Connected Kids: Community Information System Design and Development

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Abstract

People mean many different things when they discuss democracy in the context of new technologies. However, two relatively consistent themes focus on the advantages that new technologies offer: (1) information democracy, ability to generate more, better information and distribute it to larger audiences, (2) improving the operations of liberal democratic governments by better interaction between citizens and their governmental representatives. However, a major impediment to achieving these goals is the problem of access and the fast development of tools that will allow users to post content to an information system. Further, some of the most useful information should be shared across organizational boundaries. The challenge here is to find ways to satisfy diverse organizational criteria for usability and functionality, while simultaneously enabling community organizations to contribute to a cross-organizational community information system. Connected Kids is a collaborative project bringing social science and computer science researchers together with representatives of city and county government in RPI's home town of Troy, New York and a wide variety of not-for-profit youth service agencies to develop a community information system (for details, please see *http://troynet.net/ConnectedKids*).

1 Introduction

People mean many different things when they discuss democracy in the context of new technologies (Harrison & Falvey, 2001). However, two relatively consistent themes focus on the advantages that new technologies offer for (1) information democracy and for (2) improving the operations of liberal democratic governments. In the case of information democracy, it is argued that information technologies make it possible to generate more and better information and that the superior distribution capabilities of computer networking make it possible, in principle, for more people to access this information (Doctor, 1992). With respect to improving the operations of liberal democratic governments, the idea has been that new technologies make it possible for citizens to interact more closely with their governmental representatives, to gain access to services provided by government organizations, and to increase the involvement of citizens in public sector decision making (Brants, 1996; Frissen, 1997; Heeks, 1999a; Loader, 1997).

A major impediment to achieving both of these goals is the problem of access. A recent report issued by the US National Telecommunications and Information Administration (NTIA, 1999) documents significant disparities in Internet usage, and access to the computing equipment that enables such use, based on income, ethnicity, and geographic region. Specifically, those who are Black or Hispanic, those who live in rural areas and impoverished central cities, and those with lower incomes are less likely to have access to the Internet and access to a computer at home. In this context, computerized community networking projects have assumed substantial importance as social innovations that attempt to address the disparities of the digital divide (see Keenan and Trotter, 1999).

Assuming that access to existing networked information can be provided, there are still considerable challenges to face in creating useful information tools. Keenan and Trotter (1999) remind us that access is also a matter of being able to post content to an information

system. As Cowan, Mayfield, Tompa, and Gasparini (1998) remind us, communities are repositories of large amounts of diverse information. However, it is difficult for community organizations to acquire the technical and social resources needed to develop or contribute to information systems that make this information accessible to others who would find it useful.

Further, as many working on government sponsored information systems have realized, some of the most useful information should be shared across organizational boundaries and thus requires the development of collaborative information systems to pool and distribute (Dawes, Bloniarz, & Kelly, 1999). The challenge here is to find ways to satisfy diverse organizational criteria for usability and functionality, while simultaneously enabling community organizations to contribute to a cross-organizational community information system.

Connected Kids is a collaborative project bringing social science and computer science researchers affiliated with Rensselaer Polytechnic Institute (RPI) together with representatives of city and county government in RPI's home town of Troy, New York and a wide variety of not-for-profit youth service agencies to develop a community information system. The Connected Kids project seeks to develop software for a database system that can be used to pool information about youth programs and services sponsored by community organizations and supported through local government funding programs. Beyond service providers themselves, this information ultimately will be delivered via the Web to a number of other audiences including students between the ages of 10 and 18, their parents, and social support personnel such as teachers, guidance counselors and social workers.

One goal of this project is to develop a software application that will serve as an effective system for distributing information about youth service programs to the local community and that has the potential to be customized for use in other locations by organizations serving common public audiences (perhaps other government-funded organizations) to pool information about their programs. To this end, we are developing database tools and methodologies that will help reduce the development cost of community based information systems. A second goal of this project is to explore the social processes by which collaborative information systems in communities are constructed and adopted by multiple organizations.

2 Project background

The Connected Kids project presents an opportunity to observe over time how organizational and community-oriented considerations are reflected in reactions to and decisions made about software development by collaborators in the creation of a community information system. The need to develop collaborative information systems in communities that can be used effectively by diverse organizations is certainly not unique; we expect that our case study will have something to say about how such development should occur. However, the particular circumstances characterizing a given collaboration are likely to affect, in important ways, how that collaboration occurs and what its outcomes are.

Although Rensselaer Polytechnic Institute has consistently ranked highly on Yahoo's annual list of most wired campuses, most organizations in the city of Troy have not had substantial access to information technology tools. Thus, the development of our community information system presented a situation in which relatively expert academic users have fostered the creation of collaborative relationships with relatively inexpert users working in demanding community-oriented professions. Although there has been no comprehensive study of technology use patterns in Troy, New York, the city presents a demographic profile similar to that which the NTIA (1999) has recently characterized as experiencing significant disparities in access to technology. That is, the population is poor, clustered in an aging urban central city, comprised of significant minorities, and poorly educated.

The Enlarged City School District of Troy presents the greatest concentration of Internet accessible computing facilities in the City, having recently launched a district-wide computerization program that has installed a computer lab apiece at each of five elementary schools, two computer labs at the newest elementary school, and eight state of the art computer labs in Troy High School (which shares facilities with the middle school). School District buildings are interconnected through an FDDI ring; Troy High School is linked through fiber to the internal network at Rensselaer Polytechnic Institute, through which it receives access to the World Wide Web. Beyond this, government and community organizations in Troy have recently become alive to the possibilities presented by information technology. The City does not yet offer access to the In-

ternet to all of its employees. However, it has recently invested nearly $150,000 in constructing a fiber conduit path toward the creation of a municipal network that would link City government to RPI, the school system, and to Rensselaer County government buildings. The City further funded the creation of a public access computing facility with 25 machines, which opened in October, 1999. In 2001, the City received a grant from the 3Com Corporation's Urban Challenge Grant Program to provide basic equipment for local area networking to not-for-profit organizations and government offices in Troy. Many not-for-profit community organizations that serve the City have recently acquired computers and Internet connections, use email, and are beginning to inquire about how computer networking and information technology tools can facilitate their organizational missions.

Three years ago, Rensselaer Polytechnic Institute supported the creation of a demonstration community networking web site named TroyNet (see *http://troynet.net*), which has served as a focus for pedagogical projects and for outreach to the community. With respect to pedagogy, for the past three years, graduate and undergraduate students enrolled in Web Design for Community Networking have worked closely with community representatives to design and develop numerous content modules presenting information about Troy's history and culture, business opportunities, tourism, and other topics in support of community development (see Harrison, Zappen, Stephen, Garfield, & Prell, 2001; Harrison, Zappen, Prell, forthcoming). As a result of this activity, we and our students have been asked by local government and community organizations to develop more complex information resources to support their activities. For example, we have designed and programmed a database driven community calendar that requires no knowledge of HTML to administer and is maintained by Troy's RiverSpark Visitors Center (see *http://troynet.net/calendar*). Further, Troy City Government currently uses the TroyNet web site to distribute a variety of information related to local government activities (see *http://troynet.net/government*).

When City Government decided in Fall 1999 to reorganize its administration of community development funding for youth, the Deputy Commission for Community Development and Planning approached us with a request to help conceptualize how information technology might address a problem they had identified. The problem: City and county governments administer several funding programs (e.g., Community Development Block Grant Funding from the Department of Housing and Urban Development) to community organizations in the area offering educational, vocational, after-school, recreational, and counseling programs and services to youth. However, there is no central point of distribution for information about these services. In order to find out what is offered, one must literally call a couple of dozen different organizations and ask to receive their literature or speak to a representative. City government wished to establish a central information clearinghouse to which they could direct interested parties and that could be used by community organizations themselves to identify areas of both need and service overlap. If this problem can be solved through the development of a collaborative information system, the City is committed to deploying the system in support of its activities. This request has given rise to the "Connected Kids" project.

3 Collaborative development of information systems

The collaborative development of a local community information system depends upon initial formulation of the needs, resources, and abilities of people in the community whose interests the system is intended to serve. The initial formulation of the need and the specifications for the system is the fundamental problem that must be solved before the system can be developed and deployed.

The problem will present itself in any local community but will be particularly acute in a community characterized by a digital divide, and the wider the divide, the more acute the problem will be. Our own community of Troy, New York, is a typical decaying Northeastern city, with a substantial minority population, low income levels, low levels of educational achievement, all clustered in an aging urban central city. Home to two major colleges, the city nonetheless has a population of only 18.4% with bachelor's degrees, according to the 1990 census. It is a mirror image of the digital divide. One of the main objectives of the Connected Kids project is to let various user groups input their perspectives in the development of the system. As an initial

step, representatives from various community organizations participated in focus groups to discuss their needs with respect to such a system.

To accomplish this task, early in the development of the project (in February 2000), the design team together with representatives of the Planning Department of Troy City Government hosted a general information meeting about the Connected Kids project. Discussion was led by the project leaders and included showing a sample site, which attendees were encouraged to explore for a few minutes, and then comment on. Most meeting attendees indicated their interest in being involved in future work with the Connected Kids project.

In October 2000, the design team hosted a series of four 1-2 hour focus group discussions to consider issues related to the conceptualization and initial design of the information system that would form the core of the Connected Kids project. A total of 27 individuals participated in the four focus groups. They represented 11 not-for-profit social service agencies in Troy, two school districts, the local County department of youth services, and four units within the City government (youth recreation services, community police, information services, and the planning unit), a total of 18 organizational units. The discussions were facilitated by an independent female consultant with significant experience in leading focus group discussions. She was also a resident of Troy. The facilitator worked with the design team to create a protocol, which was followed in each of the group discussions. The project leaders did not physically attend the meetings, although they met with participants and escorted them to the site of the discussion.

Preliminary results from these focus groups suggest that the specifications for a local community information system will have to include some attention to (1) the nature of the system, (2) the needs of the information providers, and (3) the needs and characteristics of the relevant audiences for the system. Other audiences also participated in similar focus groups, and the results of these meetings are also being analyzed. The findings show that the system itself will have to provide a central source of information for youth-services organizations to share with each other, a "funnel" to direct visitors to their own webs, and a means of creating a web presence for organizations that do not already have one. From a technical perspective, this requires the development of a system based on a commonly agreed data model. The system will also have to provide information about the organizations, their programs or services, and their events and activities. It will have to minimize duplication of data entry and will have to be easy to update and maintain.

Information providers indicate their need for a source of contact information about other organizations and specific contacts for specific programs and events, for purposes of referral. They indicate further their hope and expectation that such a source of contact information will encourage collaboration between and among organizations and that the system itself will provide a forum for discussion of mutual concerns and the pursuit of common goals and interests. But some information providers indicate that they will need to see the results of the focus-group discussions before they can feel confident about the possibilities for mutual support and collaboration with representatives from other organizations.

Information providers also indicate a need to serve the members of their own local community with sensitivity to their relatively low levels of income and education. They expressed particular concern about the need to provide information about day-care and summer activities, about appropriate activities for low-income kids, about locations of these activities for parents and kids with limited access to transportation, and about access to information for parents and kids who have neither computers nor Internet access nor knowledge of how to use these resources. They also expressed concern about the need to conduct discussions about these issues directly with parents and kids in our own community.

The initial formulation of the need for a community information system thus indicates a need for a complex, multi-purpose system that provides a variety of kinds of information resources and serves a variety of audiences or user groups. This initial formulation will have to be confirmed and refined by continued consultation with community members to ensure that the development of the system is in fact responsive to community needs, as the community perceives them. Connected Kids researchers/designers have initiated development of a youth-services information system and are currently conducting participatory-design and additional focus-group meetings with members of youth-services organizations, teachers and counselors, parents, and young people. As a result, we are continually refining

and enlarging our understanding of the communities' resources, needs, and abilities and are modifying the system accordingly.

4 Database Methodology

The information system described above needs to incorporate two related and conflicting design principles. It needs to be tightly coupled, in the sense that the users searching for a specific type of information can find that information with fairly simple query formulations. This means that different information providers will have to modify the way they represent the information to conform to a common model. On the other hand, the system also has to be flexible by allowing providers to represent and display information in different ways. The organizations participating in focus groups voiced their concerns about the ability to preserve their identity in a shared information system. This requires that the information providers have the ability to customize a great deal of their information space, both the content and the presentation that they are presenting to the outside world (Candan, Prabhakaran & Subrahmanian, 1996). However, the system has to maintain complex dependencies between information units in the background.

Collaborative information systems also require the system to evolve and change frequently. This means the data model, the content and the representation of the system might be evolving at the same time. All these are interdependent components of a complex information system. Changing all requires considerable programming effort, either at the time of the change or beforehand as a functionality of the system itself. It is also important to note that the underlying technology that such information systems are built upon is constantly changing. Hence, a robust system should be lightweight with very few specialized functionalities built into the system. Most common functionalities should be provided by external systems that can be plugged in when required.

One of such functionalities is the ability to track changes and recover from mistakes. Change management is a very well studied problem in databases, but is not easily supported for information systems that combine database content with a presentation layer that is visible to the users. When the users are allowed to change both the content and its representation, the problem becomes even more complex. When versioning type software is adopted for such information systems, the dependencies between various types of changes have to be taken into account. Earlier work in schema-restructuring (Koeller & Rundensteiner, 2002) is a good starting point for implementing this functionality. In this case, the problem of propagating changes in the data model to views over this data is presented. Another view is the management of changes to underlying documents in an XML warehouse, where each change is local to a specific document (Marian, Abiteboul, Cobena & Mignet, 2002). However, this work does not take into consideration the dependencies between different types of documents. An important extension of these approaches is to allow users to view many different types of changes made to a system, accept and revoke changes selectively and propagate the effects of previous decisions to the current system.

Programs that allow users to create new information units and customize interfaces are either very complex and sensitive to changes in the data model, or very simplistic and are not interesting to the users. However, it is possible to consider how data is customized can be parametrized and incorporated into the core data model. One possible view of customization is a data manipulation language over the existing data types. This means users are allowed to create copies of similar content and modify it for their use. This language will also make the change management and detection easier. While how the system evolves is described at a higher level with the help of primitive operations, the mappings to a specific programming environment will allow the system to evolve over time with little programmer effort and maintenance (Adalı, Sapino & Subrahmanian, 2000). Furthermore, as the overall look and feel of the system changes over time, it will be reflected easily in the customized information spaces of individual users. It is important to note that the database functionality discussed above should be incorporated into an existing system by making use of the existing tools as much as possible.

One of the desirable components of a collaborative information system is the ability to establish and maintain links between systems and people. As an example, consider the ability to upload information from a web site to a database and then automatically propagate any new changes from the web site to the database. Another possibility is to make referrals from one orga-

nization to another. These links involve (1) complex dependencies between the content of possibly independent sources, (2) existence of policies that authenticate, allow or deny users to create these links through some pre-defined steps, (3) mechanisms to detect or propagate such changes consistently. As the system evolves towards one that maintains complex interdependencies between different types of information systems (such as a backend database and a presentation layer) and different information units (such as the customized information space about a specific organization), we will investigate how users can specify such relationships between existings systems through the use of such protocols.

5 Conclusions

From the computer science side, the Connected Kids project involves research in the technical aspects of collaborative information systems. The research problems discussed above are being investigated as part of this effort. The results are being integrated into the existing information system that is being developed independently using common programming tools. From the social science perspective, it explores the social processes by which collaborative information systems in communities are constructed and adopted. Different audience groups are being polled for their unique perspective on the creation of such a system. Our aim is to create tools and understanding that will be useful in bringing together different community resources in the context of an information system.

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