

# Part 1: Understanding the Network

Version 1.1

Latest Revision: January 2003

## 1A. An Overview

**1A-1.** The North Carolina Information Highway (NCIH) is a statewide digital broadband network capable of transmitting signals at speeds up to 155 million bits of information per second. Interactive video and data services are offered at the majority of its sites. In January 2003, the NCIH consisted of 176 operational sites at 76 high schools, 46 community colleges, 23 special and state agencies, 15 medical and health sites, 6 universities, 9 correctional facilities, and 1 local government. The network is compatible with most other video conferencing platforms, such as microwave networks and satellite linkages, thereby opening up public agencies to the rest of the nation and to the world.

If you are not familiar with the basic principles of information technology and networking, Appendix 2, "Technical Fundamentals and Terminology," offers a helpful introduction.

**1A-2. Background and Development.** Interactive video conferencing was introduced to North Carolina in 1985 through the North Carolina Research and Education Network (NCREN), which is operated by MCNC at its complex in Research Triangle Park. NCREN includes state universities and several medical schools. Originally a microwave network, it now includes an extensive cable system. In addition to teleconferencing and data services, which include access to the Supercomputing Center, it functions as the state gateway to the Internet. NCIH and NCREN sites are fully interoperable.

The Vision Carolina project (1991-1994) was the precursor of the NCIH and linked educational resources in the Charlotte and Wilmington metropolitan areas to improve access to distance learning opportunities. The partners included public schools, community colleges, universities, and a regional medical center. They pioneered a variety of innovative educational applications, including team-taught courses and collaborative enterprises that transcended traditional institutional boundaries.

The NCIH came into existence in 1993 through joint executive and legislative action and was, at the time of its creation, the most advanced telecommunications initiative in the United States. Network operations began in August 1994 with 33 sites operating at a statewide video conferencing speed of 45mb. In 1998, new computer-based hardware was introduced to the network and the operating speed was reduced to 768kb. In 2002, the speed was again reduced to 384kb. By taking advantage of technological progress and steadily reducing the bandwidth needed for video conferencing, the state has enabled clients to realize substantial savings in both one-time and recurring expenses.

**1A-3. Applications.** From its inception, the NCIH has been intended as a mechanism for improving statewide communication, leveraging scarce resources, and addressing

problems of urban/rural equity. While its potential is generally perceived as limitless, usage is presently focused in the fields of education, medicine and health care, law enforcement and criminal justice, economic development, and government efficiency.

Most current NCIH sites are educational in mission and utilize distance learning as a means of overcoming geographic barriers. Especially innovative is the trend towards cooperation among different levels of the public educational system. Many of these opportunities involve upper-level, advanced placement, or specialized courses that are beyond the means of small institutions or school systems to offer. Reduced travel time and transportation expenses are of particular value to adult learners.

Within the medical community, emphasis is focused on telemedicine and on providing community health care information. Diagnostic and consultative sessions take place on a routine basis. One significant application is the ongoing training provided to county health care professionals. Community colleges and the Department of Correction use the NCIH to provide training to staff and educational programs to inmates. Emergency Management Services, which coordinates disaster preparedness within and outside the state, is among the many agencies that utilize the network to share resources on a timely basis.

**1A-4. Structure.** The NCIH is a public-private partnership. Its backbone is part of the public-switched network in North Carolina. This infrastructure is owned and maintained by the telephone companies of the state, which work in cooperation with one another to deliver services statewide. The state establishes technical standards, determines policy, and leases service as a customer on behalf of its numerous clients. It does not own the network, as that would require enormous capital construction costs and the maintenance of a large bureaucracy to duplicate services that are available in the private sector. The final element in the partnership is the individual site. Sites assume the one-time cost of installing their facilities and the recurring expense of operation.

The NCIH may be visualized as a central hub with radiating regional spokes. The hub is a telecommunications switch in Raleigh and the regional spokes are switches in different locations, all connected by high capacity cables that process digital signals at enormous speeds. BellSouth provisions the switches in Raleigh, Asheville, Charlotte, Greensboro, and Wilmington. Sprint video signals are routed through Greenville. Two Verizon switches are situated in Durham. Multi-point control units (MCUs) at network switches create interactive capability for multiple sites so that they can see and hear one another as though occupying a single room.

Individual NCIH sites are connected to the nearest telephone company switch. When two or more sites in the same region interact with one another, the video signals are transmitted back and forth through a single switch. When sites in different regions communicate, the video signals interconnect through the Raleigh hub.

Video sessions are centrally scheduled through an on-line computer program, the BellSouth Video Conferencing Service (BVCS) **Web Scheduler**. Every site has at least

one scheduling contact who is trained in the use of the Scheduler. Access is provided through a link from the NCIH Home Page. There is also a *Reports* section to which read-only access is available to anyone through a link from the Home Page. More information about scheduling and types of sessions is provided in Section C below.

**1A-5. Administration.** The NCIH is administered by the state's information technology agency and is supported by advisory organizations that include clients and technical experts. The North Carolina ***Office of Information Technology Services (ITS)*** manages state information resources from headquarters in Raleigh. Its support staff furnishes planning, operation, and maintenance for network transport facilities. A list serve, or automated electronic mailing list, helps its customers communicate. ITS also maintains a 24-hour Customer Support Center that is the initial point of contact for technical troubles. These resources are described in more detail in Part 2.

Four ***regional coordinators*** are based in Raleigh, Wilmington, Winston-Salem, and Flat Rock. They serve as field support during site implementation, perform network training and troubleshooting, and assist in the creation of collaborative partnerships. Staff names and contact numbers are listed on the NCIH Home Page. Although each coordinator is assigned a geographic area, the staff works as a team to provide service. If you are temporarily unable to reach the coordinator assigned to your region, do not hesitate to call one of the others.

The North Carolina ***Connectivity Council*** (formerly known as the Policy Committee) is a voluntary advisory board consisting of major stakeholders in the information technology community. Its core mission is to provide unified recommendations on NCIH direction to the Information Resource Management Commission (IRMC), and through it to the General Assembly and its legislative staff. The council meets monthly in Raleigh.

NCIH client groups have formed around the state to benefit the end user community. These voluntary and professional groups include representation from public agencies as well as contacts from the private sector. Collectively, they have hosted a variety of meetings and conferences on an annual basis. In recent years, the largest meetings have been the NCIH Stakeholders' Conference, hosted at rotating sites around the state, and the annual conference of the NC Distance Learning Association. The NCDLA has pioneered the concept of a virtual conference, which participants can attend on-line.

## **1B. The NCIH Facility**

**1B-1.** Depending on the use for which they have been designed, NCIH facilities come in many sizes and configurations. The principal hardware components are the codec and other equipment that send, receive, and mix the signals being transmitted over the network. Some equipment is required by the state for network operation and compatibility. Many options are available and can be tailored to specific applications.

These components have probably been installed by an **integrator**. Several companies have integration contracts with the state. Integrators are usually responsible for maintaining and repairing equipment as well as for the initial installation. Maintenance contracts are highly recommended following the end of warranty periods in order to restore a facility to working order as rapidly as possible in the event of technical trouble.

**1B-2. Demarcation.** The circuit that connects a facility to its regional switch terminates in a patch panel mounted on the wall of the room, usually within a few feet of the equipment rack housing the codec and other hardware. It may be a locked rectangular metal box known as a *smart jack*. The cable is labelled with a number that should be kept available for reference. For troubleshooting purposes, everything up to and including the demarcation is a telephone company (network) responsibility.

**1B-3. Router.** From the demarcation, a patch cable leads to the router that is the network interface for the video connection and for the data connection if the site has combined video and data service. Currently, it is a Cisco 3800 Series (Model 3810). The router and its attendant cables are state responsibilities. ITS monitors the router 24 hours a day using remote diagnostics and will repair, replace, or upgrade it if needed.

If data service is integrated into the router, your local data LAN may connect to it. NCIH data service functions independently of the video connection. This means that data may be travelling over the circuit even when the video facility is not in use. You should not turn off the router without first checking with your LAN administrator.

**1B-4.** The **codec** (short for coder/decoder) is the heart of the system. It digitizes the outgoing video signal and converts the incoming signal from digital to analogue. Only codec systems that have been tested and approved for compatibility may be used on the NCIH network. Since codec systems are proprietary, their features and functions will vary. Several systems are currently certified for network use and are available for purchase on state contract. Maintenance of the codec and other room equipment is the responsibility of the agency.

**1B-5.** Other equipment in the facility enables the room to function appropriately. Specific details of operation depend on the complexity of the installation. Briefly summarized, a typical video facility works in the following manner:

- The **audience camera**, located at the front of the room, usually on top of the front television monitor, is trained on the participants. If the facility is designed for a presenter or instructor, there will also be a **presenter camera**, located at the back. Camera movement is controlled by the room facilitator.
- One or more **microphones** feed audio signals to the codec. Either table or ceiling microphones may be used. The NCIH employs an audio environment in which all connected sites can hear one another as though they occupied a single room. The different kinds of video sessions are described in Section C below.

- Digital audio and video signals generated by the codec are introduced to the network through the router and are transmitted to distant sites. Incoming digital signals from the remote sites follow a reverse path through the router and codec, reconverting them to analogue. Ordinary **television monitors** and **speakers** enable participants to see and hear each other. In some facilities, there may be more than one monitor at the front of the facility to display the local as well as the incoming video signal.

Many agencies customize their facility with options designed to facilitate specific applications. Typical options include three-chip presenter and audience cameras, which provide significantly better resolution; a document camera, which can be mounted either in the ceiling or on a desk stand to provide graphic images to participants; and a video cassette recorder for recording sessions or transmitting video tapes. Fax machines and multi-media equipment may also be integrated into a facility.

**1B-6.** Troubleshooting procedures are described in detail on the NCIH Home Page and are summarized in paragraphs 2B-8, 2B-9, and 2B-10. Generally speaking, thorough familiarity with the configuration of the facility and its equipment enables faster isolation and successful resolution of technical problems.

## **1C. Sessions and Scheduling**

**1C-1. Session Types.** The network supports three kinds of sessions. **Voice activation** mode is used for all **point-to-point** sessions (involving only two sites) and can also be used for up to 18 sites in a **multipoint** session. When more than two sites are active, the network automatically switches among the participants based on the dominant continuous audio signal. Participants have to speak for about three seconds before switching takes place. One site at a time is visible full-screen on the television monitor. NCIH sites always hear one another.

Voice activation can be selected for any size session but is basically intended for large conferences (more than five sites) and for more formal settings where protocols exist for each site to speak. Participants should understand the nature of the session and its constraints in advance, because if several sites try to speak simultaneously, severe technical switching problems may result. The audio signal is continuous, so unless a site is individually muted or has “push-to-talk” microphones, the microphones are live. In a large conference, audience noises can be distracting.

The second mode is intended for a maximum of five sites. A **broadcast/lecture** session begins with the host site viewing a quad screen, in which the television monitor is divided into quadrants and as many as four distant sites can be viewed at once. The host can select any site to see full-screen. Receiving sites see only the host and cannot switch to any other site, although they can hear them throughout the session. This

mode is most appropriate for lecture-style presentations in which the receiving sites need to interact with the presenter but not with one another.

The third session mode is called **chair control**. Chair control mode may be used either with voice activated or continuous presence (quad screen) depending on which configuration has been selected. When it is enabled, one site may take control of video selection for itself or the other sites in the conference (called “taking the chair”). Although a host site is designated at the time the session is scheduled, any site in the conference can take the chair. If no one takes the chair, each site can control whatever distant site it wishes to view on the incoming monitor. The site can also choose to view the conference in a quad screen. This option allows participants greater flexibility than broadcast/lecture mode and is often preferred for this reason.

Different scheduling modes are appropriate for different purposes. The functionalities of the network are designed to allow you as much choice as possible, thereby enabling you to select the features that are most conducive to the style of interaction you desire. By thoroughly acquainting yourself with these properties, you can better take advantage of all the opportunities the NCIH affords.

**1C-2.** Video sessions may be **one-time** or **recurring**. **Set-up time** must be scheduled prior to the beginning of a session. Set-up time varies depending on the number of sites participating in a session. The minimum is one minute per site scheduled. This time is not billed and does not count as part of the session. It is useful to have as much setup time as possible so that sites can connect to the session, site personnel can communicate with one another, and any technical difficulties can be resolved.

**1C-3. Web Scheduler.** As previously noted, the BVCS Web Scheduler provides central network scheduling. It is reached via a link from the NCIH Home Page and may be accessed 24 hours a day. Basic information is available on the BVCS Home Page.

**Read-only access** to the Reports section of the Scheduler is available via a link from the NCIH Home Page. These reports may be accessed by anyone and are a useful source for specific applications. Reports are organized by dates, times, agencies, requesters, names, subjects, site locations, and usage. All information is exportable.

Each facility must have at least one individual designated as the **scheduling contact**. A backup is highly recommended. Scheduling contacts are authorized by BVCS to log onto the Scheduler and are trained in its use by the regional coordinator. They may access the *Create a Conference* form, used for scheduling new conferences, and the *My Conferences* section that permits modification or cancellation of existing sessions. Scheduling contacts may change only conferences that they have created themselves. They will receive notification of sessions that someone else has scheduled for their site.

Certain system requirements, setup recommendations, and browser preferences are necessary for scheduling contacts to use the scheduler effectively from their computers. A link from the BVCS Home Page provides information about the current settings.

**1C-4. Scheduling Procedures.** A detailed list of current video scheduling procedures is available on the NCIH Home Page. Because the network is centrally scheduled, one scheduling contact (usually the representative of the host site) must assume responsibility for the following duties:

- ***Determining dates, times, and title of the conference.*** This includes ascertaining any exception dates during the period that a recurring conference will meet. If the need arises, dates, times, or participating sites can be modified or cancelled after a program is scheduled. Sessions can be scheduled up to 18 months in advance.
- ***Contacting all participating sites and receiving permission to accept charges.*** No site may be scheduled without its permission. As noted in Part 2, many details of a collaborative program should be settled well in advance of the time it is scheduled.
- ***Verifying that participating sites have nothing else booked in their facilities.*** Scheduling contacts should remember that facilities may be used for purposes other than video programs.

The host scheduling contact also schedules the conference(s), resolves any problems that arise during the process (sessions are occasionally denied due to site or network resource conflicts), and modifies or cancels the completed schedule as needed. The Scheduler submits requests immediately. However, network procedures recommend a three-day turnaround for submissions, modifications, or cancellations under normal conditions. Sessions may be cancelled on shorter notice during a weather emergency.

Each conference or session within a conference generates a ***conference identification number*** at the time it is scheduled. Site personnel should keep these numbers available for reference, as they may be needed for technical troubleshooting.

**1C-5. Scheduling Other Sites and Networks.** An important element in NCIH flexibility is the capacity to connect to other teleconferencing systems. Interconnectivity is a complex issue. The state is developing strategies to enable as many platforms as possible to communicate. Compatible bridging equipment is needed to create ***gateways*** to sites or networks that utilize different video conferencing technologies.

Procedures for scheduling NCIH and NCREN sites, and a contact list for the latter, are available on the NCIH Home Page. The NCIH site should contact the appropriate NCREN program coordinator(s), who in turn must check through their administration to confirm availability of the network, the sites, and one of the six NCREN bridges (listed in the Scheduler as MCNC 1-3 and MCNC GW1-3). Only NCREN can assign one of its own bridges. After it has been designated, the NCIH site should schedule session(s) through the Scheduler using the bridge number as the receiving site.

A procedure also exists for allowing compatible guest sites, called ***Off-Net*** sites, to connect to the NCIH network. These sites must use codecs that operate under H.320

standards and must be able to access BVCS via an ISDN dial-up at speeds of 2x56kb, 2x64kb, or 384kb. Bridging is accomplished by BVCS and is scheduled by the NCIH site using ITS Guest Sites 1, 2, 3, 4, or 5 on the Web Scheduler. An hourly fee billed to the NCIH site is charged for this service. It is also highly recommended that the guest site undergo BVCS certification to minimize the possibility of technical problems at the time of connection. A one-time charge is made for certification. There is a detailed explanation of the Off-Net process on the NCIH Home Page.

Other kinds of video interactivity such as microwave, satellite downlinks, ISDN, or H.323 (Internet) connectivity may be feasible at your site. For questions about the technical aspects of participating in such sessions, which may entail special arrangements, considerable lead time, and additional expense, consult your regional coordinator. A practical, low-cost alternative to a video conference is a streaming video presentation, which can be stored on a web site, downloaded to an individual computer, and played at the viewer's convenience. Recording and editing services are available from ITS through your regional coordinator.