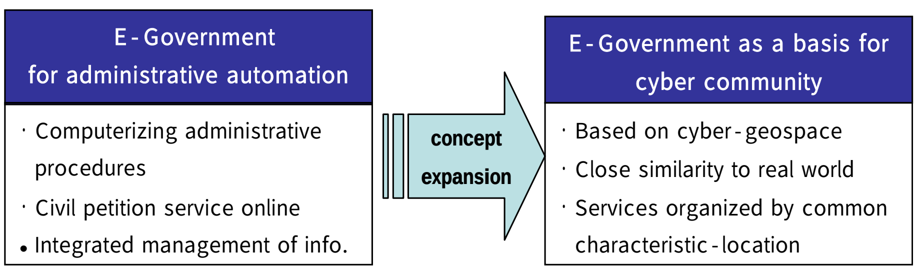
3.2 Expansion of e-government for cyber-geospace

E-government has been brought into existence because of rapid development of information technology. The impact of this technological development is so powerful and far-reaching, it is often referred as digital revolution. The information networks connecting almost every corner of the globe are now realizing the global society and global economy and opening up the new horizon for knowledge-based society. Today, the use of Internet is becoming an essential function in everyday life and with the implementation of wireless networking technology, we are entering into the stage of using internet regardless of time and place.

Although the rapid development in information and communication technology made it possible to plan and implement the concept of e-government, the technological development itself now requires the concept expanded and redefined. When the concept of e-government was introduced it did not properly reflected the technological development in spatial information handling, such as 3D GIS, Web-based GIS, and integration of mobile technology with GIS. Therefore, despite its role in information handling capacity, the spatial information handling aspect has been largely neglected. It is therefore time to expand the concept of the e-government to properly locate the spatial information technology in its proper place.

The new expanded concept of e-government envisions a cyber-geospace as its foundation upon which all the services are integrated and seamlessly provided, just as the geography provides a foundation for everyday life. In other words, while the existing e-government is limited in its functions mainly to computerizing administrative procedures and to providing online civil services, the new and integrated e-government should have quite different form and function. With the new concept of e-government, all the information resources will be organized within the cyber-geospace based on spatial characteristic which will act as a common anchor that holds the diverse information resources together and provide a single point of reference. The new e-government located within the cyber-geospace will provide a seamlessly integrated environment where people can fully utilize the advanced services for civil applications as well as perform all the necessary economic and cultural activities just as they do in real world.

<Figure 2> The expansion of e-government concept



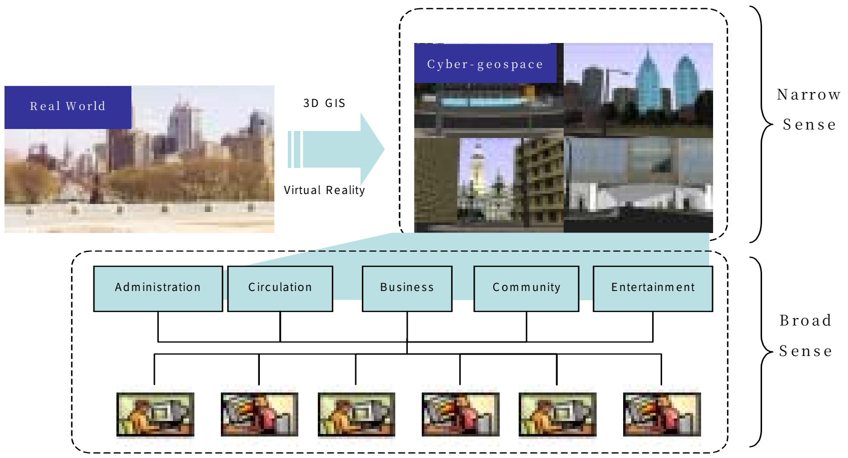
4. Concept of cyber-geospace and interrelationship between cyber-geospace and e-government

4.1 Concept of cyber-geospace

In a broad sense, cyber-geospace means an electronic space where information technology and telecommunications technology are integrated. Within the cyber-geospace, various information networks, economic activities including electronic commerce, and cultural activities are interconnected through the Internet. Therefore, through this cyber space, exchange of information, businesses transactions, merchandise distribution, education and other activities can be performed, bringing out a brand new cultural environment as a result.

In a narrow sense, cyber-geospace means a three dimensional spatial information space within which services for aforementioned activities can be implemented and utilized. All the artificial and natural elements in real world are visually represented in the cyber space. It is a recreation of real space within in cyber space.

<Figure 3> Concept of cyber-geospace



4.2 Technologies for constructing cyber-geospace

Advanced technologies in various fields are required to create a cyber-geospace. The essential technologies include spatial database technology for 3D data, data processing technology to display and analyze 3D databases, and information infrastructure through which users can access the services.

① Technology for constructing 3D spatial database

3D GIS technologies, virtual reality, building modeling technology are included in the technology for constructing spatial database. In order to construct basic 3D space which contains real world location information, spatial databases for topographical and other features that include 3D information need to be constructed first. Then building modeling needs to be done to display the spatial database as close to reality as possible. This modeling will enhance the visual recognition of real world features and help the users identify their relative location in cyber space. Virtual reality technology, when integrated with the cyber-geospace will provide a capability to move around this cyber-geospace freely to explore and access all the possible information resources.

② Technology of spatial data processing

For the users, the access route to the 3D space will be Internet and therefore the Web-based GIS technology that allows the representation and use of 3D space through Internet will play a critical role in spatial data processing. Data compression and restoration technology is also important due to the large volume of spatial data and the limited bandwidth of current Internet. The cyber-geospace will be a combined environment where location and other attribute information is interconnected with other contents and services. Therefore, Web GIS technology that enables the standardized data management through standardized interface using Internet is essential to process and analyze the spatial data.

In addition, cyber-geospace, for it is a representation of real world in a very realistic fashion, will require an enormous amount of data be stored and managed. It means two things in technological side. One is that geoprocessing of all the features in cyber-geospace is needed so that we can increase the usability of the cyber-geospace by limiting the search areas based on user location while minimizing the amount of data that needs to be processed. The other is that data compression technology, especially for high-resolution spatial data, becomes very important. We need to move large volume of data, many cases from different sources, through the Internet that provides insufficient bandwidth for this kind of transaction. Therefore, until the second generation of Internet is fully in place, the efficient use of compression and restoration technology will partly determine the usability of cyber-geospace. The technological development in other related technologies such as navigation, simulation, multimedia and streaming technology, are need to be considered in building cyber-geospace.

③ Infrastructure for information and telecommunication

The last technological element in building the cyber-geospace is the infrastructure for information and telecommunication. Fortunately, current situation is quite good. Korea is reportedly ranked 6th place in the world in the combined information and telecommunication index and the total number of subscription to the high speed internet service exceeds 10 millions. The internet subscription rate per capita is at the top level in the world thanks to the highly available and relatively cheap internet access. Since the internet infrastructure is one of the major requirements for realizing cyber-geospace, the development in Internet technology, for example, the use of IPv6 technology, needs to be closely monitored and implemented as early as possible. Political and technological support for the maintenance and advancement of information and telecommunication network is also necessary to maintain the advanced positions in information technology field.

4.3 Interrelationship between e-government and cyber-geospace

In the previous section, we expanded the concept of e-government from computerizing the administrative procedures and providing civil services online to a broader environment built on cyber-geospace that will allow the integration of services and creation of cyber communities. It means that not only the governmental agencies and public organization exist in cyber-geospace but a broad spectrum of private enterprises also makes up the cyber space. Therefore, it is logical to envision a cyber-geospace as a foundation for all these activities including e-government. By linking e-government to cyber-geospace, the conceptual basis for the integration of various services can be firmly established and the clarification of the relationship between e-government and other endeavors in private sector can be made possible. In the following section, we will examine some of the advantages of having cyber-geospace as the foundation for e-government.

① Allocation and organization of e-government elements

First of all, if we regard the construction of e-government as cyber community building process, various elements that comprise a country need to be reconstituted in the cyber space. Interconnecting and organizing e-government services, however, faces fundamental problems: the difference level of service scope and service architecture, the different use patterns and interfaces etc. This paper, therefore, proposes to organize the e-government services with the basic concept of "space" that is commonly shared by every element of e-government. In other words, in the e-government, every government service is to be allocated in the cyber-geospace based on its spatial characteristics and linked through a common factor called

Because all the business elements of various agencies and departments are unique in scope, users need to move from one service to another if they are to use multiple services. Although this movement between services can be assisted by hyperlinks, it is still cumbersome and confusing when many diverse services are interconnected without providing a mechanism to identify and group them in users mind. Moreover, users who do not have sufficient technical skills to navigate complex internet sites or who are not familiar with dealing with large volume of information tend to get overwhelmed by the complexity of the information being presented. However if all the governmental agencies and related services are allocated in accordance with the space element, users could easily integrate services on the base of location element, thereby creating a comprehensive mental picture of information and services they can use.

② Similarities to real world environment

We live in a 3D world and all our experiences are based in 3D space. However, most of services offered by e-government at present time deals with text data. When graphic data is required for information display, it is usually limited to 2D information in the form of sketch maps. The cyber space in today's e-government environment is only an abstract space without corresponding real world location information. The expanded concept of e-government calls for the need to create an integrated living space, which in turn requires the cyber space reflect the real world as closely as possible. Therefore, we can envision cyber-geospace as the final form of cyber space the e-government should achieve. The following table shows the comparison of 2D and 3D spatial information in terms of their strength and weakness.

<Table 2> comparison of 2D and 3D spatial information

	2D Spatial Information	3D Spatial Information
strength	• ossibly express wide area • st display speed • formation volume of database less than 3D • eedy construction is possible	• el same reality as real world • versified analysis possible • nstructed 3D data connectable to varied industries (movie, game, virtual reality...)
weakness	• oor sense of reality • ss of information due to abstraction of spatial information	• arge volume of database • ot easy to express wide area • ng time needed in construction

In general, 3D cyber-geospace has the advantages of being more useful in various applications than 2D data. 3D spatial data also has some disadvantages such as the large data volume and difficulties in database construction. These difficulties and disadvantages, however, are mostly technical and given the rapid development in the field of 3D database technology and 3D modeling and rendering, these technical problems are expected to be solved in the near future.

Previously we said the users can organize and access the e-government services by relating the location information in cyber-geospace to services. Even with the implementation of cyber-geospace, the need for navigation in Internet space cannot be totally eliminated. Users still need to navigate through a maze of internet sites and portals to get the information and services they want. By creating a cyber-geospace that is a close replica of the real space, however, we can guaranteed that users do not get lost in the sea of information and can always come back to their familiar territories.

③ Link to real world through location information

Abstractness notwithstanding, cyber space is also a form of space where various activities occur. Creating a complete replica of real world where all the services are available in cyber space will be the ideal goal of cyber-geospace building. Some of the activities that were possible only in the real world are now routinely performed in cyber space through Internet. For example, electronic commerce has become a major part of our economy and a new form of political participation such as campaigning and voting via internet emerged.

While some activities can be implemented and performed only through Internet, there are other activities that are possible only in real world. For example, the internet users can make a reservation for medical treatment, pay the fee through online payment gateway, and even receive the diagnosis via e-mail. However, for actual medical treatment, they have to visit the hospital. Likewise, people can search and compare the prices of a commodity in many internet shopping malls and place orders via internet, but someone has to deliver the merchandise. This means that there are still some activities that require actual movement of people and goods to complete the transaction. The fact that s the common characteristic of these activities suggests that the location information is the critical element for these activities to occur and it is still important to know where things are in cyber space.

The services provided by e-government are no exception. There will always be some activities that could not be completed within the scope of e-government. In that case, users will actually move to the locations in real world to complete the transaction. If e-government is built on cyber-geospace that incorporates spatial information as its essential element, it is not only possible to give the exact location information for the services in question, but additional spatial information such as routing to get there can also be presented. These will be the benefits of the linking e-government and cyber-geospace.

④ Creation of additional e-government services through cyber-geospace

The cyber-geospace is a "place" in which e-government services are provided. Having a place means having something to build on. By building cyber-geospace for an infrastructure for e-government, more advanced level of service can be achieved by effectively combining spatial data handling functions with cyber-geospace. Followings are some example of advanced services that can be achieved through the combination.

- Health and Safety

Since health care and welfare services are directly connected with providers locations, the accessibility to these services can be greatly improved through the use of cyber-geospace. Government can also initiate measures to increase the public health and safety of a region based on the analysis of regional characteristics. In the field of crime prevention, the police can analyze the crime rate of a region by linking available statistical database with cyber-geospace, and establish plans for allocating resources to be more effective in preventing crime. The reporting of a crime and subsequent actions following the report can be rapidly taken as all the necessary information for dispatching police force is provided through cyber-geospatial interface.

- Public Service

With the advent of the digital era, we witnessed a big increase in the productivity and service efficiency of private sector. The public expect the public institutions will follow the suit. The government, through the cyber-geospace, could more effectively provide their civil services since the data that are needed to process the application have been seamlessly integrated and easily shared among many agencies. For example, the waiting time for a permit, say for construction or development can be greatly reduced through this data sharing. 3D simulation models that take advantage of cyber-geospace can be utilized to analyze the cost and benefits of a large scale construction project before it is actually initiated. The public can access the result of 3D simulation and visually confirm the result.

- Environment

Through cyber-geospace, the scattered data and information for the environmental monitoring, protection and management of natural resources can be integrated. E-government services can help citizens to have access to the environmental information in a proper and timely manner. Government can manage the nations natural environment using environmental analysis and modeling. The data that result from the analysis can be provided to be used in various applications. For example, the farmers may want flood or drought information, while the construction companies might seek earthquake and severe wind information. Insurance companies will want to get disaster information, which is essential for determining the insurance rates, and everybody wants to know the weather information.

- Education

Today, the increased use of various multimedia programs in school reflects the utility of these tools in educational environment in achieving higher educational effectiveness. Cyber-geospace is a great educational tool in and of itself since it is a seamlessly integrated form of a space where student can freely explore and search for the information. The educational effect can be maximized if government develops a specialized set of services that take advantage of the cyber-geospace and makes it available to teachers and students via Internet.

- Social welfare

The government needs to have diverse information from many different sources to formulate appropriate plans for social welfare of a region or particular population. For example, by examining the relative ratio of the infants and the elderly and combing them with an appropriate areal unit, government can devise an effective plan to allocate public nursery and facilities for the elderly.

5. Implementing e-government through cyber-geospace construction

5.1 Current status of cyber-geospace construction

Based upon technological development in virtual reality and 3D modeling, the technology and standard for the 3D spatial database construction is getting to the stage where actual implementation is possible. However, there are not many examples of building cyber-geospace for a sizable area. In 2001, a few local governments started projects to construct 3D spatial database with the notion that it will enhance the quality of public services. Due to some unexpected technical problems in actual implementation process and the lack of continued financial support, these projects did not quite get the results they aimed for. The most successful cyber-geospace building project so far would be the research project called study on the strategy for cyber-geospace construction in preparation for digital era, carried out by Korea Research Institute for Human Settlements. As a part of the study, a complete 3D cyber-geospace for Haeundae-gu in Busan City was built and management system was developed. This study is important in that it confirmed the fact that the construction of cyber-geospace was possible utilizing the currently available technologies. It also made a contribution by raising the level of public awareness for the operational concept of cyber-geospace.

Recently, several research projects on technical and policy-related aspects of cyber-geospace were launched, reflecting the increased level of interest in both private and public sector. The Ministry of Construction and Transportation(MOCT), the agency in charge of National GIS(NGIS) program started a research project to prepare a master plan for constructing 3D spatial database at the national level. In addition, the Ministry of Government Administration and Home Affair(MOGAHA) is planning to launch an ISP project in 2004 that will provide a detailed plan to create a solid link between e-government and GIS.

5.2 Promoting e-government through construction of cyber-geospace

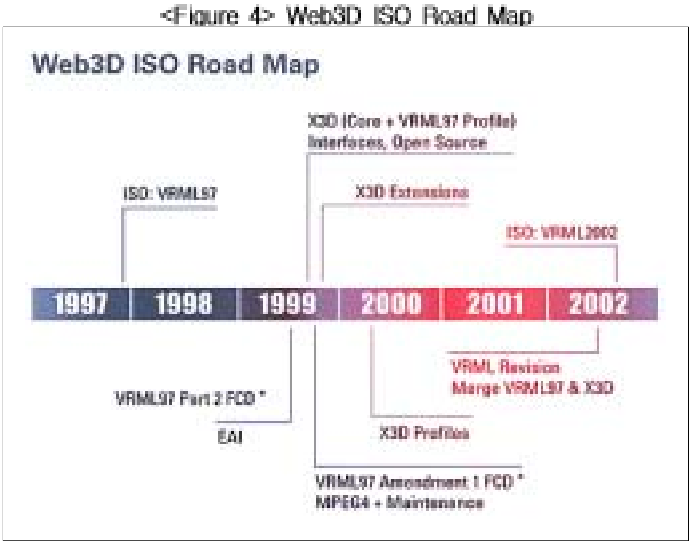
Constructing a cyber-geospace is a national project that requires active participation of all stakeholders including government, public agencies, civil organizations, and ordinary citizens. It is also necessary to apply a careful and thorough consideration on technological and policy-related aspects of the project in order to make the project a success.

① Technological aspect

- Standardization

First of all, standardization process should be taken as a first priority, and among the standards, the international standard on Web3D could be firstly considered. As a modeling language, VRML(Virtual Reality Modeling Language) and X3D(eXtreme 3D), which is a new version of VRML, could be considered for implementation.

<Figure 4> Web3D ISO Road Map



Standardization is required not only for the modeling language, but also in 3D spatial database construction. Cyber-geospace as an infrastructure for e-government should cover the whole national territory. The construction of such a large spatial database will require a long-term commitment. Therefore, by setting up a standardized database structure in the early stage of the project, it is possible to minimize the confusion and duplication of efforts. It is recommended that the future plan for cyber-geospace should give the standardization the highest priority.

- Utilizing the existing data

As the result of National GIS(NGIS) project, various spatial databases, from national topographic base maps to many thematic maps, have been constructed. At the same time, several core technologies have been developed including 3D GIS. Therefore, utilizing the existing databases and technologies in cyber-geospace building process is very important in terms of saving cost and preventing duplication of efforts. From the early stage planning for cyber-geospace construction, existing data and technology should be comprehensively analyzed, and necessary steps need to be taken to maximize the use of existing information resources. The following table shows some of the examples of existing databases and technologies

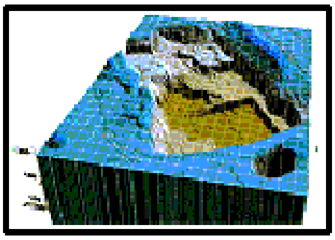
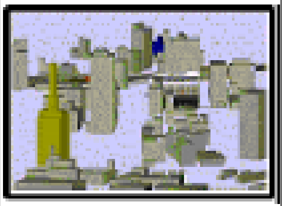
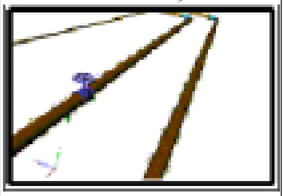
<Table 3> Existing databases and technology

	data / technology	Agency in charge
Database Construction	Topographical map - 1/1000 - 1/5000 - 1/25000	National Geographic Information Institute
	Thematic map - land use - administrative boundaries - roads urban palnning	National Geographic Information Institute
	Underground facilities map - water - sewerage - gas pipeline - communication - electricity line - oil pipeline - heating pipeline	Ministry of Construction & Transportation
	Digital Cadastral map	Ministry of Government Administration & Home Affair
S/W Development	Land Information System Geology Information Management System Groundwater Information Management System Underground Facility Management System	Ministry of Construction & Transportation
	GIS System Integration Mapping Technology GIS Foundation S/W DB Tool Technology	Ministry of Science & Technology
	Web-based 3D GIS S/W High-Resolution Satellite Image Processing Technology Virtual Reality Technology	Ministry of Information & Communication

- Combining appropriate construction technology

3D spatial information can be classified into the following 3 categories: topography, surface features and underground features. Following table shows major characteristics of each category of 3D spatial information

<Table 4> categories of 3D spatial information

	Topography	Surface features	Underground features
Representation	representation of a topographic surface - DEM: Digital Elevation Model - DSM: Digital Surface Model 	Features represented on the surface of the earth - Building - Cultural assets - Other structures 	artificial/natural features under the surface of earth - Underground Facility - Ground water/tunnel 
Data acquisition	- Aerial Photogrammetry - ALTM (Airborne Laserscanning - Terrain Mapping) Satellite Image - GPS-VAN	- 3D Modeling by Surveying - Satellite Image - 3D scanning - Image-based 3D Modeling(satellite image)	- Survey & Prospecting - Extraction from Attribute DB of local government
Current status	Stage of organizing plan : National-wide Construction(areal completion)	- Cell planning in telecommunication - Pusan Haundae-gu	Construction of underground Facility digital map & management system in Local government UIS
use	- topography analysis - Basis data of 3D Spatial Information	- Urban Planning - 3D modeling & simulation	- Facility management - Planning for excavation work - Geology feature management

As shown above, there exist diverse data collection technologies for the different categories of spatial data. It is, therefore, important to determine what the best method for constructing cyber-geospace is by carrying out a pilot project. Multiple technologies can be used based on the data type and topographic situation. However, even if multiple data collection technologies are used, the resultant databases will need to be integrated to form a seamless 3D space. Therefore, it is critical to set up a solid database structure early on, so that the confusion and duplication of efforts in the later stage of the project can be minimized.

② Policy aspect

- Cooperation within the government

An ideal way to construct an integrated e-government on the basis of cyber-geospace would be to combine the e-government project with cyber-geospace building project to make it one coherent project. However, the situation is not so simple because at least three ministries are involved in various aspects of these two projects. Currently, the Ministry of Government Administration and Home Affair is playing a primary role in e-government construction. As for the cyber-geospace construction, two ministries are most closely related. The Ministry of Construction & Transportation is mainly in charge of building 3D spatial databases and the Ministry of Information and Communication concentrates its effort on 3D technology development.

What the existing situation means is that major elements of overall projectconstruction of e-government, constructing national 3D database, and technological development for 3D data representation and utilizationare handled rather independently by three different ministries.

To remedy the situation, it is critical to establish communication channels between involved agencies as well as setting up of coordinating body to resolve the conflicts and give overall guidance on the direction of the project. Unfortunately, the recently issued road map for e-government does not mention a need to link e-government with construction of cyber-geospace. However, the Ministry of Government Administration and Home Affair has a plan to launch an ISP project to investigate the way in which GIS technology can be effectively used to facilitate e-government. If this line of investigation can be expanded to include the way in which cyber-geospace can function as the infrastructure for e-government, the future plan for e-government will be comprehensive enough to allow the cooperation among government agencies.

- Setting up legal and institutional environment

Streamlining legal and institutional environment so that the project does not get delayed due to the unnecessary red tape is as important as technological standardization. Establishing e-government based on cyber-geospace means building a cyber nation. Consequently, laws and regulations that will provide a legal foundation for this cyber nation are needed to be established. At the same time, the existing laws that relate to e-government and cyber-geospace, such as information & communication law and NGIS Act, should be adjusted to facilitate the project. The following table shows some of the laws and regulations currently under study for streamlining.

<Table 5> Laws & regulations under study for streamlining

Related agency	Law & Regulation
All Public Agency	• mp sum readjustment of civil petition related regulations • tablish rule for electronic handling, regulation readjustment • ad map for e-government, related regulation readjustment
Ministry of Government Administration & Home Affair	• gislation of individual information protection • sclosure of public information • ivacy act • gulation for operating integrated computer center
Ministry of Information & Communication	• gislation for Promotion of Information network utilization and disclosure of information • sclosure of information • gulation for running joint computer
Ministry of Finance & Economy	• vision for State's contract low • vision/Legislation for State's accounting financing/accounting low
National Election Commission	• gislation of electronic voting law

The streamlining process is expected to involve wide range of laws and regulations and the impact would be significant. Therefore, it is critical for all the stakeholderscentral and local governments, civil organizations, academia, and other interested peopleto participate in the process. Organizing seminars and workshops will be a good method to gather wide range of opinions on the subject and will provide a starting point to reach a consensus.

- Raising the public awareness

The success of e-government depends on how many people uses the service and how satisfied they are with the service. Therefore, it is of utmost importance to encourage people to take part in the project through vigorous public awareness campaign. A few months ago, there was a debate on the security of the internet-issued documents. Some people argued that it was possible to illegally alter the documents. The real fact was that it was not possible at all to alter the documents because the system has implemented very tight security mechanism to prevent forgery. The people who argued forgery was possible simply did not know the security features. This incident shows the importance of letting people know what is going on and bringing people into the project through vigorous public awareness campaign.

6. CONCLUSION

The three major objectives of the Korean e-government are:

- Reforming the working process of the government
- Reforming civil services
- Reforming management of information resources

Although the Korean e-government is still in its early stage, some of the tasks have already been successfully implemented and many online services are now being provided through the Internet. Considering our strength in world-recognized information infrastructures and the advanced level in information and communication technology, the concept for the future e-government needs to be expanded to envision the creation of cyber community, or a cyber nation.

Constructing e-government as a part of cyber nation means we are creating a different kind of space, a cyber-geospace, within which all the geographic features in the real world is electronically replicated and the most of the activities in real world can be conducted. It also means that cyber-geospace is the most basic element in putting things together in this digital worldthe infrastructure. Without proper infrastructure, no government can exist. Without proper digital infrastructure (cyber-geospace), no e-government can exist. Therefore, the truly complete e-government can only be realized when it is built on top of this cyber-geospace.

Cyber-geospace introduces an important concept called nto the e-government. With placeness concept, an abstract and cold cyber space becomes a familiar and warm place. It is a place that we know and when we see some buildings there, we can identify what buildings they are by just looking at them. It is this notion, giving people familiar places in cyber space, which allows the use of cyber-geospace as an infrastructure for e-government. We want people come to government offices, to public agencies, to banks, and to shops in cyber space just as they do in real world. People come and do their business in cyber space, but this cyber space is different from any other space. It has addresses!

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Knowledge-based research center of KAIST(egov.kaist.ac.kr)

Towards an Understanding of Spatially Enabled e-Governance:
An Initial Exploration of Issues and Implications

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1. ABSTRACT

Advances in e-governance have largely been uneven across the global spectrum. Whilst many laudable experiments are conducted world-wide, many of these are still in their infancy and therefore difficult to assess. What emerges is the need for e-governance initiatives to be more responsive to local needs, to enhance service delivery and provide the means for a deepening of democracy and a strengthening of the relationship between government and the public. In the developing world context in particular, there is a need to improve governance to the extent that service delivery can be enhanced. Nevertheless, many examples of creative and all-embracing e-governance systems exist in developing and developed countries. Whilst many of these are interactive and dynamic(thereby reaching beyond mere information provision), the incorporation of geospatial data and processes is not that prevalent. The technology for doing so is available but geospatial agendas seem to be pursued in isolation from interactive processes that incorporate Geographic Information Systems (GIS). Web-based GIS may provide the ideal tool for enhanced electronic decision-making, but such initiatives are often project-based, located in research organisations and universities or limited to particular planning processes. By drawing on a broad body of literature, this paper explores the debates surrounding e-governance, GIS and web-based GIS, as well as preliminary research done in three South African cities (Durban, Cape Town and Johannesburg) and explores some of the issues and implications underpinning the implementation of spatially-enabled e-governance.

2. INTRODUCTION

The commercialization and popularization of the Internet in 1995 heralded the beginning of a number of commonly-held beliefs with regards to the nature and persistence of cyber-space. Not only was the latter going to signal the end of spatial limitations on the way we construct ourselves culturally, socially and economically, but it also meant the end of geography or the end of geographic experiences in conventional space. We were free of spatial constraints. It was left to a limited number of disciplines to ponder the question of whether space actually matters.

Yet, a number of scholars have since questioned this rather premature and questionable celebration this early disregard for the limitations of space. Some have pointed to the spatial relationships embedded in the distribution of telecommunications infrastructure (Graham and Marvin, 2001), the distributional cyber networks and inherent geographies of dot coms(Wilson, 2001), and the persistence of spatial inequalities regardless of the predominance of Information and Communication Technologies(Graham and Marvin, 2001). Townsend(2001) argues for the importance of architecture and urban design/planning even given Wireless Fidelity(WiFi); whilst other argue for a greater attention to the spatial inequalities implied by the uneven distribution of ICT infrastructure(Graham and Marvin, 2001). It therefore emerges that geographic space is important, to be considered carefully in tandem with technological, social and economic imperatives in what is now universally accepted to be the new Digital Age.

Given this context, it is not surprising that e-governance initiatives have largely been driven independently of advances of geospatial debates. This is ironic given that a large part of e-governance concerns itself with service delivery within a particular geographically defined area. One is likely to find that the backroom work to be done to fulfill these objectives would to a large extent be accommodated by Geographic Information Systems (GIS); the mapping, analysis, planning and testing out of proposals that have spatial implications. Yet, the pursuit of geospatial agendas appears to have largely been driven independently of e-governance initiatives. The word s used intentionally; what is emerging now is an increasing awareness of the potential for spatially-enabled e-governance as reflected in a number of initiatives internationally. It emerges that not only does GIS have the capacity to give effect to the service-delivery side of e-governance, but it can go much further than that. It can enhance communication and marketing; it can deepen the dynamic between government and citizen through the exchange of spatially specific information and it can increase the transactive nature of e-governance through the exchange and use of spatial information. Most pertinent to this paper: it can enhance the spatial integration from a supply and demand side. Not only can it fulfill its ideal of operating without the limits of space in a particular geographic area, but the use of spatially enabled e-governance could perhaps respond meaningfully to spatial isolation and marginalization. This is important since meaningful e-governance is intended to empower and inform; creating an environment in which citizens can engage meaningfully with their governments.

This paper will explore the ideal of spatially enabling and enabled e-governance, through examining the literature on e-governance, GIS and in particular web-based participatory GIS. It will incorporate preliminary primary research done in three South African cities: Durban, Cape Town and Johannesburg, intended to examine some of the opinions embedded in the current literature on this subject. The field work consisted of a number of interviews conducted with GIS professionals, urban planners and local government officials engaged in e-governance initiatives. South Africa is a country possessing a high degree of technological advances, a good infrastructural base and a high degree of ICT skills in its cities. Yet, its cities and regions are typified by enormous inequalities with regards to economic opportunities and access to services. Furthermore, it contains a policy framework that is starting to embrace the notion of e-governance; whilst on the other hand, good GIS skills exist. The country therefore provides an interesting case of developing and developed world contexts with regards to Information and Communication Technology(ICT) implementation.

In order to give some understanding then of the issues contained in the interface between geospace and e-governance, the implications, this paper will consider current international debates on e-governance, GIS and the emerging writings on spatially enabled e-governance (as much as it exists) whilst also considering the above primary research. Its aim is to be exploratory, to start focusing attention on some of the factors that would impact on the implementation of effective and spatially enabled e-governance

3. OVERVIEW OF INTERNATIONAL DEBATES ON E-GOVERNANCE AND GEOGRAPHIC INFORMATION SYSTEMS

3.1 E-governance in developed and developing countries

The issue of e-governance is embedded in literature concerned with a number of disciplines. Within the context of New-managerialism, e-governance is intended to enhance the efficiency of government through improved service-delivery, communication and information sharing. The aim is to increase efficiency, break down the barriers between officialdom and the general public and make government more effective in its delivery on developmental objectives. It is difficult not to focus on the neo-liberalist underbelly of e-governance: a key aspect of these initiatives is the enhancement of a citys image its attractiveness to investors and place-marketing. The use of the World-wide Web(WWW), internet communication tools and its facilitation through advanced telecommunications infrastructure is intended to not only make government more effective but also ensure it a place in the New Economy. Wired cities and regions are keeping abreast with technology and are often safe places to invest.

But e-governance is intended to go a step further towards crossing that gap between government and governance. The latter places emphasis on the relationship between citizens and their city, their officials and councilors. E-governance is intended to yield a deepening of democracy; by moving from the purely technical to become more facilitative, supportive and innovative.(Nath, 2003) The combination of web sites, bulletin boards, e-mail exchanges between government officials and politicians on the one hand, and citizens on the other, makes a deepening of the democratic processes possible. (See Corrigan and Joyce, 2000). Internally, computing has become key to effective public administration; for internal organisation, information and data transfer; it has become also ı object of regulation and policy-making.(Frissen, 1997). The emphasis is also on economic development and building smart communities, connected through electronic means to the digital infrastructure of cities.

A distinction is made here between developing and developed countries due to the underlying objectives contained in these initiatives. Whilst the developed world lays claim to advanced e-governance, clearly developing countries have more developmental imperatives driving them. In a comparison between Brisbane and Durban, the author found that whilst both cities had a clear strategic planning framework determining the parameters of their e-governance initiatives, the latter was, not surprisingly constrained by more pressing agendas with regards to basic service delivery, and constraints with regards to capacity and technology(Odendaal, 2003). Whilst this may not be surprising, it does not preclude the use of e-governance as an effective developmental tool. Certainly in cities such as Durban and Cape Town, South African cities are seeking to balance economic and promotional imperatives in developing smart cities with the necessary infrastructure and service provision(Subban and Wright, 2003). Agencies such as the World Bank and the United

Nations Development Programme(UNDP) Two reports worth referring to in this regard are the UNDPs Human Development Report, published in 2001(Making new technologies work for human development and the World Banks infoDev programme handbook for developing countries(November, 2002).

have embraced the technology in a number of guises whilst ICT enthusiasts the world over are anticipating a number of resolutions from the World Summit on the Information Society to be held in Geneva in December 2003, which will most likely pay a large emphasis on the Digital Divide.

The true challenge of ICT inclusion and e-governance in marginalized communities in particular is the extent to which they can enable empowerment and reintegration into the urban fabric. The current urban planning literature is quite useful in understanding the conditions of contemporary cities in this regard. Authors such as Sandercock(1995) and Healey(1997) provide interesting insights into the nature of current urban challenges and the necessary processes to solve them. Sandercock(1995) writes about the voices of the marginalized, how their presence in the urban fabric does not necessarily quarantine their inclusion in urban living. She argues for their voices to be heard in planning and development processes; for urban planners to be open to allowing the disenfranchised a voice. It would be interesting, therefore, to explore the extent to which ICTs can accommodate the means to which such communities can re-enter the governance process and how well their socio-cultural backgrounds can be accommodated in this process. The latter is no doubt of extreme importance given the multi-cultural palette that makes up the social and cultural interactions of cities and regions across the world. The question would be: do ICTs provide the tools whereby the disenfranchised and marginalized can be given a voice in the urban planning and policy making processes in this regard.

However, as much as e-governance can promote transparency and inclusion, it can also exclude and divide. Many respondents interviewed expressed the concern that digital have-nots will not only be excluded from such processes but that e-governance may just add another layer of inpenetrability with regards to access to the State. Furthermore, the availability of information on the Internet does not necessarily indicate a desire for greater democracy by the state of course, since r a government whose governance is authoritarian, communication and the content of information become tools at the service of the State(Gutierrez and Daltabuit, 1999: 21). The use of ICT can, indeed, give the impression of greater transparency whilst remaining opaque.

Regardless of the concern with regards to the misuse of technology, research indicates that the intention is to achieve enhanced governance and service delivery in most cases. What emerges from the South African situation is the need to combine infrastructural imperatives(delivery of sufficient telecommunications networks) in remote areas, with relevant on-line services and content, together with Universal Access. Combining these three could yield greater spatial and functional integration of our regions and cities. In this regard, it would even be fascinating to note the extent to which spatial planning tools and processes can become accessible to small community groupings and those dedicated to community mobilization. In an introduction to a special Urban Studies issue on Wired Communities, Grieco(2000) explores the prospect of GIS tools becoming available to individuals, households and smaller(community) institutions across the Web linking to what is essentially a high cost, sophisticated tool at low local costs. Her argument is embedded in an exploration of the power of ICT to provide the means whereby local communities can increase their virtual interaction in the urban environment. Spatial awareness, this paper would like to assert, can potentially thicken these democratic processes. However, in order for this to happen, the technology needs to penetrate such communities.

Access to ICT resources that makes e-governance workable is clearly an issue, especially in developing countries. Whilst much has been said about the Digital Divide, what is emerging is that this is not simply a global haves/have-nots divide (Ottolini, 2001) but one that is present within countries and within cities. Whilst technological inequalities often follow material inequalities(as shown by Warf, 2001), what needs to be considered also are the economic, political and cultural obstacles to ICT access(Ottolini, 2001). Computer literacy, language barriers, economic issues and suspicion with regards to technology need to be considered also. The addition of a spatial layer to e-governance could potentially deepen this dynamic given the spatial awareness and mapping literacy that may be required to exchange spatial information. On the other hand, the additional of geospatial functionality can decrease spatial isolation and provide the means for greater integration. A number of opportunities exist in this regard as shown in the following examples,

- Information with regards to transport requirements for the household can potentially lead to an interface where real-time images of congestion can be relayed, with potentially alternative transport paths communicated to the household thereby fitting with household scheduling requirements(Grieco, 2000). This can be particularly useful to marginalized groups such as single mother, or disabled people.

- Local knowledge with regards to issues, problems and potential solutions can be incorporated into the planning process; issues that are not immediately obvious to outside professionals can be verified or raised by local communities through spatial interaction on the Web. (See Al-Kodmany, 2001) It therefore has the potential to be a bottom-up tool in the planning process.
- Real-time information on crime in particular areas can increase surveillance in inner city areas. People can therefore become more aware and confident in their interactions in the urban environment.
- Learning and capacity building can be facilitated through two-way communication processes on the Web. Spatial awareness leading to greater participation in decision-making processes, can be enhanced through spatially-enabled on-line communication.

The point is that these initiatives are few and far in between, but remarkable case studies exist, given the extent to, and the breadth in which they are implemented. What emerges however is the need to address the relationship between geospace and e-governance at a broader level. A number of issues need to be examined here,

- Firstly, spatial delineations underpin much of e-governance at a local level. In this regard, it is clear that the infrastructure planning required to facilitate an even spread of information technology access across a region or city, requires a spatial awareness and infrastructure planning at a broader and strategic level. Whilst e-governance processes are often embedded in larger strategic planning agendas (Odendaal, 2003), Graham and Marvin argue that spatial planners, urban designers and architects are often unaware of the full extent of their potential involvement in telecommunications planning (2001). Furthermore, Townsend (2001) argues that mobile internet and Wireless technologies, regardless of how spatially footloose they are, would need to engage with the spatial planning professions in order to ensure that the gaps between virtual spaces and physical spaces are bridged. Whilst this is not the primary argument that this paper would like to explore, it is of utmost importance to consider, if e-governance is to engage with new technologies in a meaningful way towards the goal of upliftment and empowerment.
- Secondly, embedded behind service delivery schemas are ICT and GIS processes that are often hidden from the viewer. Thus, the relationship between geospace and e-governance exists already.

- Thirdly, very few e-governance initiatives actually embrace geospatial tools yet there is ample opportunity to do so as shown above. Whilst there exists the opportunity to deepen the relationship between citizen and council by engaging with space in cyber fashion, very little is written about this.

In order to understand the relationship between geospace and e-governance, the next section in this paper explores current GIS debates. Of particular interest here are the notions around participatory GIS and in particular, web-based GIS.

3.2 Current directions in Geographic Information Systems

The use of GIS to enhance planning decision-making processes and enable thicker participation throughout development has been receiving a lot of attention in the last ten years or so. GIS has indeed matured into a tool capable of playing a role in collaborative planning processes. This was facilitated by the evolution of user-friendly desktop GIS systems in the 1990s augmented by free software available from web sites(e.g. ArcExplorer, by ESRI). Allen and Goers(2002) argue that the development of user-friendly software combined with the accessibility on the Internet has led to a GIS that is more accessible in terms of expert and community access; that avails more sophisticated analytical tools to create complex models used to solve complex urban problems, and that is increasingly interactive. Advances in technology have increased the potential for participatory GIS given the integration of GIS with other information technologies such as global positioning systems, 3-D visualization and Virtual Reality. Match that with current convergence technologies and an interesting and exciting picture emerges of potential real-time, responsive tools that make communities interaction on the web very exciting.

The issue of access needs careful consideration however. Although this access may be increasing, one would need to consider whether this is evenly distributed. Physical access is clearly an issue(access to computers, training etc.) as confirmed by interviews in South Africa, but institutional factors would need to be considered also. Greater awareness of social constructs underlying GIS is also becoming more recognized. Innes and Simpson(1993) argue that the GIS literature generally follows a technologically determinist path in its analysis where it is assumed that once the technology is available, it will automatically be followed through in practice. Yet, empirical studies of technological innovation, they argue, are often riddled with complexities, and ambiguous in its benefits. What needs to be considered more carefully are the social, institutional and technological underpinnings of implementation of the technology. What emerges is the need for a system design that builds upon common data standards, software, agreed-upon management processes and access principles in the sharing of data. Campbell(1996) argues that technology cannot be separated from the power dynamics embedded in organisations and institutions, and of course the capacity constraints. Clearly, attention must be paid to the less obvious(and messier) organisational, social and cultural dynamics that underpins the introduction of information technology into planning and governance processes.

In her ongoing research into GIS and local planning, Budic(1994) argues for ongoing evaluation of GIS efforts that provide a true reflection of the impacts of GIS adoption into planning processes. Whilst it is commonly believed that GIS technology improved the effectiveness of planning and development processes, not much appears to be documented in terms of the true impacts operationally and in terms of the effectiveness of decision-making. Clearly if GIS is to be embraced within the context of e-governance, these factors would need to be considered carefully.

3.3 Web-based participatory GIS and other relevant applications

In an issue of Environment and Planning B: Planning and Design(2001), a number of authors explore the phenomenon of web-based GIS and its potential for public participation. The range of initiatives is impressive. Al-Kodmany(2001) explores the extent to which animated sequences, pre-designated views, displayed renderings and dynamic views are used in by the University of Illinois in Chicago, in collaboration with a local community. This was done to assist in cognition of the city through exploration of Kevin Lynchs five elements of image ability (paths, nodes, edges, districts and landmarks) in order to communicate and negotiate urban design proposals. In this regard the Web proves an effective medium for :ganizing and displaying a large number of images, both static and motion(Al-Kodmany, 2001: 805) in what is effectively an interactive design process. In assessing the process, the author argues that this process potentially promotes local knowledge building on Healeys(1997) ideal of collaborative planning where the planning and design process could ideally build on local knowledge and experience through the meaning constructs that people act upon in this process. Al-Kodmany(2001) argues that this project provided a means whereby the web can be used to incorporate and assimilate local knowledge and experiences into the planning process. This is an exciting prospect, but is however mitigated by other factors such as access to technology and technical knowledge. What emerges is the need for constant evaluation of these technologies in order to improve systems as the technology rapidly develops.

In the same edition of this journal, Hamilton et al(2001) argue that sufficient learning systems need to be incorporated into the planning process to ensure that consensus-building in the development process is ongoing. Peng(2001) refers to the ideal of ommunity-integrated GIS orum around which community-based issues, information, alternative perspectives, and decisions evolve(2001: 891). To this end the Internet becomes a primary tool for the broad distribution, dissemination and analysis of spatial information. Peng(2001) argues that Internet GIS has the following advantages in this regard,

- Instantaneous access to data;
- The potential for greater interactivity between the users and complex spatial and other information;
- The potential for real-time scenario generation

In a thoughtful reflection on the above and other examples, Carver (2001) raises two important issues with regards to the relationship between technological potential on the one hand, and the reality of planning and development processes on the other. Whilst the technological issues with regards to incorporation of geo-spatial data onto the Internet have largely been solved, social and cultural issues need to be considered more carefully. The Internet has indeed become an extension of traditional communication and information dissemination means to many, but these are normally people with a history of exposure to information technology and the educational and cultural backgrounds that affords them that familiarity. To many however, it remains a distant technological and intimidating tool. Additionally, GIS may be second-nature to planners, but to many it remains an elitist (and potentially powerful) technology not necessarily viewed in a democratic way. (See Pickles, 1995; Odendaal, 2001). Secondly, Carver argues (2001) that institutional issues need to be considered also. People in positions of power (in government for instance) may regard participatory GIS with a degree of suspicion and may doubt the ability of grassroots communities to fully comprehend the complexities of the spatial planning process and thereby make meaningful input. These two points are paramount to understanding the constraints that may stand in the way of spatially enabled e-government.

A third issue emerges from interviews with respondents by this author. GIS data is considered an important resource in many local governments in particular. Making that information available on the Web is not necessarily considered to be ideal, whilst a culture of information sharing within organisations does not necessarily exist. Furthermore, database protocol and management procedures would need to be negotiated across sectoral departments which can often prove to be difficult. Addressing organizational cultures and divides is therefore paramount to making spatially e-governance work.

With regards to technology, on the other hand, it is worth mentioning the advances that have been made in this regard. A number of digital tools are available with innovations in urban and neighbourhood simulation, three-dimensional modeling and virtual reality (Al-Kodmany, 2001: 808). Huang et al (2001) explore the integration of GIS, virtual reality and the Internet for the use of spatial data. The technology explored by the authors advocate a hybrid approach that combines deploys bother server-side and client-side technological solutions in the utilization of computing resources. This enables the virtual workload to be distributed evenly between client and server allowing for true interaction. It is a compromise solution that makes assumptions about shared software and programming language, yet starts to understand how the technological barriers to sophisticated on-line analyses can be overcome. Again, these technological processes would need to be supported by an underlying organizational vision and commitment.

The beauty of GIS is this: its ability to integrate data from variety of sources, thereby creating interactive tools that can reflect the potential impacts of planning and development decisions(see Van Buskirk et al, 2003). It requires the following however: effective user-interface design; local data access; on-line editing and data archive; map server functions design; database management component; analysis models component; communication channels; data sharing and image sharing.(Peng, 2001).

Technological convergence would need to be considered. The potential for combining computer databases, digital television, mobile telephones, and handheld devices and GIS systems into a comprehensive, connected governance system of information exchange is an exciting prospect. Carson(2003) examines the CoolTown experiment in Vancouver, Washington, in the United States in this regard. The project reflects an exciting coalition between private software and hardware developers, telecommunications agencies and the local government in question. Building on the fact that the Portland-Vancouver metropolitan area has the largest number of WiFi hotspots in the United States, the project aims to link the countys computer system with its Internet web site, its plans permitting systems and its GIS. Thus, citizens can access information with regards to a property from any handheld device, internet kiosk or mobile phone. Similarly, plans can be submitted for approval from any location, day and night.

What then is necessary to avail GIS on the internet in an effective way, which takes institutional issues into account? Krouk(2003) lists three important factors: common standards with regards to data capture and representation, a clear organisation vision for spatially enabled e-governance; and a common programming language that makes communication between internet sites easier. These are important technical concerns that no doubt play an important role in this regard. The need for an effective spatial data infrastructure is clear. The policy direction at a government level, agreement on data standards and commitment to data quality is necessary at all levels of government. In examining the Bangkok experience, Bishop(et al) argue for the following issues to be considered: a need for awareness and management support of GIS data infrastructure; agreed-upon data standards; data availability needs to be negotiated; sufficiently trained personnel; resources in terms of capacity, hardware and software, proper procedures for the capture and maintenance of data; vendor support; learning from successful implementation as well as data integration. (2000).

Furthermore, the approach calls for clear government policy direction and the need for a data clearinghouse accessible to government agencies and other interested parties. The US geospatial portal recently launched is a case in point. The portal provides a central repository for spatial data, on the one hand, as well as providing web services to support local, state and federal programmes that require geospatial input. The portal was developed by ESRI, and delivered in July 2003. Users are able to do the following, -

- Search for, and view, images and geographic datasets, as well as contacts, activities and clearinghouses for geospatial data;
- Register for notification of updated data and information with regards to activities etc;
- View metadata with regards to available datasets;
- Download large datasets through future streaming or FTP services.

(ESRI, 2003)

Clearly the combination of implementation of web-based GIS is not just a technical process. The GIS literature reflects an increasing(but still limited in practice given interviews with respondents) concern with social, cultural and organizational issues underpinning these processes. Web-based GIS adds another layer in this regard with reference to the same factors influencing web access. Thus, in order to understand the potential for geospatially enabled e-governance, a number of factors that stretch beyond the technical would need to be considered. The following section aims to interrogate the relationship between e-governance and geo-space based upon the literature reviewed and interviews done.

4. TOWARDS A CONCEPTUAL FRAMEWORK FOR UNDERSTANDING SPATIALLY ENABLED E-GOVERNANCE

In understanding the inter-relationship between e-governance and GIS, in the pursuit towards spatially enabled e-governance, a number of cross-sectoral issues emerge. These, this paper argues, would need to be considered if spatially enabled e-governance is to become spatially enabling towards greater empowerment and integration of marginalized communities into the urban fabric.

It is clear that this interface is not one determined by technology alone, but would need to be considered in tandem with social, economic, cultural and institutional / organizational issues. Thus these various dimensions need to be considered in tandem with the underpinning criteria for a truly democratic and spatially enabled e-governance system. This paper argues for the following criteria,

- **ccess**

The issue of access stretches beyond the technological. Clearly if a spatially enabled e-governance system is to be effective, it should potentially enhance participation from a broad sector of society. Given the inequalities experienced in most cities (including in the developed world), those sitting at the margins of the economic and social realm would need to be included also. Thus, issues of learning, capacity and actual physical access would need to be considered. The addition of a geospatial layer to electronic transactions clearly deepens the need for access to be addressed.

- **ntegration**

Spatial tools need to be finely integrated with the transactive and communicative tools availed by ICT. Whilst Web-based GIS has potential to deepen participation in the cyber realm, it would need to be combined with traditional e-governance transactions for it to be representative of truly spatially enabled e-governance.

On the other hand, technological integration(given trends towards convergence) can facilitate broadened access and would need to be managed effectively in this regard.

- **ccountability and transparency**

The use of the Web potentially deepens democracy if this is intended; yet it can also be a smokescreen that may give the impression of openness (through the display of a broad range of information) whilst omitting important information. Spatial data can easily be manipulated representing a particular rationality that does not necessarily represent a broad range of interests. Accountability in particular, is not necessarily guaranteed by transparency the two should go hand-in-hand.

- **fficiency**

The intention of e-governance is ostensibly to enhance the efficiency and effectiveness of government for its citizens. Yet, this can easily be compromised by inclusion of information and mapping that may appear impressive yet may well be superfluous. Effective displays of information, design of web sites and choice of technology all have an impact on this dynamic.

- **'ision**

Integration of geospatial data with e-governance functions requires an overall policy vision, as well as political commitment. Ad-hoc implementation could not only waste resources but be contradictory in its outcomes.

- **:ontent**

The appropriateness and relevance of content is naturally linked to the other factors argued for above. Choice of content will, no doubt, be decided by the policy vision, whilst superfluous content will compromise the efficiency of a system.

Given these criteria that this paper argues for; the following matrix seeks to understand the relationship between these criteria and the technological, organizational, socio-cultural and economic contexts within which geospatial initiatives would need to be implemented. What emerges are sets of issues and implications and issues that would need to be considered in terms of operationalisation. (The shaded areas of the matrix indicate the implications given the geo-spatial layers added to e-governance whilst the un-shaded sections indicate implications for e-governance per se.)

<Table 1> Criteria and implications for spatially-enabled e-governance

Institutional / OrganizationalCriteria	Social-cultural	Economic	Institutional / Organizational	Technological
Access	Use of language and symbols that accord with backgrounds of various publics; access in terms of computer literacy and training would need to be addressed	Access to computers and other tools at household and community level; Internet users do not necessarily represent a cross-section of society.	Arrangements that ensure that electronic access is backed up by physical support in terms of capacity building and training	Infrastructure planning that broadens access across the spatial spectrum
	GIS remains a mystery to many; mapping elements that are user-friendly and legible to users will alleviate this.	Mapping literacy enabled through training and education necessary	Access to spatial data within institutions given inherent and potentially problematic power relationships	Effective integration of technology that provides speedier and more efficient access; investigation of other media such as digital television and handhelds
Integration	Effective integration of information so that the processes enabled electronically respond to diverse interests	Extension of e-commerce and government functions that improve the environment for investment; yet also provides opportunities for small-scale businesses and entrepreneurs; thus need to address spatial integration in terms of broadened access through open access points as part of overall infrastructure	Decision-making processes that overcome the traditional silo-style of decision-making since information and functionality needs to be shared	A common electronic platform and database that enable synergy amongst functions
	Addition of spatial information that not only serves as an extension of electronic interactions but is inclusive of diverse needs and interests. It also enhances spatial integration through enhanced spatial awareness of marginal areas	Addition of spatial functionality that not only provides tools for speedier spatial transactions (e.g. approval of plans) but also enables spatial integration of derelict areas;	Sharing of geographic data and common data and capturing conventions	Integration of Virtual reality, 3-D and GIS capacity will enhance interactive capacity; whilst effective and integrated combination of platforms will enhance efficiency.

Institutional / OrganizationalCriteria	Social-cultural	Economic	Institutional / Organizational	Technological
Accountability	Interactivity will increase transparency but needs to be followed through with actions on-line communication is not enough	Electronic input not necessarily representative of broad interests, but may be just the opinions of those who can afford access; would need to be augmented with Universal Access strategies	Copyright issues would need to be addressed given diverse data sources; do people trust information on the Internet? Inter-departmental cooperation is necessary to ensure open data sharing and effective coordination	Open source technology may provide the means whereby technical capacity can be enhanced and encouraged
	GIS seen as elitist, expert-led technology to many; thus applications would need to transparent and representative of broad interests; Need high degree of trust	GIS not necessarily accessible and would most likely need to be backed up with traditional consultation methods	Sharing of GIS data is not necessarily part of institutional policy given vested organizational interests; this would need to be negotiated between institutional stakeholders.	Choice of vendors and software may be an issue (advertising rights on web site, training etc.)
Efficiency	Cognizance of socio-cultural dynamics is necessary to broaden use of e-governance services and accommodate feedback	Enhanced efficiency of government transactions will improve economic performance	Procedures required to back up electronic transactions needs to be followed through; e-governance cannot make up for organizational inefficiencies	Data management and inter-departmental communication necessary to enhance electronic efficiency
	Lack of spatial awareness and understanding (or suspicion) of geospatial data could impede performance	Geospatial data sharing can improve planning processes and accelerate decision-making thereby potentially increasing economic performance	Funding and staffing required achieving full impact. Maintenance procedures need to be carefully observed. Management a key concern.	Prototype development and experimentation may prove to be expensive yet necessary to facilitate ongoing systems learning; Require common data standards and maintenance procedures

Institutional / OrganizationalCriteria	Social-cultural	Economic	Institutional / Organizational	Technological
Vision	Political support necessary from broad spectrum to enable dissipation of technology	E-governance outcomes need to enhance local economic performance in terms of returns on investment	Cyberdemocracy is not necessarily an ideal for all political opposition may exist	Rapid pace of technology innovation requires constant montiroting and management with particular outcome in mind
	Need consensus on the technology and what it can add to local planning and development processes	Geo-applications needs to be relevant to overall economic goals yet also encourage upliftment	Need clear vision as to what result should be since operational implications are profound and need to yield well-defined an desired results	Power relations within institutions could be disrupted through implementation would need to work towards a common vision
Content	Excessive use of jargon will compound access problems; information also needs to be relevant to local conditions whilst transactions need to respond to local needs	Content needs to be relevant to whole economic spectrum in order to encourage investment on the one hand, and also help fledgling entrepreneurs on the other	On-line for a need to be managed given potential for the exchange of comments and concerns that may be completely parochial and isolated.	Digital tools need to be managed effectively; more functionality is not necessarily better it needs to be relevant
	Needs to be informed by demand and relevance to local communities; as well as be responsive to particular issues and problems. On the other hand, local knowledge can be drawn upon and enhanced through careful selection of content and process. Spatial awareness cannot be assumed, but can perhaps be enhanced through these processes.	Critical mass of users necessary to provide thresholds for ongoing use from an economic perspective; Content would therefore need to be of relevance.	Information gained from interactions not necessarily relevant processes would therefore need to be carefully managed and designed.	Digital tools used need to be appropriate in terms of information to be exchanged

5. CONCLUSION AND IDEAS FOR FURTHER RESEARCH

Can GIS make e-governance spatially enabling does it need to be spatially enabled to do so? This would be an interesting point to ponder given the inequality vested in our cities and the degree to which marginalization occurs. Clearly a number of technical tools exists that enable impressive techniques, routines and functionality as indicated by the case studies on web-based GIS. However, inclusion of this functionality as an integral part of spatially-enabled e-governance, requires consideration of factors outside the technical. An integrated approach is necessary, one that requires political commitment, institutional vision and shrewd technical follow-through. Spatially enabled e-governance would need to be considered as an extension of current planning and development processes, not an end in itself.

A number of questions remain, and would require further consideration. The first is raised by Al-Kodmany(2000); can web-based GIS become less mystifying and expert based? If this issue is not addressed and considered carefully, the use of geospatial techniques could well serve to deepen unequal power relations. The relationship between development-expert(or powerful official) and community member is a fragile one; and unequal power relations can sour what is otherwise a potentially productive development partnership.

Further research on the visual experience of cyber-space(see Llobera, 2003) and how individuals engage with public perception of spatial problems and means of representation would also be meaningful in this regard. How various communities of varying cultural and social backgrounds conceive of space, interpret it etc. would not only make meaningful input into the planning process but may also enhance the planner/government officials learning! The Web provides an interesting forum for exploring these socio-spatial dynamics.

It would also be interesting to explore whether digital debates and inputs differ from spatial debates based upon traditional participatory methods.(See Frissen, 1997). The risk is that the transmission of superfluous information could frustrate communicative proceses; yet may also yield subtle points not necessarily raised in conventional forums.

Finally, more sophisticated and user-friendly tools through electronic means will not necessarily guarantee buy-in from stakeholders in the urban development process. The old adage reflected in the Hollywood film Field of Dreams, does not necessarily hold true in this regard. The presence of sophisticated technology does not necessarily guarantees its use. Potential participants in this process need to, in the first place, feel the need to spend time and energy to participate; and secondly, know that their views are reflected in the outcomes of such processes. Clearly electronic geospatial governance processes would need to be augmented by other processes: social, cultural and political. Technology is not enough; we need to start understanding the social, institutional and cultural processes that underpin technical concerns if we hope to exploit technology properly. An integrated approach is necessary, one that understands that the urban realm in which e-governance hopes to intervene is complex, fragmented and unpredictable.

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