Prepare for the Ride of Your Life on the Information Superhighway

by Joel Sigmon

Now that the North Carolina Information Highway (NCIH) is coming to your neighborhood, navigating the universe of electronic information, or *cyberspace* as it has been called by science fiction writers and frequent Internet travellers, is a required skill. Librarians, teachers, students, parents, business persons, government planners, and almost anyone else in today's society will benefit greatly from access to electronic information. The state's leaders envision a time when all North Carolinians will have the opportunity to use electronic information that is universal in scope and coverage. Their goal is to provide all of the state's citizens with equal and unimpeded access to extensive libraries, leading research facilities, government agencies, powerful computing centers, and a wide-range of government and private services. Librarians are already playing a key role in enabling citizens to access information through electronic networks. As the sources proliferate and the technology becomes increasingly complex, librarians will have to understand not only applications and content, but also the fundamental aspects of the technological infrastructure.

This article provides a glimpse of the future — for some, a future that is already here. The new technologies that are making the global information highway a reality are described. Sources available on the Internet are highlighted, including a preview of some of the projects under development. Access strategies are discussed briefly. And finally, the benefits of the new technology are considered. Hopefully, the information provided will give you a smoother ride on the information highway as you travel the electronic landscape of *cyberspace*.

What is the North Carolina Information Highway?

The North Carolina Information Highway (NCIH) is an advanced digital broadband network that is being developed for high speed transmission of data and video communications. North Carolina state government has formed a unique partnership with three telephone companies to bring this technology to every area of the state. NCIH is based on the use of fiber optic cable along with the deployment of ATM (Asynchronous Transfer Mode) switches and SONET (Synchronous Optical Network) transmission equipment across the state. ATM is a new multiplexing and switching technology that provides bandwidth on demand for high speed data and video communcations. SONET is the latest transmission system technology. It provides enhanced operations, administration, maintenance, and provisioning features. The standard supports optical interconnection between different manufacturers' equipment and can carry traditional circuits or ATM cells. SONET will eventually provide transmission speeds at gigabits/second. When compared with the current standards of data transmission at 56Kbps or even T1 (at 1.54Mbps), the SONET technology is astounding.

Sources

The sources that will be available to North Carolina's citizens once the network infrastructure is in place include materials provided by organizations all over the Internet and custom products developed by many state government agencies, including a number of projects involving the State Library of North Carolina. Some of the sources described below are already available on the Internet. The intent is to provide resources that increase the general knowledge and education of the state's citizens, promote economic development,

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Figure 1

Advanced Digital Broadband Network

- Fiber optic cable
- ATM switches (Asynchronous Transfer Mode)
- SONET transmission equipment (Synchronous Optical Network)

NCIH

Data and video communications

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and support sound public decision-making by government agencies at all levels. Just as amazing as the technological infrastructure is the collaborative effort of many diverse groups. NCIH planning cuts across traditional organizational lines with broad participation at all levels. Many stakeholders are cooperating to ensure that the needs of the various communities of interest are addressed and that the highest standards in creating the technical structure and applications are upheld. All agree that both an advanced communications infrastructure and content of high quality are crucial to the usefulness of data and video sources. While video is an important component of NCIH, the following descriptions cover only data products. Some examples of video applications appear later among the list of benefits.

Government Information

A government that is open and responsive to its citizens is a fundamental requirement for a vibrant and successful democracy. The information provided by the applications described below is vital to the interests of governments at all levels and their constituencies. In recent months there has been an explosion of government information available on the Internet. This trend will continue at all levels of government.

Federal Sources

The federal government has taken the lead in providing a wide range of information sources on the Internet that are presented in a useful and timely manner. Sources available from all branches of the federal government include the *Catalog of Federal Domestic Assistance*; the *U.S. Budget*; the *U.S. Government Manual*; the *Federal Register* (access provided by a commercial firm); presidential documents; Supreme Court decisions; legislative tracking and other sources on the U.S. Congress. Many executive agencies of the federal government now operate Gopher servers as do the U.S. House and Senate. There is also a gateway for accessing bulletin board systems of federal agencies.

State Sources

North Carolina state government agencies are already beginning to make a variety of information available on the Internet. The State Library of North Carolina operates FTP, Gopher, and World Wide Web servers that provide electronic versions of State Library publications, statistical data resources from a number of government agencies, and links to sources on a wide range of topics located on servers throughout the world. (See *Lagniappe* for an overview of the State Library's current Internet projects, pages 86-87.) State Information Processing Services (SIPS) is maintaining Gopher and World Wide Web servers that provide access to information on issues related to technology policy and applications. The Division of Environmental Management provides its regulations and environmental management plans via the World Wide Web. An inventory of the state's Center for Geographic Information and Analysis GIS databases and a sampling of map products in standard graphics formats are also available on the World Wide Web.

The **General Assembly** plans to make the following items available on the Internet: full text of the latest version of all bills pending before the General Assembly; the daily House and Senate calendars; the history and current status of each bill pending; fiscal notes prepared by the General Assembly's Fiscal Research Division; reports of each committee's workload for the biennium; reports of all bills by all introducers; and reports of all local bills affecting each North Carolina county. Details on formats and access methods are not yet available.

Statistical Sources from Federal and State Agencies

Statistical information provides government agencies and businesses the essential data needed to make sound decisions. With-

out access to these data, populations will go unserved, government services will not be distributed properly, and businesses will fail as a result of inadequate planning and poor marketing efforts. The information highway will greatly enhance the ability of libraries and other organizations to meet the statistical data needs of their constituencies. A description of some specific projects follows.

The **Statistics Corner** is a hypertext project developed for the World Wide Web by the State Library of North Carolina. This product seeks to make available a wide range of statistical resources to Internet users. Currently, the Statistics Corner includes a state data profile, community profiles, and links to county-level profiles. Among the resources to be made available soon are economic indicators for the state; census summaries with detailed demographics for various geographic areas; labor force data; agricultural data; business and economic statistics; and statistics on governmental operations/activities. Because some users may not have access right away to the full graphical capabilities provided by a World Wide Web browser, data are duplicated on the State Library's Gopher server as needed.

The Office of State Planning's **LINC (Log Into North Carolina)** database currently is available via the Internet to users with an account at the state's computing center. LINC provides access to a wealth of federal, state, and local government statistics pertinent to North Carolina and its counties and municipalities. Many of North Carolina's libraries are established users of LINC via dial-in access. Internet access will ultimately reduce telecommunications costs and provide more stable connections and faster file transfer for these libraries. In the next eighteen months, the Office of State Planning hopes to expand its LINC database to accommodate the addition of other types of information needed by state and local government agencies for planning in health, education, economic development, and other service areas. Goals for this expansion include providing easier Internet access, improving the interface, and making resources available in a greater variety of formats.

The Office of State Planning and the State Library are working together to develop a hypertext version of the *North Carolina State Government Statistical Register* on the World Wide Web. The *Register* is a comprehensive inventory of statistical series generated by North Carolina state government agencies.

The State Center for Health and Environmental Statistics and the State Library are exploring ways to use the capabilities of the North Carolina Information Highway to improve access to **health-related data**. As a starting point for this initiative, the agencies will work together to make three databases available, along with mechanisms for searching them and creating reports. These include an inventory of North Carolina health-related data, the *BABY Book* (Basic Automated Birth Yearbook), and *Selected Health Indicators*, a custom product developed by the Center.

Geographic Information Systems (GIS)

In cooperation with the state's Center for Geographic Information and Analysis (CGIA), the State Library hopes to develop the capability for selected public libraries to **view, analyze, and ouput GIS data in a desktop microcomputer environment**. For the past two years, the State Library has provided a limited mapping service using desktop mapping software for DOS on a PC. Services currently include standard census outline maps and thematic maps. NCIH will provide a means of greatly expanding GIS services on a statewide basis. Currently, CGIA has over sixty layers of digital data in a GIS format compiled statewide. These data are a strategic resource vital to the interests of the state's citizens. Improved access will assist government agencies in planning and service delivery and will support economic devel-

opment in the state by providing information to business in various ways.

Business Information

A major focus of NCIH content development is to provide information resources that support economic growth in the state. Many Gopher and World Wide Web Internet servers, including those of the State Library, currently provide access points for locating and retrieving a wide range of business and economic information. One popular business source is the U.S. Department of Commerce Economic Bulletin Board, which provides numerous statistical data series produced by federal agencies.

Through the combined efforts of the State Library, the Department of Commerce, the Office of State Planning, and other North Carolina agencies, NCIH hopes to provide access to company-specific data on North Carolina companies, surveys of industries important to the state, and summary data which track business activity. Preliminary plans include business directories; company reports and news; trends and forecasts; marketing and product information; applied technologies; government policies; and international markets. Formats of business sources will include: text; tabular data; graphic images, such as maps, charts, and photographs; and audio/video files.

Educational Resources

NCIH will provide tremendous ongoing benefits in the areas of improving student performance and providing educational equity in the state. North Carolina's major universities have long been recognized for their excellence in quality of instruction and research. Unfortunately, the state's public schools have not always achieved similar success, particularly in rural areas. NCIH will enable government agencies, universities, and libraries to combine and coordinate their efforts more effectively to improve educational opportunities for North Carolinians. Here are some of examples of efforts already underway.

North Carolina's universities are currently the largest contributors to the Internet in the state. Many of the state's universities provide information via Gopher and/or the World Wide Web. The University of North Carolina's *SunSite* is one of the major Internet resources in the world. In addition to its very large archive of software and information files in various formats, UNC has developed multimedia products for the World Wide Web that showcase information about North Carolina. One current example is an exhibition of folk music provided by the Southern Historical Collection. These resources provide enormous educational opportunities for North Carolina's citizens.

The State Library is developing a multimedia **online encyclopedia** for the World Wide Web. This source will provide a broad electronic overview of the State of North Carolina. Information will include historical highlights, a description of North Carolina's economy, educational and cultural assets, and the state's system of government. Sections on the state's geography, symbols, and people will also be included. The information will be developed using Mosaic (a World Wide Web browser). The software's hyperlink feature will allow the user to retrieve information at several different levels. The variety of levels of information will make the encyclopedia an excellent resource for North Carolina school children studying the state, a source of information for people who are interested in visiting or relocating to the state, and will provide useful information for businesses interested in expanding or relocating to North Carolina.

Access

The methods of access and retrieval of data on the information highway will generally be via the standard Internet protocols. In order to make the Internet easier and more attractive for users, the State Library and other organizations will apply customization strategies that enhance access methods currently available on the Internet. For the State Library, the focus will be on two areas: (1) developing easy-to-use interfaces, and (2) establishing a North Carolina Network Information Center. Both strategies will help direct users to relevant and timely information useful to the various communities of interest in the state. A description of these two strategies follows.

Custom Internet Interfaces

Through the development of custom interfaces, the State Library and other Internet information providers will seek to facilitate access to the wide range of information available on the Internet. The access and retrieval system operates in a client-server mode. Two types of information servers, Gopher and World Wide Web, currently provide the primary means for developing custom interfaces tailored to meet the needs of users. WAIS (Wide Area Information Server) software provides the added capability of indexing information across protocols. (See *Lagniappe*, pages 86-87, for more information on Gopher and World Wide Web.)

North Carolina Network Information Center

The purpose of the North Carolina Network Information Center (NC NIC) is to provide services that make accessing and using the Internet easier and more attractive for end-users. The North Carolina Network Information Center will be established by the State Library in cooperation with the Microelectronics Center of North Carolina (MCNC), State Information Processing Services (SIPS), the North Carolina Department of Community Colleges, and the University of North Carolina General Administration. In accordance with a national model for network information centers developed by the Network Information Services Infrastructure Working Group in the User Services area of the Internet Engineering Task Force (IETF), the North Carolina NIC will perform these functions: (1) provide information resources; (2) support end-users through direct contact; (3) collect and maintain NIC referral information; (4) support the national Network Information Center infrastructure. In performing these functions, the North Carolina Network Information Center will accomplish these objectives:
- Help users get connected to the Internet
- Help users identify, locate, and access Internet resources
- Help users acquire basic Internet skills using self-help approaches
- Help users contact appropriate individuals/organizations for assistance with specific needs or problems
- Exchange information with others NICs
- Market Internet services provided by the various communities of interest
- Provide a mechanism for feedback and evaluation from users

Information will be distributed online via Gopher, the World Wide Web, E-mail, FTP (File Transfer Protocol), and the North Carolina Information Network (NCIN). (Libraries may access NCIN via dial-up service or Telnet over the Internet.)

Benefits

The benefits of the North Carolina Information Highway are numerous and far reaching. NCIH planners envision great benefits in education, health care, criminal justice, economic development, government, and other areas. Here are some of the key expectations:

Education
- Students will be able to access classes through the video

capabilities of NCIH with the long-term goal of educational equity among the state's school systems

- Public schools will have the capability of advanced networking with libraries and universities
- Students will be exposed to technology that they will use as adults
- Schools can more easily transfer documents and data between sites electronically
- Students will have opportunities for "video field trips" with leading professors, scientists, government officials, and business people
- Training opportunities without the hardship and expense of travel will be available for teachers

Health Care
- Telemedicine will revolutionize the delivery of health care to rural areas
- Sophisticated diagnostic equipment at the state's regional medical centers will be available to rural areas
- Training of medical personnel at remote locations will become routine
- New treatments that use high-speed computer imaging will be available
- Management and transmission of patient information and electronic claims processing will be improved
- The latest health information from numerous databases will be available instantaneously in a multimedia environment

Criminal Justice
- Law enforcement field officers will have immediate access to information databases, resulting in lives saved and property protected
- Video arraignments will speed due process and reduce costs
- Interactive video will be incorporated into prisoner rehabilitation programs

Economic Development
- A state-of-the-art telecommunications infrastructure will attract high-tech businesses
- Enhancements in the state's educational system will also impact on economic development
- Remote training will be commonplace for businesses, saving both time and money
- Businesses will have better access to strategic information and market data
- NCIH will facilitate locating industry throughout the state rather than just in metropolitan areas

Government
- Paperwork will be reduced, effectiveness and efficiency will be enhanced, and, as a result, taxpayer dollars will be saved
- All branches of state government will have access to diverse databases that will provide information needed in the legislative process, policy making, regulatory activities, and service delivery
- Emergency management will be improved to offer vital services in times of crisis
- Video conferencing will reduce state employee travel costs
- Access to information on jobs, unemployment, and other vital topics will be readily available to the state's citizens
- Advanced networking will provide cooperation and information sharing among agencies

Summary
The North Carolina Information Highway is the first network of its kind in the world. It will support applications from a variety of users and has the flexibility to grow as user needs and applications grow. Implementation of the North Carolina Information Highway will change the way we live, work, and play by providing a wide range of services equally distributed to every corner of the state. These services will be more responsive and enhanced far beyond what the current technology provides to all citizens of North Carolina. All of these services will in turn encourage and support economic development and improve the overall quality of life in the state.

Perhaps just as important to North Carolina as the many tangible benefits outlined above, is the enlightenment that comes as a result of the interaction with the global community made possible by the North Carolina Information Highway. NCIH planners envision that North Carolina will be interconnected to a global information highway. The advanced switching technology provided by ATM nodes throughout the world will allow links to existing non-ATM interfaces, such as Ethernet networks, as well as to direct ATM interfaces, such as wireless communications, cable TV, multimedia workstations, ATM LANS, and supercomputers (see Figure 2). In a near-future era, the direct interface provided by NCIH with the global information network will present endless possibilities for expanding our minds, strengthening our society, and understanding our neighbors on planet Earth. While the vision may seem like science fiction to many, the technology to turn the imaginary into the wholly possible is here now. Just as surely as our everyday experiences have helped to make us what we are, our travels on the North Carolina Information Highway will shape our thoughts, attitudes, and actions. So, hold on to your seat and prepare for the ride of your life!

Figure 2

HIPPI

FDDI
Fiber Channel
SMDS

Frame Relay

POTS

Ethernet

ISDN

ATM Switching Nodes

Supercomputers

Wireless

Law Enforcement

CATV

Multimedia Workstations

ATM LAN

Interworking Existing Non-ATM Interfaces

Direct ATM Interfaces