Managing Metropolitan Futures:

The Role of Information Intermediaries

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Abstract

This paper reviews the literature and the experience of the development of Community Statistical Systems deriving from the original Community Information Network movement in the 1980s. We propose here the development of a new approach and a new model in the development of CSS. Instead of hosting all required databases (and having to continually update them), the databases would instead remain with the original data providers and the intermediary would facilitate the connections between different databases and the end-user. The intermediary would also develop compatibility protocols to ensure that all databases can be integrated. In addition, protocols for automatic updating of data sets and for determining access could be functions of the intermediary.

Executive Summary

This paper reviews the literature and the experience of the development of Community Statistical Systems deriving from the original Community Information Network movement in the 1980s. The paper traces the evolution of these systems into the second generation of Neighborhood Information Systems[1], or Community Statistical Systems, which with the development of technology provide powerful integration of multiple databases for improved community outcomes. This paper provides a conceptual review of the development of Community Statistical Systems and their precedents in Neighborhood Information Systems and Community Information Networks. The paper presents findings for the development of a new approach to the effective deployment of Community Statistical Systems.[2]

Geographic Information Systems technology enables mapping of any number of neighborhood trends and patterns. By combining layers of information about a place, GIS enables comprehensive evaluations of the area and the development of Neighborhood Information Systems (NISs) that build integrated data sets.

There are two levels of NIS use that fulfill different purposes: "transactional" use based on individual points of data and "analytical" use based on the transformation of data into information. Typically, neighborhood information systems are used by community groups to find

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[1] The Wharton Real Estate Department Geographic Information Systems (GIS) Lab of the University of Pennsylvania developed a Neighborhood Information System (NIS) prototype with the support of a grant from the Fannie Mae Foundation.

[2] An annotated bibliography of relevant literature is provided in Appendix 1.

specific information about individual property parcels. That, in and of itself, can help promote better community development. However, information about individual property values, for example, has limited use in revealing patterns for the neighborhood as a whole. On the other hand, in the aggregate, analysis of house values can be used to develop neighborhood price indexes, which in turn can be powerful indicators of the relative economic health of different neighborhoods across time and space. The two uses have different functions. One supplies raw data about land or housing parcels, while the other provides information on the community. However, in general, community statistical systems and neighborhood information systems cannot easily supply the totality of these data sets to support this second function, nor can they update these data in a timely fashion.

We propose here the development of a new approach and a new model for neighborhood information systems. To date, most such systems are hosted at a single location by a single server provide by a data intermediary. The power of an NIS derives from the integration of multiple data layers for interpretation, analysis and discovery of patterns; the relevant data sets change, depending on the user. Space and cost limitations make database storage of all relevant data sets unwieldy and probably infeasible. The alternative and better approach is to develop a distributed web strategy with a different role for the data intermediary. Instead of hosting all requisite databases (and having to continually update them), the databases would instead remain with the original data providers and the intermediary would facilitate the connections between different databases and the end-user. The intermediary would also develop compatibility protocols to ensure that all databases can be integrated into the same GIS template. In addition, protocols for automatic updating of data sets and for determining access would be functions of the intermediary. The potential for this new model of NIS is great since ultimately access could be provided to relevant administrative data sets, currently used for the day to day business of governments, which could then be deployed for informing and improving community development policies.

I. Introduction

In general we can define *Community Statistical Systems (CSS)* as integrated multi-topic, multi-source, administrative databases that enable community residents, local nongovernmental organizations, and local government decision-makers to gain a greater understanding of current and historical neighborhood and city conditions and so enhance the quality of public discourse, planning, and decision-making.

At present, community statistical systems are built on a “data center” model. Individual datasets are loaded onto a data center workstation or server that users access directly to generate maps, analyses, and indicators. As helpful as this approach has been, problems limit its usefulness. The “data center” model is easily overwhelmed as the number and spatial resolution of relevant datasets greatly increases; copies of records on the data center server cannot be easily updated as changes occur because of data storage limitations; administrative records are filled with idiosyncrasies and inconsistencies that are hard to reconcile and subject to misinterpretation; individual data sets are ill-matched with one another, making comparison and integration difficult; and user organizations and community residents are constrained in their ability to analyze the data by sponsor’s decisions regarding software, data organization, and data reconciliation.

To address these issues, there is a need for a next generation model with two major departures from the current model. First, the new model should involve a ***“virtual” data center*** that focuses on shared data services rather than exchanged datasets; government agencies and NGOs should be able to access data distributed over the web through carefully controlled web services. Recent developments in web services, data warehousing, access control, and interoperable geoprocessing components make it practical to consider 'virtual' data centers to increase the flexibility and remove some administrative burden and duplicated effort associated with more traditional community data centers.

Second, the new model would use an **interpretive information layer** through which decentralized users could each build a set of rules for selecting, reinterpreting and cross-referencing relevant administrative records (e.g., to identify properties under common ownership). The reusable infrastructure that enables the interpretative information layer - and the institutional structure that could support it - would allow users to more easily and reliably develop customized neighborhood indicators and analyses from detailed, spatially disaggregated administrative data.[3]

The proposed approach has the potential to facilitate analysis of local data. Further, by enabling neighborhood residents and their representatives in community-based organizations to undertake their own integration of local data and knowledge, the model would enhance the capacity of these users to acquire detailed, nuanced understanding of neighborhood and city conditions. As implementation of the model would lead to more knowledgeable local governments, citizens, and NGOs, the discourse between and among these organizations would be more productive. The result should be an improvement in the appropriateness and effectiveness of local, state, and nonprofit neighborhood-focused programs and services. Moreover, successful implementation of the model should stimulate a significant positive attitude among citizens regarding the notion of digital government.

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[3] Considerable research is needed to identify the software, knowledge representation and integration strategies, and organizational relationships that make it practical and desirable to shift to this new model. University of Pennsylvania and The Massachusetts Institute of Technology propose to collaborate with community organizations and local, metropolitan, and state agencies, to study and prototype the next generation of community statistical systems and the spatial data infrastructure and organizational relationships and capacities necessary to sustain these systems. We are in discussion with local partners to participate in testbeds in Boston, Philadelphia, and Milwaukee. For further discussion, see Ferreira, Reamer, and Wachter 2002.

This paper reviews the literature and the experience of the development of community statistical systems deriving from the original community information networks movement in the 1980s. The paper traces the evolution of these systems into the second generation of neighborhood information systems, or community statistical systems, which with the development of technology provide powerful integration of multiple databases for improved community outcomes. The paper critiques current approaches and suggests the development of a new approach to the provision of community information for improving local community policy. In Part II that follows, we describe the evolution of community information networks and their effects on community information. We then turn in Part III to the further deployment of community information in the form of community statistical systems. In Part IV, we suggest a new role for data intermediaries in their function of delivering community information, as community statistical systems continue to progress to improve community outcomes.

II. CIN – Community Information Networks

A *Community Information Network* (CIN) movement has emerged in the United States, as community groups, data intermediaries, and local government agencies are switching to the Internet for information delivery. CINs have the advantage of carrying any form of information to a large audience at an affordable cost. As new mechanisms of data dissemination, proliferating CINs have expanded the amount of publicly available community information. In addition, CINs have the flexibility to organize information from multiple sources with various levels of sophistication. This new form of data dissemination has potential and may change the nature of the generation and provision of community information.

The CIN -- defined as an Internet website providing community groups and residents with unrestricted data and information in local geographical area -- has become a popular channel through which local governments, nonprofit organizations, educational institutions, and local media disseminate community information. Encouraged by the favorable experience of using websites to reach out to the public in the past six years, these entities have increasingly embraced the idea of developing CINs. Today, more than 200 CINs have been created in the United States for community development, public participation, and local planning. CINs have become important means of public access to community information. They take such multiple forms as a journal of community activities in Seattle (The Seattle Department of Neighborhoods), a provider of Internet access in Forth Collins (The FortNet), an inventory of community asset maps of Cleveland (The Cleveland CIN), blight warning systems in Los Angeles and Philadelphia (Neighborhood Knowledge Los Angeles [NKLA] and The Philadelphia Neighborhood Information Systems), and a constellation of grassroots-level websites in public library system in the Chicago region (The NorthstarNet). The CIN movement has gained momentum recently but because of its short history, few studies on CINs are available.

CIN is a system that provides data and information at the community or neighborhood level with a purpose to facilitate residents and nonprofit and community based organizations to participate in the community development and planning processes. CINs may provide a wide range of local information, such as: community history, social asset maps or profile, calendar and events, listing of local services and business providers, planning reports and studies, development plans and proposals, digital images, other graphic and multimedia representation of the community, demographic and housing statistics, and GIS data and maps.

The potential of Information Technology (IT) has captured the attention of community development practitioners. Current IT development has made possible individual electronic device connect with one another and provided a rapidly improving means of communication. This new form of connectivity is increasingly mobile and interactive. It provides links to expanding data banks and information sources, access to improved capability in managing and analyzing information, and integration with tools such as planning support systems that allow multimedia presentation and videoconferencing. Almost forty years since the Community Memory experiment at Berkeley, the possibility of materializing the original community development vision is more likely due to the ever-evolving and improved technology. The first systematic attempt was at implementing a CIN was the Cleveland FreeNet. Established in 1986, it provided a prototype of the first generation of community network (CN) to connect users to the Internet and to provide access of community information. Under this vision, community residents could use digital devices to instantly retrieve and access community information, communicate and organize without the constraint of space and time, interact with governments in a virtual environment, champion for common concerns by using new representation tools, build social capital digitally, and eventually empower themselves and the institutions in democratic participation.

A number of local communities have devoted efforts and resources to make IT accessible and useful for community development. One of such efforts is the community networking movement since 1986. If information is a prerequisite to informed decision-making, posting large amounts of community information on the Internet may help reinvigorate communities (Goldman, 1991; Kyem, 2002). This belief has encouraged the use of the Web to contribute to local planning community development and public participation (DiMaggio, 2001; Schwartz, 1996). By expanding public access to community information, CINs may minimize the reliance of individuals and community groups on the not-so-easy attainable technical assistance in using data. In the short history of CINs, these alleged benefits have not been ascertained. Researchers have yet to study CINs histories, their nature and variations in approaches. At the operational level, little is known about the types of information posted on CINs, the technological platform, the website organization, interactions between providers and users, and the relationships among CINs. [4]

III. CSS- Community Statistical Systems[5]

While community information networks are focused on outreach and providing information and data to the community, *community statistical systems* (CSS) are integrated multi-topic, multi-source, publicly available databases that enable community residents, local nongovernmental organizations (NGOs), and local government decision-makers to analyze as well as to become better informed about city conditions.[6] Access to data and the ability to view multivariate trends allow the creation of neighborhood indicators.

Community statistical systems provide data on a wide range of topics, including demographics, real estate, housing, education, crime, employment, business development, social welfare, public health, environmental quality, and public amenities. Data are drawn from federal,

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[4] As Wong (2002) discusses the character of a CIN is shaped by its institutional arrangements, the set of values of the project team, and the technical sophistication of staff. As Wong informs, overall, these CINs encompass a number of major information areas. The most common include lists of local services, neighborhood profiles, school information, and community event calendars. Far fewer information areas report real estate transactions, crime and public-order statistics. The most information-intensive CINs are the Aurora Online Community Network in Illinois and Chicago's NorthstarNet. In terms of numerical data, 41 percent provide data tables. Fewer than 26 percent report data at the neighborhood level or in more disaggregated units. In contrast, 80 percent of CINs in educational institutions provide data tables, indicating their quantitative orientation.

CINs vary greatly in technical complexity. Twenty percent of CINs had not completed their websites when the web site examination was conducted. Only one-forth had Common Gateway Interface (CGI) search capability. While one-fourth of the CINS displayed pre-generated GIS maps, only 11 percent provided interactive mapping features. In general, CINs with commercial affiliations invest the fewest resources on technology, while those based in universities and government agencies are more advanced. Outstanding examples are the City of Round Rock in Texas, NKLA, OaklandNet, and Philadelphia Neighborhood Information Systems. The use of electronic forums for communication and the provision of training in data analysis and GIS are not common.

[5] The material in this section and in the following section, "A New Approach," has been taken to a large extent from Ferreira, Reamer, and Wachter 2002. Additionally, see Ferreira 1998.

state, and local sources, and usually include both survey data (e.g., Census 2000) and administrative transactional records (e.g., registry of deeds, police reports, school records).

In recent years, GIS, computer-aided design (CAD), the Internet, and the web have enabled us to digitally encode and share location information about the places and spaces in which we live. These information and communication technologies (ICT) greatly enhance our capacity to visualize and plan metropolitan futures. It is becoming more and more common for local governments, state agencies, and NGOs to use these tools to describe, analyze, and evaluate local impacts at the census tract, zip code, and even at the parcel level.

The large majority of community statistical systems are web - and Geographic Information System (GIS) - enabled. In a typical system, a user can create map-based and tabular indicators by neighborhood to gain a visual and statistical understanding of trends of particular interest (Barndt, 1998, Kingsley et al, 1997).

Community statistical systems are operated by local governments and by NGOs such as community foundations, United Way chapters, university research centers, and community action agencies. While publicly available community statistical systems sponsored by local governments tend to serve broad, citywide constituencies, those sponsored by NGOs are often designed to address issues of particular concern in lower-income neighborhoods, such as poverty, unemployment, non-traditional family structures, street crime, and public education. In general, many NGOs serve as important “policy intermediaries” between residents and government; community statistical systems allow NGOs to perform this role better (Wong and Chua, 2002).

For the most part, community statistical system development has been a “bottom up” activity. Proactive governments and NGOs have independently taken advantage of these technical

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[6] Community Statistical Systems are less focused on outreach and more on statistical analysis for improved community systems

developments to craft new systems. Recently, researchers have examined their evolution as the use of geographic information systems (GIS) has become more widespread, and there has been growing interest in so-called 'public participation' GIS (Harris, 2002). A primary national leader in promoting and facilitating the creation of community statistical systems is the Urban Institute, under its National Neighborhood Indicators Partnership (NNIP) (http://www.urban.org/nnip). At present, NNIP consists of partners in 19 metropolitan areas; 18 of the primary partners are NGOs, one is a local government. Through a peer support process and publications, NNIP is in the process of identifying and disseminating "best practices" in community statistical systems.

Among local governments, the primary national promoter of community statistical systems is Local Leaders for GIS (LLGIS, http://www.llgis.gov), with members drawn from the National League of Cities, the National Association of Counties, and the International City/County Management Association.

Community statistical systems have important technical and institutional dimensions. On the technical side, the development of community statistical systems has been and will continue to be enabled by the creation of powerful personal computers, the development of GIS and database software and standards, and the automation of administrative records. However, on the institutional side, NGO sponsors must develop a good working relationship with local government in order to gain ongoing access to administrative records. The NGO and local government must develop effective means for maintaining confidentiality of particular records. Users must develop the capacity to effectively analyze data. The roles of community residents as data users - and providers - must be articulated and implemented.

While the number and sophistication of community statistical systems is growing quickly, the approach, in both its technical and institutional aspects, is in an early stage of development. To further both model development and dissemination, in March 2002 the Ford Foundation sponsored a three-day conference in Tampa, Florida on the "Next Generation of Community Statistical Systems". Over 160 persons attended; organizations represented included community non-profits, local governments, universities, federal and state statistical and program agencies, commercial data providers, and national professional and trade associations. (The conference was organized by the University of Florida; the conference agenda is available at http://www.shimberg.ufl.edu/conference.html.) According to the participants, the conference was successful in promoting a productive set of exchanges among a diverse set of people and organizations with overlapping interests, but unconnected heretofore.

In response to the sense of the conference, in June 2002 a group of conference organizers and presenters was convened to explore the creation of a network of organizations and researchers interested in facilitating the creation and implementation of next generation of community statistical systems. At the conference and this subsequent meeting, strong interest was expressed in exploring the development of new, more effective models that will enhance the analytic and decision-making abilities of local governments and NGOs

At present, community statistical systems are built on a "data center" model. Individual datasets are obtained and loaded onto a data center workstation or server that users access directly to generate maps, analyses, and indicators (Kingsley, 1999). As helpful as this approach has been, it has several problems that increasingly limit its usefulness. Firstly, the current 'data center' approach involves amassing and redistributing a larger and growing number of relevant core datasets to more and more 'data centers'. However, the "data center" model is too easily overwhelmed as the number and spatial resolution of relevant datasets greatly increases. Additionally, copies of records on the data center server cannot be easily updated as changes occur. Transaction-level administrative records are filled with special purpose codes, spelling variations, inconsistencies, multi-record complications, etc. that are hard to reconcile and subject to misinterpretation. Many individual data sets are ill-matched with one another, making comparison and integration difficult. Reconciling and re-interpreting these records at each data center is difficult, costly, and time-consuming. In particular, most GIS datasets in current use by local agencies and community organization (e.g., census-based demographic data and boundary files for roads, census tracts, and the like) are not readily derived from (or reconciled with) local administrative records and everyday transactions. Property sales, building permits, crime reports, utility hookups, and the like are, ultimately, more reliable and efficient indicators of land use occupancy and neighborhood change (Coulton, 1999). Lastly, user organizations and community residents are constrained by sponsor's decisions regarding software, data organization, and data reconciliation. Such decisions may not fit well with user needs. In general, users lack the capacity to customize data sets for their particular interests and have difficulty integrating 'official' datasets with locally generated knowledge about community assets, habits, interests, and opportunities.

IV. A New Approach

Several specific areas of research on advancing Community Statistical Systems could assist current efforts to improve the analytical power of community statistical systems, promote community empowerment, and facilitate 'public participation' GIS.

The next generation of community statistical systems should address issues through two major departures from the current model. First, the approach would be more of a ***"virtual" data center*** that focuses on ***shared data services*** rather than ***exchanged datasets***. As state and local agencies build data warehouses for more of their administrative data, it would become more practical for individual government agencies and NGOs to access these data through carefully controlled web services. The agencies and NGOs can then focus more staff efforts on accumulating the local knowledge needed to augment and interpret the data.

Second, the next generation model would benefit from an ***interpretive information layer*** through which individual users can build a set of rules for interpreting and reconciling the vast array of administrative records. As a simple example, a community-based organization could create an inventory of "shell" ownership names that a landholder might employ and use that inventory to regroup holdings of 'official' owner names in order to gain a more accurate picture of the land holdings controlled by this individual. By leaving the official records untouched and filtering them on-the-fly through the lookup table, the locally accumulated knowledge in the inventory could be isolated from the read-only official records and more easily shared and reused.

Over time, interpretative layers could be incrementally improved as new information is accumulated and as feedback is gained from using the data. Different organizations would develop customized 'business logic' that addresses their particular neighborhood issues and utilizes their local knowledge. Users could create – and reuse - ever-better interpretative rules as they see fit. In addition, the interpretive layer uses standard database management access controls that could restrict access to the disaggregated data in accordance with privacy restrictions and inter-agency memorandums of understanding.

There are many instances in which data coordination and interpretation issues limit the ease with which spatially-disaggregated metropolitan planning data can be easily and usefully shared and reused. Our approach focuses on using emerging web services and spatial data processing technologies to accumulate reusable knowledge independently from the official databases that they reference. Such an approach is potentially much more empowering of local agencies and NGOs than the current data center model since it provides an efficient way to (re)interpret official data using local knowledge that need not be disclosed and can be readily documented, augmented, corrected, and reused..

This approach has the potential for profound positive consequences regarding government's ability to fulfill its societal mission. By facilitating ongoing and integrated analysis of a diverse array of local data and knowledge, the model would greatly improve the breadth, depth and value of government strategic planning. Further, by enabling neighborhood residents and their representatives in community-based organizations to undertake their own integration of local data and knowledge, the model would enhance the capacity of these users to acquire detailed, nuanced understanding of neighborhood and city conditions[7]. As implementation of the model would lead to more knowledgeable local governments, citizens, and NGOs, the discourse between and among these organizations would be more productive. The result should be an improvement in the appropriateness and effectiveness of local, state, and nonprofit neighborhood-focused programs and services. Moreover, successful implementation of the model should stimulate a significant positive attitude among citizens regarding the notion of digital government.

Community mapping and attention to parcel-level locational detail is especially important in neighborhood-scale planning and the GIS industry which is moving from a 'dataset' focus toward a web services focus that could better support distributed geoprocessing through interoperable components. The new model for supporting community statistical systems would permit significant attention beyond what currently exists to important digital government issues such as security/privacy strategies, partnership agreements, cost sharing, and infrastructure maintenance.

Nevertheless, our approach also requires a set of skills and infrastructure that is too much for most NGOs and small government agencies to handle. How much mileage can one get from the basic

[7] Further applied research on the delivery of data and information to final users is a necessary next step after the development of common technological platforms among data intermediaries.

approach? How practical is it? Who could/should support the virtual data center infrastructure? What is the business plan? What data security and trust is needed? For example, should the system email users of sensitive data, log access, hide names?. Should users be asked to cost share only if they exceed some generous lower limit (e.g., Google now has a 1000 limit on free daily requests to its web service search engine). What is the role for universities, state GIS agencies (such as MassGIS), federal efforts (such as EPA-enviromapper, Fedstats, HUD 2020, FGDC, etc.)? What about the private sector (MLS, application service providers, etc), in addition to the NGOs? Do we need a consortium of public and private partners? Further research is necessary to explore these questions and suggest institutional arrangements that will allow NGOs and local governments to manage community statistical systems.

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