1.0 Introduction

The Albert R. Mann Library at Cornell University has built an
electronic library that brings computerized indexes to journal
articles, numeric data files, and the full text of journal
articles and reference works to users' workstations. This
system, known as the Mann Library Gateway, is used on the Cornell
campus at libraries, offices, labs, and microcomputer centers.
It is also used off-campus by Cornellians who are working at home
or traveling. The Gateway system has been very well received and
has grown steadily in usage and size over the past two years.

2.0 Gateway Description

The Gateway is a computer system that manages multiple
connections to a variety of carefully selected electronic
information resources. These resources may either reside on
library computers or be located on computers across the country.
By browsing a list of titles and the accompanying brief
description for each title, the user identifies relevant
information resources. Upon selecting a resource from the menu,
the Gateway software completes the connection to the resource.
The location of the information resource as well as the
connection and login processes are transparent to the user.

2.1 Gateway System

The Gateway system currently runs on a Hewlett-Packard Series
9000 computer, but it is designed to run on any UNIX-based
computer system. The system is composed of several software
modules: the administrative module, the "circulation" manager,
and the user interface.

2.1.1 Administrative Module

The administrative module allows staff to create, delete, and
modify all user accounts associated with the Gateway. This
module allows the Gateway administrators to enable or disable
access to each resource for each user. For example, the library
might wish to make a "demo" account available, but deny access to
a particular resource. Limits can also be established on any
resource. For example, licensing restrictions on a bibliographic
database limiting simultaneous access to 100 users can be
enforced.
     Individual accounts are created and modified by a member of
the library support staff using a workform interface to the
administrative module. When a large number of accounts need to

be created for a class, the accounts are generated in a more automated manner by technical staff. "Anonymous" login has also been established, but such access is limited to sessions originating on the Cornell campus. This access control provides the ability to meet the varying contractual requirements of database producers and vendors.

2.1.2 Circulation Management Module

The "circulation" management module is the entity that actually enforces the limits set by the administrators. This module also monitors hardware resources, assuring that no component becomes overloaded and acceptable response times are maintained. For example, the management module monitors the number of simultaneous users connected to each resource, and it can deny access to additional users if a predetermined limit is reached; access is again allowed once the number of simultaneous users drops below the limit.

The system also manages multiple passwords that may be required for simultaneous access to a resource. For example, if a remote system requires a unique password for each session and we have 10 passwords permitting a maximum of 10 simultaneous sessions, the Gateway circulation manager assigns available passwords when a user initiates a session to that remote system. The Gateway "knows" if a password is available or in use, and it manages the access, thus preventing the individual user from knowing or using the confidential passwords.

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2.1.3 User Interface Module

The third module is the user interface component. Currently, one version of this module exists. It supports the ANSI 3.64 (VT100) terminal emulation used by nearly all microcomputer telecommunications software. This character-based interface was deliberately chosen as the one interface available to all Mann Library patrons when the Gateway was created.

The database screen presents the user with the available resources (see Figure 1). The left half of the database screen consists of a scrolling title list displaying nine titles at once. The right half displays a brief description of the one database highlighted in the title list. The brief description changes as different titles are highlighted, and it gives the years of coverage and the frequency of update if the database is serial in nature. At the bottom of the screen are brief commands.

```
-------------------------------------------------------------------
Figure 1.  Database Selection Screen
-------------------------------------------------------------------


                                        Mann Library Gateway


Databases _____        Description_____


   User Guides and Help             : BIOSIS is a database of
   ABI/Inform                       : citations and abstracts to
   AGRICOLA                         : the literature on biology,
->BIOSIS                            : biomedicine, and other
   CARL UnCover                        life sciences.
```

```
Census of Population and Housing
  CLIMOD                              Source:    BIOSIS Inc.
  Cornell Online Catalog              Coverage: 1986-present
  Crop Estimates-County File          Updated:   Weekly

(No. 4 of 32 databases available)

Directions _____

Select a database, press RETURN.    Press = to move down the list
Use arrow keys                             - to move up the list
  to move through the list.            p to change password
Press SHIFT+1st letter of the title    q to quit the Gateway
  to jump through the list alphabetically.
-----------------------------------------------------------------
```

Database titles are often cryptic and give no clues about the nature of the resource. The brief descriptions are of great help in assisting the new user in identifying the appropriate database.

2.2 Software Design

As mentioned above, the software system is very modular. This approach allows the system to evolve piecemeal and to be eventually distributed over multiple computers. All administrative functions are currently being handled with a collection of UNIX Korn shell scripts and Awk programs.
     The circulation module mentioned above consists of locally developed C code. The circulation module links to two other components that handle resource connections and the user interface. Resource connections are managed by the Expect software package, which is readily available from the National Institute of Standards and Technology. Expect is very flexible in that it allows the management of many different types of connections from standard Telnet to FTP and Kermit file transfers. Finally, the user interface was developed using Liant Corporation's C-Scape Interface Management System. C-Scape provides a multiple-window environment within the standard UNIX terminal environment and provides a growth path to the newer X Window system.

2.3 Gateway Resources

Currently, there are over 30 titles in the database list. Most of the titles are individual resources, but some of the titles identify systems that provide access to multiple databases. In total, close to 200 databases are available to the Cornell community through the Gateway.
     Although the majority of the databases are bibliographic in nature, full-text, numeric, and directory databases are also included. Resources are selected as part of the Mann Library's collection development process. Selection is made by specialists in each type, or genre, of information. The decision process is coordinated by the Head of Collection Development. Decisions that have significant impact on equipment needs, technical processing, or provision of service are discussed and reviewed by the Electronic Resources Council, a committee with representatives from the Mann Library's Public Services,

Technical Services, and Collection Development divisions, plus a
representative from the Information Technology Section (ITS).

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     The Mann Library maintains five databases locally under the
BRS/SEARCH software. The databases are, in order of their
addition to the Gateway, Agricola (1982-present), BIOSIS Previews
(1986-present), ERIC (1966-present), ABI Inform (1985-present),
and Periodical Abstracts (1986-present). These databases are
distributed over two DEC Station 5000 servers, requiring over 18
gigabytes of magnetic storage for the databases and their
indexes. The Crop Estimates and the National Resources Inventory
databases are also maintained locally.
     In addition, selected tables from the Census of Population
and Housing are available via a Gopher on a Mann Library server.
User guides are also loaded under Gopher and made available
through the Gateway in electronic form.
     Other resources available through the Gateway are maintained
elsewhere, and the Gateway software provides connections. The
complete list of resources available as of early 1994 is shown in
Table 1.

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Table 1. Gateway Resources

     ABI/Inform
     Agricola
     Applied Science & Technology Index
     Art Index
     Avery Index
     Biological & Agricultural Index
     BIOSIS Previews
     Business Periodicals Index
     CARL UnCover
     Census of Population and Housing (1990)
     CLIMOD (Northeastern Regional Climate Center Database)
     Cornell Online Catalog
     Crop Estimates
     Dialog (150 databases)
     Dialog Bluesheets
     Dialog Business Connection
     Dialog Papers
     Engineering Index-EI Page One
     ERIC
     General Science Index
     GEOREF
     Humanities Index
     Index to Foreign Legal Periodicals
     Index to Legal Periodicals
     National Resources Inventory
     Periodical Abstracts
     PsycINFO
     Reader's Guide to Periodical Literature
     RLIN
     Social Science Index
     User Guides and Help
     Wilson Combined Indexes (includes all Wilson databases in

this list)

3.0 The Evolution of Electronic Information Services

The Mann Library is the second-largest unit within the Cornell
University Library system. With its collection of over 600,000
printed volumes and almost 500 electronic titles on tape,
magnetic disks, and optical disks, the library is recognized as
one of the most prominent academic agricultural libraries in the
United States. The library serves students, faculty, staff, and
extension personnel in Cornell's College of Agriculture and Life
Sciences, College of Human Ecology, Division of Biological
Sciences, and Division of Nutritional Sciences. As a land grant
library, it also serves the citizens of New York State.

3.1 Early Growth of Mann's Electronic Library

While the printed library collection remains fundamental to the
library's mission to serve Cornellians and New Yorkers, Mann
Library staff have also made providing access to electronic
information a principal goal over the past twenty years. This
access has steadily expanded as information technology advances
have been made. Mediated online searching has been available at
the Mann Library since the early 1970s, end-user access to remote
online databases has been provided since the early 1980s, and
access to databases on CD-ROM has been available since 1987.
Library staff have also provided access to numeric data on tape
and diskette since the early 1980s.
     In 1988, library staff began a research project in which the
Agricola database and subsets of the BIOSIS Previews database
were mounted on a local VAX computer. Researchers used these
databases from computers and terminals in locations outside of
the library, and staff investigated whether changes in user
behavior resulted from the availability of this electronic
information. Meanwhile, in a study funded by the U.S. Department
of Education, library staff created an online system to provide
menu-driven interactive access to numeric data. As a result of
these experiments, the library administration decided to make
more databases available to a wider range of users--and Mann
Library's electronic library began to take shape.

3.2 The Birth of the Mann Library Gateway

An early version of the Mann Library Gateway first emerged as a
result of a joint project between the Mann Library and Cornell's
Division of Biological Sciences. Faculty and library staff
agreed that undergraduates in biology classes needed to know how
to use electronic information for their classwork. These skills
would also be essential for graduates in their future jobs.
Staff from the Mann Library and the Division of Biological
Sciences wrote a successful joint proposal to Cornell's
President's Fund for Educational Initiatives to provide hardware,
software, and instruction to provide Biological Sciences
undergraduates with the ability to retrieve information from
databases accessible over the campus network. The databases were

to be delivered through a single point of access, the Gateway.

The development of the Gateway has been a joint effort of librarians and technical staff at Mann Library (the project team is described in Section 3.4). The project manager worked with Biological Sciences faculty and the library's collection development staff to select the best resources for undergraduates in biology. Library staff and faculty agreed that BIOSIS Previews, the premier bibliographic database in the life sciences, would be the best database to begin with. BIOSIS Previews is widely recognized among biologists and information specialists to be a comprehensive, high quality resource. Faculty judged it a critical electronic resource for undergraduates. The selection team also recognized that it would be very useful to faculty, research staff, and graduate students. The library built on its earlier experience with subsets of BIOSIS Previews, and it mounted five years of the full database on a local computer using the BRS/SEARCH software.

The project team decided that biology students and faculty should also have access to the Cornell Online Catalog, so that they could easily determine which references found in BIOSIS Previews would be available on campus. The team also agreed that other databases in addition to BIOSIS Previews should be provided to the biology students and faculty, beginning with databases that the library already had online. These were Agricola and two numeric files: Crop Estimates and the National Resources Inventory.

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Fundamental to all the project team's work was the belief that access to these databases must be made very simple. A single point of access to all resources must be provided. Although the databases resided on different computers in different buildings and required different login protocols, these differences should be transparent to students and faculty. Users should only be required to learn one computer address and login protocol. To achieve this goal, the project team created an interface that presented an easy-to-use menu. This menu listed Agricola, BIOSIS Previews, the Cornell Online Catalog, National Resources Inventory, and Crop Estimates. Upon making a selection from the menu, Telneting and logging in were handled behind the scenes by the Gateway software. This system was the first version of the Mann Library Gateway. Soon after this Gateway was created, the RLIN system was also added to the menu.

Access to this early Gateway system was provided in Spring 1991 to biology students and faculty in campus microcomputer centers, in Mann Library, and at other networked locations. Dial-up access via modem was also provided, and it was the most common means of access outside of the microcomputer centers and the library. Most faculty and staff did not have connections to the campus network at this time, and they relied on dial-up access.

In Fall 1991, library staff and biology instructors conducted BIOSIS training for over 100 introductory biology students. These students worked their way through a tutorial and a searching assignment. In Spring 1992, instruction was expanded to all 700 introductory biology students. Meanwhile, biology faculty were using the Gateway for their research and were planning future instructional uses of BIOSIS Previews and other databases. Initial instruction for biology faculty and teaching staff was done by members of the project team. The bulk of the

instruction for undergraduates was provided by biology teaching assistants. The system and the instruction sessions were received very favorably.

3.3 Production Version of the Gateway

After the completion of the grant-funded project and the success of the first version of the Mann Library Gateway, library staff decided to expand the system to include subject areas beyond biology and agriculture and to expand the user population beyond the original biology clientele. At this time, the original grant project team was disbanded and a new team was formed. This new group, the Gateway Production Group, was responsible for maintenance and expansion of the Gateway system.

     In Winter 1991-1992, use of the system was opened to all faculty and students in the colleges and divisions served by the Mann Library. In 1992, use of the Gateway was opened to all Cornellians. Use of the system is limited to the Cornell community at present due to contractual requirements of some database producers. Access to the system is controlled by passwords issued at Mann Library.
     A "public" version of the Gateway will eventually be available to anyone. This "public" Gateway will provide access to all resources except those which must be limited to the use of Cornellians because of cost or contractual requirements. This "public" Gateway will enable Mann Library to fulfill its role as a land grant library in the electronic milieu.

3.4 Project Team

The membership of the project group has varied over the last four years depending on the focus of Gateway development activities at the time. Library-wide and campus-wide input has been crucial to the development of a successful product.
     The project team has been coordinated by Marty Schlabach, a librarian from Public Services. A systems analyst/programmer has always been a part of the group to provide leadership in Gateway programming work. In addition, the Head of the Information Technology Section has been an active participant in the group. The Head of ITS provides the library- and campus-wide view for technical discussions, and he brings to the group the authority to make Mann Library hardware and software decisions. An Interface Designer joined the Project Team soon after the project began and has been a key influence in the development of an easy-to-use system. A part-time Instruction Librarian was hired to work with faculty to integrate the use of the Gateway and its electronic resources into courses. The Head of Collection Development coordinated the process of selecting databases to be added to the Gateway. Another programmer and the Bibliographic Files Librarian joined the group as we became more heavily involved in mounting bibliographic databases locally.

     The current Gateway Production Group membership is:

     o   Marty Schlabach, Gateway Coordinator, Public Services
          (Chairperson)

o   Bill Fenwick, Programmer, ITS

o   Bill Garrison, Interface Designer, ITS

o   Tim Lynch, Systems Analyst and Head, ITS

o   Oya Rieger, Numeric Files Librarian, Public Services

o   Linda Stewart, Bibliographic Files Librarian, Public
     Services

4.0 Training

Mann Library staff believe that providing instruction in the use
of electronic information and information technology is a
fundamental role of libraries. Library staff have provided
online searching classes and instruction in the use of software
for over ten years. As the Gateway has been made available,
online searching instruction has evolved from demonstrations of
remote vendors' databases and local CD-ROM searches to hands-on
classroom sessions. The Stone Microcomputer Center at Mann
Library includes a classroom with twenty networked workstations.
In this classroom, users receive instruction in basic and
advanced BRS searching, use of the Dialog Menus software, CARL
UnCover and RLIN searching, and use of numeric data--all
resources available through the Gateway. Almost every session
offers the opportunity for structured hands-on practice with
several trained searchers, who are available to answer user
questions.
     The Mann Library provides instruction for classes at the
request of faculty, and it also conducts "open workshops" for any
interested members of the community. BIOSIS Previews instruction
for freshman biology students continues, and it is in its third
year. During the 1992-1993 academic year, library staff taught
over two hundred classes to almost 2,400 users.

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5.0 User Support

Mann Library staff provide support to users of the library's
printed and electronic collections. When the Gateway was first
made available to users in 1991, library staff had much more
experience with supporting users of printed materials. The
library administration's goal was to use the reference desk as
the front line of support for electronic library users, just as
it is for users of the traditional print library. Initially,
however, members of the grant project team provided support to
Gateway users. They answered the questions and kept records of
all questions asked and answers provided. These records were
later analyzed so that Gateway support documentation and training
could be provided to reference desk staff.
     From the Gateway's earliest days, questions about which
telecommunications software to use, how to connect, how to
correct display problems, how to search, and how to save search
results came in person, via telephone, and through e-mail. Many
questions also came in from people who had forgotten their user
IDs and/or passwords. During the initial months, these questions
were answered by two librarians, a systems analyst, and the
administrative assistant in charge of managing user IDs and

passwords.

In Spring 1992, the front line of support for Gateway users was moved to the reference desk. Most desk staff were experienced bibliographic searchers and were easily trained to answer questions about searching databases available through the Gateway. Questions regarding logging in and use of telecommunications software required more training. Workshops presenting information about telecommunications software were developed and presented by reference librarians and systems analysts. Members of the Gateway Production Group prepared an informational notebook for use by reference desk staff. This notebook contains handouts explaining use of various databases, detailed login procedures, and brief guides to major telecommunication packages used with the Gateway.

At present, most telephone calls and in-person requests for assistance with the Gateway arrive first at the reference desk. Most questions are answered at that point. When necessary, reference staff refer questions to experts on the Mann Library staff. E-mail requests for assistance arrive at the general e-mail address for the Reference department, and, when necessary, are also referred to experts.

In Spring 1993, an online method for distributing Gateway handouts was developed and made available as a choice on the Gateway menu. Now, users often find their own answers. This has been an important supplement to other support services.

While Mann Library remains the main source for Gateway user support, other libraries in the Cornell University Library system have taken on significant support responsibilities for Gateway users in their own user populations.

6.0 User Response

The Gateway system has been very well received, as evidenced by the huge increase in sessions per day. When the system first became available, the usage averaged fewer than 100 Gateway sessions per day. The average use now often exceeds 700 sessions per day. In May 1992, the system supported a monthly total of 1,989 sessions; by May 1993, the monthly total was 5,188 Gateway uses. November 1993 saw a new high of more than 15,000 Gateway sessions.

The library has also received many favorable comments about the Gateway from students, instructors, researchers, and extension personnel.

7.0 Future Plans

An additional group has been formed to plan and develop the next version of the Gateway. The Gateway Development Group, which includes some members of the Gateway Production Group, began its work by inviting a few people from the library to join in a brainstorming session about what the next Gateway should be able to do. This resulted in two documents which were used as springboards for discussion in a number of focus groups. The focus groups included representatives of faculty and staff who use the Gateway for research and instruction as well as library and technical staff from across the campus. Suggestions from these focus groups were described in a recent article. [1]

The Gateway Development Group then drafted a requirements

document that summarizes the features and functions desirable to have in the next Gateway. Client/server architecture and a window-based user interface are the key technical foundations of the next Gateway environment. The requirements document is currently being discussed and the planning and design process is underway. The Gateway Development Group's goal is to have an operational prototype available by Summer 1994.

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8.0 Conclusion

Information resources are increasingly available in electronic form. Given recent advances in networks, telecommunications, and computers, librarians must provide access to electronic resources in a distributed manner. In addition, it is the librarian's responsibility to organize and facilitate easy access to those resources.
     The Mann Library has taken steps toward providing that ease of access by creating the Gateway. In addition to offering the library's clientele a wide diversity of electronic resources, the Gateway provides a single entry point to this panoply of databases, and it assists users in identifying and selecting appropriate resources.
     The Cornell community has accepted and embraced the system, and increasingly it expects additional resources, services, and capabilities. Usage continues to escalate, as electronic resources are integrated into the daily lives of faculty, researchers, and students.
     Although the system is sophisticated in its capabilities and it is easy to use, it is technically "primitive." The Mann Library is now utilizing newly available technologies to meet users' expectations by developing the next generation of the Gateway.

Notes

1. Susan J. Barnes, "An Electronic Library Grows," Computers in Libraries 13 (September 1993): 12-15.

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