The IASSIST QUARTERLY represents an international cooperative effort on the part of individuals managing, operating, or using machine-readable data archives, data libraries, and data services. The QUARTERLY reports on activities related to the production, acquisition, preservation, processing, distribution, and use of machine-readable data carried out by its members and others in the international social science community. Your contributions and suggestions for topics of interest are welcomed. The views set forth by authors of articles contained in this publication are not necessarily those of IASSIST.

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The first page should contain the article title, author's name, affiliation, address to which correspondence may be sent, and telephone number. Footnotes and bibliographic citations should be consistent in style, preferably following a standard authority such as the University of Chicago press Manual of Style or Kate L. Turabian's Manual for Writers. Where appropriate, machine-readable data files should be cited with bibliographic citations consistent in style with Dodd, Sue A. "Bibliographic references for numeric social science data files: suggested guidelines". Journal of the American Society for Information Science 30(2):77-82, March 1979. Announcements of conferences, training sessions, or the like, are welcomed and should include a mailing address and a telephone number for the director of the event or for the organization sponsoring the event.

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What is EconData?
In July 1996 NIWI’s Steinmetz Archive started the project EconData to establish a Dutch data service for economic data. This service will be integrated with the current activities of the archive. EconData builds on previous feasibility studies conducted by the Economic and Social Institute (ESI) in Amsterdam and the Economic Institute Tilburg (EIT). Both of these studies have been funded by the Netherlands Organization for Scientific Research (NWO). For EconData the Steinmetz Archive receives additional funding from NWO. This grant follows a recommendation by the Social Science Council (SWR) of the Royal Netherlands Academy of Arts and Sciences (KNAW).

Aim
EconData aims at broadening the scope of the Steinmetz Archive. New services will be established to support economic research, including macro-economics, business economics and economic modeling. In addition the more traditional functions of a data archive, EconData puts strong emphasis on data brokerage. The data service will act as an intermediary between suppliers of economic data and data users. This will include suppliers of international data and users of Dutch data abroad. For this purpose the project plan includes the establishment of an online register of available data sets, irrespective of whether these data sets are available from the Steinmetz Archive or from other sources. EconData will be evaluated in September 1998.

Registration
EconData will establish a public register of economic data files. Owners of data are invited to register data files which are suitable for secondary analysis. In addition to actual information on the data files, including information on the data owners and the conditions for use, special attention will be given to key information which will allow users to quickly and efficiently locate relevant data files. Furthermore, summaries on the contents of data files will be given to provide users with quick impressions of the possible uses of the data files. The register will be offered to users in two forms: a publication (from the Steinmetz Archive) and an online database (accessible through the Internet) which will be updated and expanded on a regular basis.

Mediation Service
The public register of economic data files will serve as a starting point for EconData’s mediation service which will facilitate negotiations between data owners and users. EconData will not only promote contact between these two groups but also represent users in negotiating data access with data owners. Furthermore, through mediating access to Dutch economic data files, EconData also hopes to expand its archive. In addition to mediating the acquisition of economic data files in the Netherlands, EconData aims to play a role in negotiating access to international economic data files. For this, EconData-Data utilizes the extensive experience of the Steinmetz Archive in the field of international data archive cooperation. The Steinmetz Archive represents the Netherlands as coordinator within the Inter-university Consortium for Political and Social Research (ICPSR), the managing body for the world’s largest collection of scientific data files which include many economic data files. The Steinmetz Archive is also an active member of the Council of European Social Science Data Archives (CESSDA) which oversees a cooperative network of European data archives on the Internet.

Data Guide
The Data Guide is the first inventory of economic data files from a number of important archives. This inventory also includes approximately 100 relevant files which are available from the Steinmetz Archive. Other archives covered by the Data Guide are those in the United States (including ICPSR), Australia, the United Kingdom, Germany, and Sweden. From these archives, a selection was made of data sets which would be of interest to Dutch economists. The Data Guide provides key information on each file as well as references to information on economic data files available on the Internet. Furthermore, the Data Guide contains information on micro economic data files of Statistics Netherlands which are, in part, available through the Statistical Services Agency (WAS). Finally, the Data Guide provides information on Belgian and German panel data files. The Data Guide can be ordered from the Steinmetz Archive (price: 25 Dutch Guilders plus shipping). Please post or fax orders to the address listed at the end of this paper.
Further Possibilities
EconData aims to stimulate data owners of registered data files to place their data in the care of EconData's archive. Such an arrangement offers the following advantages for data owners:

- secure storage of data and corresponding documentation
- description and documentation of data according to international standards
- systematic collection and documentation of publications based on secondary data analysis
- exposure of the research to the national and international scientific community
- increase of the yield of data collection through secondary analysis
- handling of inquiries from users and administrative management

Results So Far
Up until April 1998 more than 200 economic data sets have been registered. Descriptions of most of these data sets are available in the on-line database. Since the beginning of the project more than 40 economic data sets have been deposited at the Steinmetz Archive. These data sets are available under standard conditions to users of the Steinmetz Archive.

NIWI/Steinmetz Archive
The EconData project is carried out by NIWI's Steinmetz Archive. The Steinmetz Archive currently manages approximately 2700 data files in the field of social science research and has 30 years of experience in collecting and providing access to social science research data files.

Standard procedures have been developed by the Steinmetz Archive for the acquisition, protection of privacy, storage, provision of access and the documentation of data files. The Steinmetz Archive has an extensive network of contacts with data suppliers who can also supply economic data files. The archive has exchange contracts with data archives outside of the Netherlands. On the Web site of NIWI one can find links to diverse archives for extended search and access possibilities. Furthermore, search facilities are available for data file users at the archive. Each quarter, the Steinmetz Archive issues Data News, a newsletter which among other subjects, announces new additions to the archive. Three databases are available free of cost, of which the most important database is STAR. This database contains descriptions of the studies from the main collection of the Steinmetz Archive. STAR is accessible both at the Steinmetz Archive and on the Internet. There is also an order form for data files available at the Web site.

Contact Person
Since July 1996, Albert Bots has been appointed by the Steinmetz Archive as project manager for EconData. In addition to supervising the activities of EconData, Albert Bots is also active as a lecturer at the Faculty of Economics of the Free University in Amsterdam. Albert Bots can be reached at the Steinmetz Archive for further inquiries.

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The International Association for Social Science Information Service and Technology (IAASSIST) and the Canadian Association of Public Data Users (CAPDU) announce their joint 1999 conference, "Building bridges, breaking barriers: the future of data in the global network".

The conference will be held May 16-21, 1999 on the University of Toronto campus in Toronto, Ontario and will address issues of computing and information services in social science research, teaching, and data management.

This is IAASSIST's 25th annual conference, and the ninth CAPDU conference.
The New Jersey Environmental Information Network: Providing Access to New Jersey's Environmental Literature

Introduction

The environmental situation in New Jersey is complex. The state is replete with areas tremendous natural beauty: pristine beaches and sand dunes, lush green countryside, historic towns, rolling hills, scenic river valleys and mountain overlooks, lush wetlands, and dense pine forests. By many measures, however, New Jersey is the most polluted of the United States’ fifty states, and its environmental heritage is undermined by past and present treatment of the environment. Efforts to remediate environmental damage resulting from New Jersey's industrial history and current industrial practices, and attempts to preserve open space through intelligent management of future development, have resulted in a tremendous amount of scientific study within the state. However many, perhaps most, of the resulting research reports are unpublished, elusive, and unavailable for secondary research purposes.

This paper will outline the efforts of a partnership in New Jersey to make environmental information widely and readily available. In addition to discussing the project’s background and implementation, we will cover in some detail the technological considerations for creating a web-based product that will be used to manage and query diverse information types. This discussion will include: determining system architecture and requirements, database design and programming, design of user interface and graphical design for web accessibility, and need for awareness of and compliance with current information technology standards. These are general issues, which all producers of end-user information systems must address.

More specifically, this paper will discuss the technological issues involved in building a database based on a topical and geographical approach to information management. The New Jersey Environmental Information Network is neither a digital library nor a traditional catalog/index to information; it is a hybrid of both, and it encompasses all available media and formats important to the study of the environment. The NJEIN contents range from print inventories of species within a geo-region to directory information about local experts to digital models and GIS layers. The hybrid nature of the product has given rise to some unusual data management issues.

by Ron Jantz & Linda Langschied*

Project Description:

The New Jersey Environmental Information Network (NJEIN) is a prototype of a web-based environmental information system for New Jersey ecosystems. The authors' participation in this project is as members of the New Jersey Ecological Research Partnership, a group of academic, non-profit, and corporate organizations concerned with making scientific information on the environment available to all potential users. Special emphasis is placed on making scientific research available to enable sound decision-making processes within the state.

The specific goals of the Partnership include:

• developing consistent, quality assured data and data dissemination mechanisms;
• promoting involvement of the public in data collection, utilization, and education;
• promoting mechanisms to facilitate transfer, access and use of environmental information.

The NJEIN was envisioned by the Partnership as the appropriate mechanism for realizing these goals. Working with New Jersey’s Department of Environmental Protection and Rutgers’ Ecopolicy Center the authors, representing Rutgers University Libraries’ Scholarly Communication Center, have received support to develop a first version of the prototype. A conceptual description of the NJEIN would include these essential elements:

1. NJEIN will serve as an electronic clearinghouse of information about the New Jersey environment that can be queried by location, topic, or both.

2. It encompasses all topic-relevant information, regardless of physical format.

3. The system provides retrieval of located sources through:
   a) downloading of data;
   b) “scan-on-demand” system for non-digital objects (fee-based);
c) web links where available;
d) referral to a physical repository where appropriate.

4. The NJEIN will grow as items are entered into the database by data holders/producers, rather than by librarians/information managers.

5. NJEIN’s structure (both intellectual and technological) reflects an emerging concept of “place-based management” which is being embraced by multiple federal and state agencies; it also acknowledges the naturally-occurring approach to environmental studies that scientists and other researchers employ. The importance of place-based information organization is particularly manifested in the prominence of GIS usage by environmental researchers. Therefore we determined that all items entered into the database, whether digital or non-digital, will be geo-located and thereby retrievable by geographic query of the database.

6. Because of the foregoing, and in order to accommodate the GIS data layers produced by the New Jersey Department of Environmental Protection and others, the NJEIN will utilize the FGDC metadata standard for descriptive cataloging of items in the database.

7. Particular emphasis is given to capturing the abundance of “gray” literature and data that is produced in the state, often through project-specific research done by consultants, and making it available for secondary research.

New Role of Librarians in Information Systems Design:
The development of the NJEIN in a library setting illustrates the rapidly changing role of librarians in providing information access to electronic information. A decade ago, electronic information service librarians acted as the intermediary between patrons and remote, command-driven databases; with the advent of end-user systems, librarians became coaches to hands-on users. New tools and, perhaps even more importantly, new institutional imperatives (in particular, the impetus to create digital libraries) have contributed to reshaping the librarian role yet again, with librarians entering the picture earlier in the process as participants in creation of electronic products.

Developing the NJEIN, an electronic information tool intended for all levels of research from a diverse user community, requires an application of technology that is sophisticated enough to satisfy expert scientific inquiry, yet friendly enough for the interested citizen. The New Jersey Ecological Research Partnership elected to seek librarians, rather than systems programmers, to lead the project’s design and development in the belief that technology is only as good as a deep understanding of the needs of its users. Using this interpretation, the field of librarianship does embody numerous characteristics that are essential to assuring quality development of this kind of product. Among them are:

1. Direct experience in user services: Librarians employed in public services and collection development have a demonstrated understanding of what kinds of data users seek, and they strategies they employ in information seeking.

2. Experience with information needs of a diverse audience: The Project’s primary intended audience is those officials in New Jersey (e.g., municipal and county administrators, planning boards) who are charged with local decision-making that could effect the environment. But a corollary goal is to make the same information available to those people who might influence government decision-makers: New Jersey’s scientists, students, and citizens. Librarians are accustomed to working with a diversity of users, and could anticipate and account for differing levels of user skill in accessing information, particularly in designing a user interface for both entering and searching the database.

3. Technological skills: While these skills could have been obtained from other sources, as noted above, the project leaders among the Partnership (scientists from the Department of Environmental Protection and Ecopolicy Center) expressed great concern that systems programmers might not have adequate knowledge of or sensitivity to end-user needs. Therefore, their preference was that information specialists would take the lead in bringing the project online. Fortunately, recent organizational and technological developments in Rutgers University Libraries ensured that the Library is prepared to undertake the development projects like NJEIN. In particular, the creation of the Scholarly Communication Center (SCC) within Alexander Library, Rutgers’ graduate library for social science and humanities research, provided a foundation for digital initiatives.

Placing the Project: the Scholarly Communication Center
It was, in fact, the Scholarly Communication Center which drew the original Partners to the Rutgers libraries. In order to meet the dual requirement of user-orientation design and sophisticated technological application, the Partnership sought to join forces with librarians adept in both areas. Ultimately, they were referred to the librarians involved with planning Rutgers University Libraries’ Scholarly Communication Center (SCC). The SCC, officially opened in October 1998, is a technological research, teaching and learning center. Its components include:

1. A teleconference lecture hall, which gives presenters
access to a plethora of multimedia presentation options, has satellite uplink/downlink capabilities, and interactive distance conferencing technology. Locally, this facility allows us to hold meetings among Rutgers three distant campuses; it recently enabled journalists in Poland to “attend” a discussion on contemporary international journalism with faculty from Rutgers School of Communication, Information, and Library Studies.

2. Two hands-on, multimedia infused computer classrooms. The classrooms are used primarily to deliver hands-on instruction, and one lab has distance education capabilities.

3. The Humanities and Social Science Data Center, which serves as the hub for reference services, and for research and development activities for the SCC. The Data Center is intended to serve as a testbed site for creation of new information tools. One of its first projects was to bring online the public opinion polls conducted by Rutgers prestigious Eagleton Institute of Politics.

In making the decision several years ago to raise the $3 million dollars to build the SCC, our institution committed itself to a technological future. Creating and maintaining this facility necessitated our hiring of new talents. Thusfar, we have revised open positions to create new placements for an Information Technology Librarian, Data Librarian, humanities computing specialists, and system programmers.

While Rutgers librarians, as members of the faculty, have tremendous autonomy in setting their professional priorities, large projects undertaken by librarians are expected to conform to overall institutional priorities. In evaluating whether to assume the development of the NJEIN as an SCC project, the librarians looked to the Mission Statement of the SCC which includes the following goals:

To serve as a testbed and demonstration site for the application, development and evaluation of electronic resources by:

- Providing opportunities for developing electronic resources, multimedia programs and for handling electronic data, text and images.
- Providing guidance, instruction and training in the development, use and evaluation of electronic resources in all formats.
- Delivering remotely accessible resources in support of the goals of the educational and research mission of the University.
- Fostering specialized projects using resources of particular interest to the Rutgers community and the state of New Jersey.

The development of the NJEIN clearly fit the articulated goals of the SCC, and the decision to join the partnership was made. The SCC would “host” the NJEIN, and its librarians would undertake project development with financial support from the New Jersey Department of Environmental Protection.

Summary
Our ultimate vision with the NJEIN and similar efforts is to develop focused, domain specific collections that are of specific interest to the Rutgers University community and the citizens of New Jersey. Through these efforts, we hope to impose structure and access methods on a large amount of very useful, but also distributed and uncataloged information.

Traditional librarian skill sets in describing and organizing information, and in providing user education services, as well as new technological ones, are critical to projects such as NJEIN. Nevertheless, many (probably most) libraries will not have all requisite skills in-house, and that is true of this project. Developing the NJEIN is an illustration of the need for collaboration and partnership in order to meet shared goals among diverse stakeholders. In this instance, we refer to the environmental scientists, creators and users of data, and librarians/information technology specialists — all are critical contributors to NJEIN, and its success depends on a continuing partnership. What is at stake is the future of decision and policy making within the state. We are very proud to be a part of a process that will help to preserve New Jersey’s environmental heritage.

Designing the NJEIN
Design Methodology.
It is appropriate to say a few words about our design methodology. Traditional methodologies have generally required a static set of requirements that precede the development phase. This approach frequently assumes that the analyst can somehow anticipate and understand all the complex interactions that might occur in an information retrieval system. Our approach has been to embody the requirements in a prototype which allows us to see the interactions and introduce the product at a very early stage to potential customers. Hence our requirements document is, in effect, the prototype. This approach has enabled a highly interactive and iterative design process in which we might make several changes to the prototype in one day. We have been able to do this and still keep the prototype up and running while students continue to load data into the NJEIN. Many development organizations have found that prototyping is one of the most effective methods for determining system requirements. Finally, we have taken the approach that there is a small design team that controls the design of the system and the database. Systems cannot
be designed by committee; the design team enters into many discussions about the design in committees, small groups, and one-on-one interactions. The resulting design changes are integrated into the prototype where the team makes final decisions based on user needs, technology available, schedule, and other factors. These approaches have been used in other information retrieval systems (Crawford, 1996) and many other similar product developments.

Although the NJEIN is still in prototype form, our efforts so far have allowed us to learn much about the types of information that will be entered into the database, the user interface, and the definition of the database.

NJEIN Architecture and Platform.
To a large degree, the SCC is acting as a “technology conduit” into the Library; we want to explore various technologies, use the technology in prototypes and hopefully help promulgate stable technology platforms throughout the various Rutgers University libraries in many useful applications. One of our objectives is to establish a technology platform that can be used repeatedly for similar types of applications such as providing access to a variety of databases on the Web. As our university addresses how it will acquire and deploy digital material (Sewell, 1998), we want to have platforms in place that can be used by librarians and others to provide access to electronic resources. Basically, a platform is a set of identified components that work well together and remain relatively stable over a period of time. This approach allows developers to become experts and the components to be thoroughly tested so that reliability is increased and learning time is decreased. The primary platform components are illustrated in the discussion of the NJEIN architecture below.

The architecture for the NJEIN is relatively simple and is illustrated in Figure 1.

We have incorporated off-the-shelf software that has been frequently used in other database applications in the SCC (e.g., Eagleton Archive, Event scheduling, Microforms database) with the objective of standardizing on software components to minimize maintenance and support efforts. Three basic Web-enabled functions are available: 1) create/modify the reference database, 2) search/browse the reference database, and 3) retrieve/download the digital document when available (e.g. scanned text document, image, or numeric data). The primary components of the

![Figure 1 - NJEIN Architecture](image-url)
computing and application platform are NT 4.0 with Internet Information Server, FrontPage, Cold Fusion, and MS Access.

Using FrontPage and Cold Fusion, the process of providing database access on the Web is fairly straightforward and can be accomplished simply with SQL statements and without writing a complicated script. From an architectural point of view, the important part of this diagram is the role that Cold Fusion plays in enabling access from the client workstation to the server reference database. The Cold Fusion server processes database requests through the use of templates. The templates are similar to an HTML file with a "cfm" extension and special CF (cold fusion) tags which the server recognizes while ignoring the regular HTML statements. Using these tags and the SQL query language, one is able to quite easily design web pages that will create database records or alternatively query the database to retrieve information based on a user request. As a result of a database query, output is passed back to the web server from the Cold Fusion server in order to create a dynamic web page. As Figure 1 indicates, we are running Microsoft's Internet Information Server (IIS) which has three major features which make all of this possible: 1) Internet Database Connector (IDC) which provides built-in access to ODBC databases. 2) security integrated with Windows NT, and 3) ISAPI, a robust high-performance method of communicating with gateway programs (Blum, 1997).

The Reference Database.

Description.
The Reference Database contains descriptive and access information about the document. Our subject domain is focused on the environment and is geographically limited to New Jersey and surrounding areas (e.g. adjacent states) that might have an impact on the environment of New Jersey. The audience for this database is just about anyone in New Jersey: students, practitioners, scholars, researchers, New Jersey citizens, and decision makers. The medium is primarily print on paper and electronic text and images although other media such as microfilm or video will not be excluded. The document format includes reports, inventories, studies, theses, map images, numeric and GIS data. The domain deals with the sources of data and where and how these data are found, selected and acquired. For the NJEIN, as mentioned previously, we will be focusing on what is sometimes referred to as "gray" literature, or literature that has not been catalogued or indexed.

![Table](image)

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<td>8.6 Data Present Form</td>
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<td>8.10 Online linkage</td>
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Figure 2 - Major Fields in Reference Database

Spring 1998
Previously. Our sources will be primarily universities, institutes, governments at the county and township level, and consultants who do work for New Jersey state and local governments.

Metadata.
Definition.
There are many definitions of metadata and the following operational definition (Ng, et al) highlights the flexibility required in an Internet environment:

*Metadata is data which characterizes source data, describes their relationships, and supports its discovery and effective use.*

For our database, we wanted a metadata scheme that was very flexible and would support both intrinsic aspects of the document (e.g. subject, title, etc) and also extrinsic aspects related to administration and non-bibliographic issues such as size or system requirements. Further, we knew that many of our documents would have a geospatial component. Given these requirements, we have decided to use a subset of the Content Standards for Digital Geospatial Data (Federal Geographic Data Committee) for the definition of the reference database. Our reasons for doing this are as follows:

- A subset allows us to have a relatively simple database so that users (non-specialists) will be able to enter data into the Reference Database.

- Using a subset of the FGDC standard will allow us to map our data to other FGDC databases with the objective of being able to exchange data with other organizations and institutions.

- Using the FGDC standard will enable us to take advantage of many of the continuing efforts that are producing related tools such as parsers and compilers.

- We want to be closely aligned with state and federal efforts related to GIS. A 1994 presidential Executive Order has directed federal geographic information to be described using FGDC (Executive Order 12906).

Figure 2 shows some of the key metadata fields in the reference database, organized by major FGDC categories. For example, items in section 6.4.2 of Figure 2 identify extrinsic aspects of the data whereas sections 1 and 8 contain intrinsic data items.

Accessing the Archive.
As stated earlier, a major objective of this project is to impose structure and provide convenient access to New Jersey’s environmental information. Although pursuing this objective from a librarian’s perspective, we are departing from traditional approaches that libraries might take in organizing and cataloging information. As in many endeavors to organize information on the Web (Vellucci, 1997), we do not expect to have exclusive ownership or control of the information resources. Our focus is shifting from ownership to providing access and our “collection” process consists of finding environmental information and developing partnerships with those organizations who do produce and own the data.

This approach lacks the architectural and user interface simplicity of a single, physical OPAC. However, we believe the compromise distributes the effort of maintaining the collection while also improving access. As Vellucci has pointed out, “it is essential and desirable that the confining parameters that define a collection be expanded to accommodate documents that are not owned and physically housed within the library’s walls.” To accommodate this diverse environment, we have developed an architecture that has a centralized reference database but may in fact link to other searchable databases, resulting in two tiers of searchable databases.

The NJEIN should provide the ability to not only locate a document but to also retrieve a copy of the specific document. Although we are in the early stages of the prototype, we plan to put considerable effort into making it possible to actually obtain a document (as opposed to just finding a reference to it). As indicated in Figure 1, there are three general types of document formats in the Archive. *Print documents* will be located at institutions such as Alexander Library Special Collections, the NJ State Library, and designated partner institutions throughout New Jersey. We will enable a user to request a print document electronically through Alexander Library. Frequently requested print documents will be scanned and moved to the digital documents database. *Digital documents* include both scanned print documents as well as other static documents such as map images. This material will be located on the SCC server and downloadable to a local workstation through standard Web browsers. The third type of archive material is *GIS/Numeric* databases. The important distinction here is that this digital information is likely to be processed further by a user. For example, numeric data would likely be analyzed using a statistical tool such as SPSS and GIS shape (.shp) files might be used in a GIS tool such as ArcView. It is here that the extrinsic aspects of the metadata become very important such as File Decompression Technique or Transfer Size (see metadata items in Figure 2).

We have taken a pragmatic approach to handling this type of GIS and numeric data. Creating and maintaining GIS databases is a time-consuming and complex process. Our approach is two-fold and recognizes the complexity of the data, our partnerships and also the diverse user population. Our townships (Murphy, 1997), counties and states are creating and maintaining a wealth of GIS data. Our
The reference database will have an abbreviated record that contains the essential data about the GIS database and points to either the actual document or a search interface so that a prospective user can locate the desired information, understand its content and determine system requirements such as file format and size. Further, where possible we will capture the resulting digital map image, index the image, and place it on the SCC server. This approach has the advantage of making the map images easily available to many of our customers who are not able to deal with GIS data while also having the continuing support of the GIS databases reside in the locations where they are created and maintained. Figure 3 provides an architectural illustration of this approach.

**The User Interface – Basic Principles**

Effective user interfaces are extremely difficult to design. The designer has to understand the user of the database, have a good grasp of system design principles, and also be familiar with the subject content. In our project, we will have in the order of 1000’s of records (as opposed to 100,000s) which permits a relatively simple navigation and search structure. We are using the tree structure as shown in Figure 4 below which limits flexibility to some degree but has the advantage of a user interface model that is straightforward and readily understood.

There are a few simple design principles that we have tried to keep in front of us while working on the prototype:

- The user interface should entice and encourage people to want to use the system.
- We will not segment the user community by introducing “advanced” search techniques (i.e. design so that everyone can use all search and browse options).
- There should be many ways to access the subject content and
  - Screen display should follow two rules of thumb (Thomson, 1996): 1) No more than 30% of the screen should be filled with text and 2) The optimum range of options available at any one point is between 5 and 9.

**Opening Screen.**

The opening screen should describe the content, scope, access options, and size of the database (Anderson, 1997). Given the above rules, a major challenge in the opening screen is to present the essentials of content and access without using a large amount of obscure and inappropriate
Figure 4 – User Interface Structure

text. Figure 5 provides a representation of the opening screen for the prototype.

Data Entry.
As has been discussed previously, a unique aspect of the NJEIN is to allow New Jersey citizens and institutions to add data to the collection. To date, librarians and students have been “seeding” the database with relevant documents of all types. Ultimately, we would like to see the NJEIN become self-sustaining by establishing partnerships with institutions, local governments, and citizens by which they would enter environmental data as it becomes available. The data entry screens are relatively straightforward and will not be discussed in detail here. For ease of entry, data entry is performed by selecting a document type such as “thesis” or “report”. This allows us to customize data entry for each type of document and provides a natural context for the user who has the specific type of document in their hands.

In many respects, the NJEIN is a hybrid combining aspects of digital libraries and more conventional OPACs. As mentioned previously, we will have both digital and print documents available. This objective has led us to provide a minimal level of indexing and cataloging as opposed to a database that contains all digital documents and relies on automatic indexing of the entire document for effective retrieval (Witten, et al, 1996). There are two unique aspects to the data entry functions provided in the NJEA.

Creating a Database Record and Controlled Vocabulary. Keeping in mind our objective of enabling users to enter bibliographic data, we have required only a few fields to be entered in each record. For all of our document types, in addition to author or originator, a record also requires entries for title, abstract, primary theme, primary place, and document type. Generally, the title can be taken directly from the document without undue difficulty or user confusion. In terms of traditional cataloging tasks, the abstract will be most difficult for the novice user. Users will, in all likelihood, struggle to accurately and succinctly describe what the document is about. To assist in helping users describe what the document is about we have required three additional fields: primary theme, primary place, and document type. To enter data from these fields, a user selects from a pre-constructed set of themes, places, and types. Themes have been selected to describe environmental topics that are specific to the state of New Jersey and places include the states in the Northeast, New Jersey counties, and the bioregions of New Jersey. As an example, Figure 6 shows the screen for “Reports Entry”.

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Welcome to the New Jersey Environmental Information Network

Sponsored by the NJ DEP Division of Science and Research
Hosted by Rutgers University Scholarly Communication Center

The NJEIN is an information archive that enables access to a wealth of information about the New Jersey environment. You can browse the archive by theme, place, document type, or bioregion. You can search the archive by keyword with special limits. The NJEIN also invites you to submit your environmental data to the Archive so that it is available to others in New Jersey. A Directory of New Jersey environmental organizations is also available.

Our user interface assumes that at least some of the users will be willing to take the time and effort to contribute to the system. Thus, users have the option of entering as many additional theme and place descriptors as appropriate. This process adds the user’s knowledge state to the representation process (O’Connor, 1996).

These user interface concepts are all brought together in the single search interface in which a user can use keywords to search across the title, abstract, theme and place fields. These searches can be further limited by selecting from “pick-lists” of primary themes, primary places, and document type. For example, a user may search for “pollution” and limit the search to primary place=“Monmouth county” and document type=“map”.

Metadata Review Process
The metadata review process is intended to supplement the user process of entering bibliographic data. Each time a user enters a record from the Web, email is sent to a library coordinator. This person is assigned the task of reviewing the record for quality and completeness. Since users are required to enter basic information and can take advantage of the pre-constructed lists, we expect this process to be one of eliminating records that don’t make sense or do not provide adequate information as to how to locate and acquire a specific document. The record will not actually be searchable in the database until the librarian has entered a metadata review data (item 7.2 in Figure 2).

Browsing the Reference Database
Browsing is the process of scanning by content or structure and results in an awareness of unexpected or new content and paths in the database (Dodd, 1996). In the NJEIN, we have put considerable emphasis on browsing for several reasons. Our user population is diverse and scattered geographically throughout the state so that it is difficult to educate the user community about subject terms and cataloguing rules. Searching is difficult and, according to researchers, can put undue cognitive load on an uninitiated
user who has to devise search strategies, determine search terms, and grapple with boolean logic (Behesti, et al, 1996). The data shows that between 30 and 45% of all searches starting in an online database are concluded with browsing library shelves.

Browsing allows the user to become familiar with the database contents and structure without trying to understand the design principles of the information retrieval system.

Our second reason for placing considerable emphasis on browsing stems from a pragmatic system design approach. Browsing lends itself to direct manipulation user interfaces; further our database is in its infancy and sophisticated search capabilities are not yet needed.

The browsing approach is to provide as many access paths as possible to the database. These paths are summarized in Figure 7:

**Figure 6 – Approaches to Sample Data**

**Figure 7 – Approaches to Browsing**

1) Select a county
2) Select a bioregion
3) Select a geospatial area
4) Select a primary theme
5) Select a primary place
6) Select a document type
Searching
After a user has familiarized himself with the database through browsing, he can undertake the more mentally demanding task of searching. In the search process, we have tried to use the knowledge gained through browsing. So, for example, the user can employ the rather straightforward search form as shown below which allows a keyword to be searched across multiple fields (title, abstract, theme, and place). This search process can be further limited by using one of the browse approaches. For example, one might limit the search process to only document types of “map image”.

Status and Conclusion
The NJEIN prototype has served, and for the foreseeable future, will continue to serve its purpose well. Through its development, the authors have gained critical knowledge and experience that will inform the creation of future products. Discovery and entry of scientific information into the database is ongoing, and attendant administrative tasks and processes are in place. These operations will continue, as they are quite fundamental to the project. However, recent developments on the national environmental level have propelled us into the delivery of environmental information on a much grander scale than originally envisioned. NJEIN as we have envisioned it may not exist, but instead merge with a national priority for environmental information management. In doing so, the NJEIN stands to become a prototype for the rest of the nation’s states. We invite our readers to visit the NJEIN website at http://scc01.rutgers.edu/njenvironment and send us feedback.

A recent partnership between the New Jersey Department of Environmental Protection’s GIS Division and the federal Environmental Protection Agency has been established to create a national registry of environmental information, the Environmental Information Management System (EIMS). The authors, along with NJ-DEP’s GIS officials, represent New Jersey in this initiative. To date, all other participants come from within the EPA’s vast bureaucracy. New Jersey is the first, and so far, sole state participant. It is with some regret that in order to participate fully with the national project, we must relinquish some of our own design and administrative control and flexibility. Yet we are convinced that uniformity and interoperability across the various EIMS databases is a worthy aim, intended to take researchers smoothly across the possible points of access to environmental information and so we have become partners again with scientists, researchers, and information managers, this time on a more global scale.

We hope to be able to report to IASSIST again, in not too many years, the status of environmental information systems in New Jersey, and in the nation.

References


The expanding roles of librarians for the new millennium

by Jinhong Tang

The world's communications and exchange have changed dramatically, bringing us closer to the notion of global village. Globalization has become the byword of our era. Libraries seem to have lost their clarity of definition. Where a library exists is no longer important, but what a librarian performs counts. Librarians have long been experienced in organizing knowledge and serving the user. Their roles have been changing with social advances. From the bookkeeper and custodian in ancient times to the reference librarian and the Chief information Officer in late 20th century, the scope and meaning of the term librarian is expanded. The primary driving force is the information and communications technologies. As a result, many new titles are facing librarians, such as information navigator, information broker, information engineer, etc. To sum up, three major roles are waiting for librarians to assume with the coming of the new millennium: global information provider, educator and trainer, knowledge manager.

Global information provider
The changing characteristics of global information environment can be summarized as: automation of the information infrastructure of the whole society; the increasing popularization and deepening of computer and communications networks; and the multimedia dissemination of information.

Library managers in global information environment
As we reach global information environment, library managers should have cross-cultural management competencies [Nicholson and Rochester, 1996]:

- transformational management skills—shifting from attitudes and behaviors that are ethnocentric to ones that are cross-cultural and mastering new drivers of competitive success

- interacialional management skills—understanding how leadership, motivation and staffing practices are addressed in differing locations

- transactional management communications skills— understanding how to market operations successfully and work well with colleagues and mastering a complex, fast changing and possibly unfamiliar competitive environment

Information provision in global information environment.
The traditional acquisition, organization and distribution of information is no longer enough for both information users and librarians given the exponential growth of information technology and ever-increasing demand for information service. The future is one of users accessing electronic data and catalogs of electronic and printed collections anywhere in the world from workstation unfettered by local, institutiona, national or geographical consideration. So, information service meets challenge and threat at the same time. Librarians should learn to be proactive rather than respond to changes.

Librarians are disconcerted by the marginalising of much of their roles as guardians of intellectual heritage and share a common concern with all others in information provision. As librarians, we are accustomed to viewing ourselves as primary information providers. Libraries house a wealth of information, collected with substantial knowledge of our clients' evolving needs. But, a new information environment is facing us. Online catalogs offer much greater access to library collections; computer-based indexes and databases are more comprehensive than printed ones; and interactive multimedia can provide well-structured independent instructions in information retrieval and other skills [McLean, 1996]. The use of Internet has pervaded every domain of library work.

Making collections available to people regardless of locations—"the library beyond the walls" will increasingly become a focus of activity. Librarians should not only bring collections to the user, but service as well. For example, email reference service is possible now [Hardy, 1996].

In the field of global information provision, the Internet is a constantly evolving global network of networks, which is transforming the way we communicate, research and live. Users can take on many kinds of roles: world traveler, foreign correspondent, explorer, publisher and so on. The Internet is comprised of many different information resources, and numerous applications are available for the
purpose of Internet searching.

Because of massive volumes of heterogeneous information sources on the Internet and browsing as a major access paradigm, the process of matching may not be effective or efficient. The consequences of such an environment may be: unused information; tiring retrieval process; low recall and low precision.

Information provision in an electronic environment is not an easy process. The challenge to librarians is to create an agreeable environment for electronic information retrieval. Librarians can fulfill this task by facilitating in electronic information retrieval and consummating indexing.

- Facilitating electronic information retrieval

To come to grips with the Internet resources is a promising mission for library world nowadays. Many libraries are trying their best to act as pathfinders. Let us take Hong Kong University of Science and Technology Library (HKUST) as an example [Yip, 1997]. Early in December 1994, a pilot group was set up to work on the library World Wide Web project at HKUST. Its objectives are: (1) to develop selection guidelines for the Internet resources; (2) to build the Internet navigation skills among selectors; and (3) to select free Internet resources and make them accessible to the HKUST community through the library catalog or hyperlinks on the library Web server.

A conclusion can be drawn from the experience of HKUST library: far from sounding the death knell of librarianship, the Internet is the best thing the library world has ever had. The Internet needs the library and the library needs the Internet.

- Consummating indexing

The traditional way to represent information documents in large collections is by indexing. Each document is assigned one or more index terms selected to represent the best meaning of the document. These index terms are then searched to locate documents related to queries expressed in words taken from the index language. Indexing is the oldest technique for identifying the contents of documents to assist in their retrieval. The indexing process is typically performed by professional indexers associated with library organizations. The objective of indexing has changed with the evolution of information retrieval [Kowalski, 1997].

Now let us look at the environment for indexing which exists today.

The explosion in the availability of information through computers, which allows people to explore databases in other places by systems such as the Internet and World Wide Web has created new opportunities in information organization and retrieval. Indexing is the ancestor of such activities and professional indexers or librarians must be flexible enough to adapt their skills in indexing to information management and retrieval. Indexes need to convey more intelligence than the contents of text, in the sense that it should be able to structure or indicate every possible route a user might take into the text.

Discussions and writings about searching the Internet frequently mention the difficulty of finding what is wanted and the need for good indexing. A prepared index to a site with a specific depth, should offer a thesaurus of controlled entry terms closely related to the outline and bring together material from disparate sources. Indexing the Internet is an exciting and challenging project. It is exciting to develop approaches to search the growing amount of online materials.

There remain key issues on indexing for librarians today: how will indexing techniques have to change to stay relevant? Librarians should be finding out how they can participate in and contribute to information access and the Internet. People demand better result, which is partly a feature of the search facility and partly of indexing. Librarians should grasp the new opportunities coming with the Internet. In short, librarians have the expertise and skills in content analysis to contribute to the control of information on the Internet [Macdougall, 1996].

Educator and trainer

There are many forms of user education from library tour to bibliographic instruction. Many of those programs are now working with or evolving into information literacy programs with emphasis on the Internet instruction [Martin, 1997].

Information literacy education

Literacy, beyond embracing the basic abilities of reading and writing, now embodies the general ability to understand and perform functions successfully. The term is often paired with areas such as media, computers, culture and information. The goal of information literacy is to ensure that people understand how to, and why they need to, learn about sources in the information society. Some of these sources will be in the library, others will be in the world at large. The definitions of information literacy varies slightly from source to source, though the focus is helping users gain a broad understanding of information sources and enhancing their ability to deal with that information. The American Library Association gives this definition:

To be information literate, an individual must recognizes when information is needed and have the ability to locate,
evaluate and use effectively the information needed [American Library Association, 1989].

There is a growing recognition of the need to train users in information literacy skills. Libraries should take on the role of imparting information literacy skills. For example, The Digital Information Literacy program at The University of Texas at Austin is dedicated to promoting electronic resources to the library users and encourages users to examine the Internet information [Martin, 1997].

Three steps in user education
End user training is an evolving area of research. Learning to use a library was once a fairly simple activity for the user. Library searching was relatively straight forward, and the end-product easily retrievable. Users are becoming more independent and effective, search engines in both print and electronic formats are coming into being. Access to information is not enough and librarians will be encouraged to become editors and create filters to help users select what they want.

• Identify what librarians need to impart to users

The mission of user education aims to help users at all levels learn how to identify the information they need from the morass of information in electronic and other forms.

• Recognize that learning to search is a progressive process

Users will have rudimentary skills in their first weeks of training. What should be kept in mind is that they will need help every later time they use a library, search the Internet or databases.

• Have an important part in playing extension support to users

People go in for do-it-yourself activities. That is true with information seeking. Librarians may prepare users to deal with the complexity of information environment and encourage users to search what they need on their own given the availability of technological support.

Knowledge manager
We are embarrassed with the problem of information overload. Longing for information gives way to knowledge seeking. Knowledge related to specific problem solving is crucial. Knowledge, not merely information, is the major competitive factor in life. Knowledge assets become the key assets (with its emphasis on concepts such as intellectual capital, intangible assets, intellectual property, etc.). The shift from distributing information to managing knowledge is becoming an independent production factor next to labor, capital and natural resources. Knowledge is evolving into intellectual assets on which business organizations around the world are dependent for their survival [Bonaventura, 1997].

Tacit and explicit knowledge are the two basic forms in which knowledge can be operative in an organization. Tacit knowledge resides in people’s heads. Explicit knowledge stores in books, journals, CD-ROMs, the Internet, etc. Explicit knowledge is formal knowledge that can be packaged as information and can be found in the documents of an organization: reports, articles, manuals, patents, pictures, images, video, sound, software, etc. Tacit knowledge is personal knowledge embedded in individual experience and is shared and exchanged through direct, eye-to-eye contact. Tacit knowledge is practical knowledge that is key to getting things done, but has been sadly neglected in the past [Bonhoft and Pareschi, 1997].

Many factors contribute to the rise of knowledge management. They can be grouped into the following areas: increasing popularity of learning organization; growing importance of knowledge; technological availability; the transition of economy; and growing interests in knowledge management research.

Library practice has been updating with the societal advances. From book warehouse to information center, the principle that library is an ever-growing organism is embodied. What can librarians do to realign their focus from the old world of “information management” to the new paradigm of “knowledge management”? Librarians have excellent skills in organizing and codifying information sources and making these accessible to others. This represents the top layer of the knowledge map—information—rather than tacit and explicit knowledge. Librarians are involved in a continuing search for excellence in organizing and codifying information sources, networking, etc. All these activities are important for knowledge management, but not sufficient [Broadhent, 1997].

New knowledge often begins with the personal. The fact that a reference librarian knows something of why services aren’t utilized the way the organization desires isn’t of itself organizational knowledge. It becomes organizational knowledge when there are management processes in place which capture that often personal, tacit, front-line information from which others in the organization learn and make decisions. That represents a quantum shift for most organizations to a focus on using human expertise for business advantage. So, knowledge management is a form of expertise-centred management. It is characterized by variety and exception rather than routine and is performed by professionals or technicians with a high level of skill and expertise. Knowledge management is about the
acquisition, creation, packaging and application or reuse of knowledge [Broadent, 1997].

We will see in 1998 how much further management experts can go along the road that leads towards knowledge management, that is direction that librarians should be looking if we want to be abreast of the next century. How to make the transition from “information management” to “knowledge management”? As an information manager or a librarian, we are best placed to be the driver of knowledge management within our organisations [Bonaventura, 1997].

There is no common-held model for knowledge management. Knowledge practitioners are responsible for accumulating and generating both tacit and explicit knowledge. Library information service processes can be viewed from the perspective of knowledge management. If you are an information and technology professional, you may look at it from information technology perspective; if you are a business manager, you may look at it from business perspective. Knowledge management means different things to different people.

Knowledge management isn’t only for senior management, librarians at junior or middle management levels are having to deal with the complex task of knowledge management [Kinnell, 1996].

_**Library managers: knowledge coordinator**_

The role of the chief librarian in a library is that of a designer, teacher, and steward who can build a shared vision and challenge prevailing mental models. The chief librarian needs to be responsible for knowledge coordination. He or she needs to have an understanding of developing the human and cultural infrastructure within a library which will facilitate information sharing, specifically the conversion of tacit knowledge of librarians into explicit knowledge that may be shared across the library. The person should have the combined capabilities of a business strategist, technology analyst, and a human resource professional. A consulting background, particularly a background involving similar roles of liaison and consultation, would be desirable. Communication skills are also crucial. If a library is managed in this way, the tacit knowledge of librarians can be made best use of, the library service strategy can be most appropriate, the benefits of a library can be most accomplished. The major tasks of a knowledge coordinator fall into several areas [Cronin and Davenport, 1988]:

• **Identify users’ needs**

Faced with an exponential increase in the amount of published information in a variety of forms, the knowledge coordinator will have to identify and respond to the particular needs of local clientele and to structure, market and deliver services and knowledge to these users.

• **Emphasize access to knowledge**

Academic and theoretic knowledge is fundamental to teaching and researching at a university, and priorities should be given to such areas.

• **Exploit new technology and local networks**

The availability of personal computers and campus networks presents both an opportunity and a challenge as faculty, students and research staff become more information literate and their needs more sophisticated.

• **Link library program to academic program**

With limited resources and ever growing universe of information, there must be a close mapping between library collections and services and the educational and research priorities of the university.

• **Market library service**

A demanding area for academic libraries is the need to acquire marketing and public relations skills. It is no use developing library service without being publicized and marketed. Professional skills coupled with business acumen are important part of academic library operation.

_**Librarians: knowledge creator**_

From the library’s perspective, knowledge creation implies participating more in users’ reading and studying by identifying users’ information needs and developing appropriate service and products to meet the needs. While a user is seeking knowledge, explicit knowledge stored in documents either in print or electronic format is needed to be implanted in the user’s head and to be analyzed and synthesized with the user’s tacit knowledge and/or his previous experience, etc. That is the process of internalization of knowledge. In the meantime, new ideas, concepts and methods can be generated by the user. These new ideas, concepts and methods are the new contribution to human knowledge and need to be formalized and organized for transmission and storage. That is the externalization of knowledge. During this knowledge transfer process, a librarian acts as a node in internalization and organization of knowledge. Only by participating in the teaching and research activities, can academic librarians become part of knowledge creation. (See Figure 1)

It can be inferred that knowledge management call for user-centred library service. Briefly stated, a librarian, analogous to the medical professional model, must be able to diagnose needs, prescribe a service or remedy, treat or design an appropriate remedy, and evaluate the treatment or remedy [Glazier and Powell, 1992]. Librarians need to lay the foundation to serve the users of tomorrow. Librarians need to plug into the Information Super Highway and
exploit the relevant technology to make knowledge available to users in a fast and reliable manner. Librarians need to move towards a borderless information environment and remove all boundaries and barriers to knowledge transfer and share. Knowledge management will be playing a key factor in the future of libraries.

References
Reporting to the Director of the Trinity Center for Neighborhoods, the Director will establish the Cities Data Center at Trinity College. Funded by the W. K. Kellog Foundation, the Center will assemble a collection of data and studies on the Hartford Region and other urban sites. The Center will archive data specific to Hartford and comparable urban environments (including original research and data from Trinity scholars, governmental agencies, businesses and not-for-profits organizations). The Center will also provide training for students, faculty, and neighborhood groups in the use of analytic tools appropriate for this data.

Bachelor's degree required, along with social science/research credentials; Master's degree preferred. Experience in social science data analysis, facility with appropriate statistical software, including Geographic Information Systems, and the ability to collaborate effectively with faculty and administrative staff and community leaders also required. Must be committed to the mission of a liberal arts college.

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