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ABSTRACT

This digest discusses several aspects of electronic networking, including network functions, implementation, and applications in education. Electronic networking is defined as including the four basic services of electronic mail (E-mail), electronic "bulletin boards," teleconferencing, and online databases, and an overview of these four functions includes discussions of specific E-mail network providers, databases, and database vendors. Information designed to provide guidance in choosing an appropriate system is also given, including a checklist of electronic networking features and a discussion of hardware and software selection considerations. In addition, listings and descriptions are provided for educational networks, user groups and bulletin board updates, networking associations, and networking periodicals and books. Ten references are included. (KM)

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ERIC DIGEST

ELECTRONIC NETWORKING

Can you think of another term which covers almost every form of interaction between computers? Electronic networking includes four basic services: the sending and receiving of mail electronically; the long distance use of one computer by several terminals; the posting of news on specialized "bulletin boards"; and the searching and reading of information known as databases. Each electronic communication system usually charges a membership fee and will bill for the actual time (in minutes) you spend using the system per month. Expect to pay somewhere around $500 per year for moderate use of an electronic mail and bulletin board system. In addition, there may be costs to rent telephone lines if the computer which houses the electronic mail system is not in your locale. If this is the case, costs can be lowered by joining a company which rents the lines at lower rates because they handle a large volume of traffic. The major suppliers are Telenet and Tymnet.

Four Functions of Networks

First, let's concentrate on electronic mail systems. Electronic mail is showing, by far, the greatest growth—an industry to the tune of over $100 million a year. Some of the major mail network providers are: McDonnell-Douglas's OnTyme, RCA Mail Telecom, Canada's Envoy 100, The SOURCE, Uninet's World Link, Western Union's Easy-Link, GTE's Telemail, COMPUSERVE, MCI Mail, and ITT's Dialcom. Using a typical electronic mail system, you can send "telegraphic style" memos, letters, and even voluminous proposals to anyone who uses the same electronic mail system. (With the recent implementation of international gatewaying technology, expect to see more interconnections between E-Mail systems—case in point, the new linkage between MCI Mail and COMPUSERVE which both companies claim to be the "world's largest interconnected electronic mail network".) E-Mail communiques arrive at their destination immediately. All the addressee needs to do to read the letter you sent is to "sign-on" to the system. Three pieces of equipment are required: a telephone or dedicated phone line, a terminal or personal computer (almost any kind), and a modem. If you have a microcomputer, you must insert appropriate software to convert the PC into the terminal mode. Once you have the equipment, the sign-on process usually requires subscribing to a system (some are free) and using a password to protect confidentiality. Basically, all the services of the post office are open to the electronic mail user (e.g., registered mail, bulk mail, express mail, and international mail). Even better than surface mail, electronic mail has the capacity to send one letter to an unlimited list of addresses. If that feature doesn't win you over, the ability to solicit instantaneous responses should.

Secondly, electronic communications include "bulletin boards." Electronic bulletin boards are exactly what they sound like—you post notices on the board or read those that are already posted. In the past few years these boards have proliferated at such a rate that "BBSs" have tended to become specialized and less informal. Some of the bulletin boards available are listed in the resources section of this digest. A final word of caution—boards can be "open" and "closed." On an open board, everybody who uses the system will be able to read what you have posted. Closed boards, on the other hand, limit access to those system users with special security measures.

A third function of electronic communications involves teleconferencing. On an informal level this is known as "chatting"—a live, keyboard-to-keyboard conversation between those people using the system at a particular moment. It resembles live telex communication but at several times the speed, and at a fraction of the cost. With certain communications systems like The SOURCE, you can even record the conversation and file it, get a printed copy simultaneously, or file it and print it out later.

Online databases are the fourth major capacity of electronic communications. When you consider Naisbett's estimate that the amount of data in the world today is doubling every 20 months, avoiding cognitive overload is becoming increasingly important. Rather than wandering through the geometrically progressing morass of electronic information, you can ask your computer to search for only the information that meets your needs. The *Encyclopedia of Information Systems* and Cuadra/Elsevier's *Directory of Online Databases* point to continuing growth in the database industry. Some 450 databases went online in the past year, making a total of over 2,900 databases offered online worldwide, according to Cuadra. An increasing number of these databases can be accessed via gateways—the directory identifies 35 at this time. Basically, there are three general types of databases: full text with such holdings as NEXIS' five major newspaper collections since 1977; bibliographic databases such as ERIC found on DIALOG; and non-bibliographic collections, e.g., Bureau of Labor Statistics Data Bank. One of the newest databases is File 511 available on DIALOG and known as The Electronic Directory of Education, which provides directory information on all 100,000 U.S. schools, 15,000 school districts, 3,000 colleges and universities, and 15,000 public libraries. In addition, the names of teachers, principals, administrators, and librarians who staff these institutions are included. The file is compiled by Market Data Retrieval (MDR) through an annual phone survey of over 50,000 interviews. In fact, MDR offers a rare guarantee—the first person who finds a U.S. elementary or secondary school, college, or public library that is not included in the database will be mailed a $10 check. Contact: Market Data Retrieval, 16 Progress Drive, Shelton, CT 06484; (203) 226-8941.

One of the most efficient ways to pinpoint and access a special database is through a database vendor. The following vendors

sell access to most of the online databases you will use and most have a discounted night rate:

BRS	800-833-4707 (62-80% night discount)
COMPUSERVE	800-848-8990 (52% night discount)
DIALOG Information Services	800-227-1927 (53% night discount)
Newsnet, Inc.	800-345-1301 (25% night discount)
Pergamon Intl. "INFOLINE"	703-442-0900
SOURCE Telecomputing Corp.	800-336-3366 (62% night discount)

And once you have found the database you would like to search, it may be easier to use one of several new software tools instead of learning complex search strategies such as Boolean algebra. Specifically, I am referring to IN-SEARCH (Menlo Corp.), a front-end package that facilitates searching the DIALOG databases and uses windows to create the illusion of library catalog cards in our categories: arts/education/social sciences; biology and medicine; business, government and news; and engineering/mathematics/physical sciences. Another novice-oriented software package for searching DIALOG is SEARCH-HELPER, from Information Access Company. SCI-MATE, from the Institute for Scientific Information, is a menu-driven software package which combines the Universal Online Searcher and the Personal Data Manager—definitely targeted for the science and technology researcher who will need to perform cross-system searches.

Selecting an Electronic Network...

Selection of the appropriate electronic communications system can be tricky. With the numbers proliferating daily, the following check list may be helpful in selecting the right network for you. You may not need all these features, but given the confusing and sometimes expensive nature of this communications medium, the more questions you can ask before getting captured in an unnecessary commitment, the better. In fact, California has become the first state to pass legislation to regulate the videotex industry. (Videotex is a generic term used for any electronic system that can be used to retrieve both print and graphic computer-based information via video display monitors or specially adapted television sets. It can be used as an information source, a delivery medium, or a communication network.) The Electronic Commerce Act of 1984 requires videotex systems operators to provide subscribers with "specified information including the charges imposed and the procedures that may be followed to resolve a complaint regarding the use of the service." Failure to comply with the act's provisions could result in a fine of up to $5,000. A copy of the act (Assembly Bill 2367) is available from the California Legislature, Assembly Utilities and Commerce Committee, State Capitol, Sacramento, CA 95814; (916) 445-4246. Rumblings in other states suggest this will be a national trend.

Checklist of Electronic Networking Features

1. Electronic Mail
   - has mail options (urgent? registered? private? timed delivery?)
   - has broadcast list?
   - can scan mail?
   - automatically informs user of new mail?
   - gives summary of new mail?
   - permits multiple commands on one line?
   - has overnight hard copy delivery in the United States (letting the sender communicate with non-pc users; similar to services such as ZapMail)?
   - provides listing of subscribers?
2. Telex Interface
   - has inbound/outbound telex interface?
   - has interface with voice mailboxes (turns voice into data and data into voice messages)?
3. Bulletin Boards
   - is monitored (notification of unread information)?
   - can scan bulletin boards?
   - can search by number of message? date? sender? subject?
   - information and network capacity is local? state? international?
   - has key word search on subject line?
   - automatically informs user of monitored bulletin boards?
   - is command driven or menu driven?
4. Filing Messages
5. Speed of Transmission
   - works at 300 baud? 1200 baud? 2400 baud? works at another speed?
6. Security
   - uses invisible password/no show?
   - has individual passwords within user account (private ID)?
   - enables user to change his/her own password?
7. Forms Generation
8. Equipment Compatibility
   - interfaces diverse hardware and peripherals and languages?
   - requires standard phone line?
   - requires RS-232C interface on your computer?
   - requires asynchronous communications capabilities?
   - needs half or full duplex?
   - uses ASCII? 7 or 8 bit? parity?
9. Location Independent
   - operates locally/regionally? nationally? internationally?
   - has IN-WATS access available?
10. System Support Services
    - has customer service hotline during working hours? 24 hours/a day?
    - uses individualized user billing?
    - customizes network design?
    - has materials design and production services?
11. Complete Control over Bulletin Boards by "Administrative" Users
12. Connect Time Rates
    - different rates for prime time? off peak? night hours?
    - variable rates depending on transmission speed: 300 baud? 1200 BPS? 2400 BPS? 9600? faster?
13. Telephone Access
    - via TELENET? via UNINET? via TYMNET? via others?
14. Connect Time Estimates Provided
    - monthly average? annual average?
15. Volume Charge Estimates Provided
16. Annual Subscription Fee Charges
    - has discounts for additional users with same institution or districts?
17. Gateway Capacity with Other Databases
    - access to commercial databases?
    - access to news services?
    - access to private databases?
    - access to public databases?

What Hardware Do I Need to Network?

Getting connected with an electronic network requires:
- a microcomputer or a terminal—practically any brand will do!

Memory capacity becomes important if you are engaged in uploading and downloading large files.

- a compatible modem which converts digital information into audible tones that telephones can understand. Modems come in two types—external and internal. External modems are designed to use the same modular plug as standard dedicated phones at one end—you connect the modem to your computer by using the RS-232 serial port. If your computer does not have a serial port, you will need a serial card for some Apple, IBM and TRS-80 computers.

Make sure the modem cable fits your computer. A simpler and increasingly popular approach is to use an internal modem card. Regardless of whether you use an internal or external modem, frequent users should also check the automatic features of a modem before purchase. Some features to consider are: autodial, storage of frequently dialed numbers, auto-redial, and auto-answer. Clockcards are also handy when you want to take advantage of cheaper night rates. The speed at which modems send and receive information is measured in bits per second (bauds). On most commercial electronic carriers, there are two basic speeds: 300 baud and 1200 baud. Operating at 300 baud, a modem can send between 250 and 300 words per minute. In the past few months 2400 baud modems have become widely available. And what about price? Well, while 300 baud modems are cheaper, remember that using electronic communications involves phone lines and per-minute computer service charges. If you expect to use your modem extensively, e.g., with file transfers, consider investing in a 1200 baud model which permits you to operate at both speeds. If you consider yourself a speed demon, maybe a 2400 baud modem is for you. But be careful—the technology is advancing quickly but some of the rickety phone lines around the country are not—and the transmission may be full of errors. For an in-depth treatment of modems, refer to recent issues of popular computer journals such as *Creative Computing* and *Communication Age*.

What Software Do I Need?

On many microcomputers, software is needed to convince your computer that it is a terminal. Averaging between $100 and $500, the software program is a set of instructions—on a diskette, cassette tape or cartridge—that manages communications for your computer. If you are planning to use your computer only for an occasional call to a bulletin board, buy an inexpensive program in which your computer serves as a "dumb terminal"—one which sends and receives information. Programs offering all the features of a "smart terminal"—one which not only serves as a dumb terminal, but saves information it receives on a disk and sends out files that have been stored on disk—usually cost less than $200 and are well worth it. In summary, a good communications software package allows you to: store data coming across the screen in either its own memory or on a disk; turn the printer on and off with the touch of a key; eliminate the arduous task of the log-on sequence by means of stored instructions called "macros" or "script files"; and receive data while the computer is unattended. Excellent surveys of the strengths and weaknesses of popular communications packages can be found in *Creative PC Magazine* (for IBM compatibles) and *A+ Magazine* (for Apple equipment). Some of the more popular and effective programs are:

- for Apple systems: ASCII Express, Era 2, Talking Termexec, Access II, Softterm 2, Macterminal, CAT Communication System);
- for IBM systems: PC-Talk III, Smartcom II, Crosstalk XVI, Era 2, Smarterm, Kermit, Bizcomp, Watson, Telepath and Softerm PC;
- for TRS-80 systems: Lazycom.
- for the Kaypro II: Smartcom II.

Networking Applications in Education

A Sample of Some Educational Networks

What follows is a listing of some of the educational networks currently available. Some are free but those on commercial networks (e.g., COMPUSERVE and The SOURCE) usually involve a subscription fee and and online charges.

- ADCIS-NET is a network used for sharing information about computer based instruction. It is part of the COMPUSERVE Information Service and is available to any member of ADCIS (Association for the Development of Computer Based Instructional Systems) or a COMPUSERVE member. Features include: bulletin board, private and public message posting, computer conferencing, databases containing courseware catalogs and reviews, directories, and publications. Contact: Ronald Comer, 076 Health Services Library, Ohio State University, 376 West 10th Avenue, Columbus, OH 43210. In addition, COMPUSERVE offers a multitude of education-related SIGs (special interest groups such as the American Educational Research Association and ICCE). Contact COMPUSERVE's Information Services, POB 20212, 5000 Arlington Centre Blvd., Columbus, OH 43220, or call (800) 848-8199 for a complete listing of offerings as well as subscription information.

- EDLINE is an electronic network on The SOURCE which is coordinated by NSPRA (National School Public Relations Association). Edline's features include: electronic mail, electronic version of Education USA, Federal Alerts, Rural-Line, a variety of national networks including CCSSO, and OERI; state networks such as ORENET and PENNLINK; and regional networks. Contact: Laura Bono, SPRA, 1501 Lee Hwy., Arlington, VA 22209; (703) 528-5840.

- Since 1983, the ELECTRIC PAGES has been providing educational services in Texas via several interrelated networks. Some of these include: Texas Education Agency, Texas Association of School Boards, Texas Computer Education Association, Teen Issues, and Southwest Educational Development Laboratory. A single subscription and ID number allow all members of a particular school district to log onto the Electric Pages and gain access to the private networks. Contact: The Electric Pages, POB 2550, Austin, TX 78768; (512) 472-6432.

- LEARNING LINK is New York City's WNET/13 computer based network designed to help teachers, administrators, media specialists, and staff trainers use technology to meet their instructional needs online. The network is available to schools in the New York-Connecticut-New Jersey area and can be used to get online information on educational TV broadcasts and order video, print, and software resources. The Chicago Public Schools also operate a local network with a special focus on bilingual education.

- LITNET is an electronic mail/telecommunications system being implemented by the U.S. Department of Education that will link together all sectors of the literacy community who are interested in participating. LITNET can be found on SPECIALNET, the largest educational network, which is managed by the Council for Exceptional Children (CEC). In terms of LITNET, this network is operated by the National Association of State Directors of Special Education. NASDSE is willing to make the system available to local programs without requiring a subscription fee. On a related note, CEC is funding an ambitious new program called HANDYNET whose aim is to provide a multi-disciplinary information network for the disabled in Europe.

- SCHOLARNET is a new electronic networking service aimed at helping scholars communicate. Initially it consists of PoliNet and HumaNet and is based at North Carolina State University (Delphi is the host system). Other interuniversity electronic services, such as BITNET/EduNet have been available for some time.

• TECHCENTRAL is an electronic network which focuses on instructional technology and is a service of AECT (Association for Educational Communications and Technology). Access to the system is available via GTE's Telemail. Among its features is a combination of national, regional, and state networks. Contact AECT, 1126 Sixteenth St. NW, Washington, DC 20036; (202) 466-4780. At the state level on TECHCENTRAL is PIMS-Pennsylvania Instructional Materials Services, which maintains a central database of all film and video purchased in the state. All correspondence, including forms for entering new data into the system, is done electronically. PIMS also shares information on common problems and parts availability online for audiovisual, video, and microcomputer repair. The director of this effort is Chuck Forsythe, who has also been instrumental in setting up some exciting school district E-Mail exchanges between students in Pennsylvania and Australia. He can be reached at the Montgomery County Intermediate Unit, Montgomery Ave. and Papermill, Erdenheim, PA 19118. Other educational associations available on the GTE Telemail system include such national groups as the American Association of School Administrators, the American Association of Colleges for Teacher Education, and the American Library Association. Contact these associations directly at their national offices for more information.

• A European network consisting of five centers is designed to promote the use of online information services:
—Swedish Diane Center: contact Ms. Kanafarski, Svenkst Diane Center, IDC-KTHB, S-10044, Stockholm, Sweden (tel: (8) 7878960).
—Danish Diane Center: contact Ms. Retlev, Danmarks Tekniske Hojskole, Byg. 101, DK 2800 Lyngby, Denmark (tel: (2) 886666).
—The Aslib Online Center: contact Ms. Deunette, Aslib Information House, 26/27 Boswell St., London WC1N 3JZ, England (tel: (1) 4302502).
—Cobidoc in the Netherlands: contact Mr. Rosenbrand, Cobidoc, Postbus 16601, 1001RC Amsterdam, The Netherlands (tel: (20) 223955).
—Italian Diane Center: contact Ms. Paci, Italian Diane Referral Centre, ISRDS CNR, Via Cesare De Lollis 12, 00100 Roma, Italy (tel: (6)4952351).

• Interconnections between international public data networks and local packet switching networks will be on the increase, starting with the ice-breaking effort of TYMNET, a McDonnell Douglas Network Systems Company, and Southern New England Telephone Co. Through this new arrangement, computer users located anywhere in Connecticut can now dial a toll-free number to access the more than 1,500 host computers and information services available through TYMNET.

• Increasingly, institutions are using videotex and other electronically interactive technologies to facilitate instruction. Consider these examples:
—Stanford University expects a 25% increase in the use of voice transmissions and a 125% increase in data transmission by 1988-89. Pacific Bell will begin the process by laying an optical fiber trunk between Pacific's central switching office and the university. When complete, the local network will serve over 100 major businesses, government facilities, and other institutions throughout Silicon Valley. Contact: Bill Massy, Stanford University, (415) 497-2300.
—Electronic Text Consortium just announced field test results from their Annenberg/CPB project to support Congress: We the People. Contact Brenda Pfaehler, University of Wisconsin-Extension, (608) 263-3187. Other members of the consortium are the Center for Communication at San Diego State University; University of Nebraska, Lincoln; and WGBH-TV. Apart from this effort, members from the following universities have been doing pioneering work in higher education-related electronic networking: University of Florida, University of South Florida, University College of the University of Maryland, San Francisco State University, Michigan State University, MIT, and New York University.

• The Electronic University (developed by Telelearning Systems of San Francisco) has an online correspondence school and is working with 2,000 participating schools. This network also enables you to access Telelearning's Electronic Library consisting of more than 60 databases, including BRS, UPI, and Medlars. Contact: Telelearning Systems, 505 Beach St., San Francisco, CA 94133; (800) 225-3276. Two other long-distance learning programs exist. The New York Institute of Technology offers courses leading to a BS degree in business administration, behavioral sciences, or general studies, and is available via GTE Telenet. City University of Bellevue, WA, has 11-week electronic courses toward a BS in accounting, business administration, health care administration, and general studies, or try for an MBA or MPA. For more information, contact: American Open University of the New York Institute of Technology, 21 Chestnut St., Greenvale, NY 11548; (516) 499-8060; or City University, 16661 Northup Way, Bellevue, WA 98008; (206) 643-2000.

• Specialized inservice training is increasingly becoming available online. The Health Education Network, sponsored by the College of Medicine at Ohio State University, offers medical education to more than 40 health education institutions.

• International Program Library Project Update makes information about software available to universities and research institutions across the United States and Europe. Sponsored by the QZ Computing Centre at the University of Stockholm, the project's goal is to open channels for information exchange among individuals who acquire software for their institutions. QZ Centre's COM system is accessible through Telenet, Tymnet, Mailnet, BITNET, AEPANET, CSNET, and EDUNET. Contact: Candice Willut at (609) 734-1915. Other international videotex networks include British Telecom and France's Teletel/Transpac.

• PC Conferencing Program has been introduced by IMedia of Cupertino, CA. The program allows the computer screen to replace elaborate video camera equipment by permitting people to view the same screen on their computers at different locations. Users must have access to a modem, identical computers (IBM-compatibles), and a voice-data telephone line.

User Groups and Bulletin Board Updates

There are all kinds of microcomputer messaging systems available to learn from and play with, but many of them come and go. Many user groups allow limited free access to first time or guest users (after dialing the BBS, you may be directed to enter the user id: GUEST, which probably means you cannot download free software until you become a member.) The following are a sampling of the school-based BBSs that are available and only the cost of a phone call away:

• Michigan Technological University in the Upper Peninsula, (906) 487-2589.
• Rhode Island College in Providence, (401) 456-8250.
• Leprechaun, Notre Dame University, South Bend, IN, (219) 239-5875.
• Ed Tech at San Diego State University, (619) 265-3428.
• Joint BBS by Computer Using Educators and the Far West Regional Educational Laboratory, (415) 565-3037.
• Education-80 in Greenwich, CT, (203) 629-4375.
• Fordham Jesuit BBS in New York City, (212) 579-2869.
• Brooklyn Research Academy Information Network, (212) 258-7078.
• Cheyenne Wells High School, CO, (303) 632-3391.
• University of Minnesota's College of Education BBS, (612) 376-4616.

Final Note: The People's Message System of Santee, CA, keeps an updated register of BBS systems all over the United States. If the reader wants more information regarding user groups and/or material already presented, please contact the author.

Networking Associations

• *Electronic Mail Association* is directed by Michael F. Cavanagh, Suite 300, 1919 Pennsylvania Ave., NW, Washington, DC 20006; (202) 293-7808. A complete up-to-date membership list of major electronic mail networks is available at no charge from the association.

• *Electronic Networking Association* is an association without walls, office or tangible space. All association business is conducted through Unison, a computer communications facility run by Mile High Media in Denver, CO. In November, the association held its first annual conference—online. For more information, contact: George Por (co-founder), High Lights, 3051 Adeline St., Suite E, Berkeley, CA 94703; (415) 548-8213. Via modem: The Source: (BDB404); Unison: (George Por); The Well: (george).

Networking Periodicals and Books

There are all kinds of computer networks available but beware that many come and go. Here are some resources that provide current networking news.

The Computer Data and Database Sourcebook is written by Matthew Lesko. Published by Avon Books, it is updated on a monthly basis via NewsNet (phone: (800) 345-1301).

The Computer Phone Book is written by Mike Can and published by New American Library.

Database and *Online* are two professional journals published by Online, Inc., 11 Tannery Lane, Weston, CT 06883. The company also convenes a valuable and comprehensive annual meeting known as Online.

Database End-User is published by Meckler Publishing, 11 Ferry Lane West, Westport, CT 06880.

The Directory of Online Databases is published quarterly by Cuadra Associates, 2001 Wilshire Blvd., Suite 305, Santa Monica, CA 90403.

Infoworld is a comprehensive weekly newspaper of the microcomputing community, POB 1018, Southeastern, PA 19398-9982.

Link-Up is a monthly paper of online and videotex news for business, personal, and educational use. It is published by Learned Information, Inc., 143 Old Marlton Pike, Medford, NJ 08055.

The National Directory of Bulletin Board Systems is an annual catalog of about 1,000 homegrown online services and is available in print and online via NewsNet. Contact: Editor, Meckler Publishing, 11 Ferry Lane West, Westport, CT 06880; (203) 226-6967.

Other Networks is a quarterly newsletter, POB 14066, Philadelphia, PA 19125.

Plumb Newsletter is published by Riverside Data Inc., POB 300, Harrods Creek, KY 40027 and has eight issues annually.

Telcoms is a monthly newsletter of the Center for Interactive Programs, a division of the University of Wisconsin-Extension that develops and disseminates resource material on audio and video teleconferencing. Contact: Loren Parker, CIP, Lowell Hall, 610 Langdon St., Madison, WI 53703; (608) 262-4554.

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