DOCUMENT RESUME

ED 317 142 HE 023 362

AUTHOR	Updegrove, Daniel A.; And Others
TITLE	Electronic Mail and Networks: New Tools for Institutional Research and University Planning. AIR Professional File, Number 34.
INSTITUTION	Association for Institutional Research.
PUB DATE	89
NOTE	9p.
AVAILABLE FROM	Association for Institutional Research, 314 Stone Building, Florida State University, Tallahassee, Florida 32306-3038.
PUB TYPE	Collected Works - Serials (022) -- Guides - Non-Classroom Use (055)
JOURNAL CIT	AIR Professional Title; n34 Win 1989-90
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	*Electronic Mail; Higher Education; *Information Networks; Information Transfer; Telecommunications

ABSTRACT

This paper provides an introduction to the concepts of electronic mail and networks in non-technical language. It defines electronic mail, explains how it works, and describes academic networks that provide electronic mail services, especially BITNET and NSFNET. It explains how university administrators use electronic mail and networks for day-to-day communication, for making data requests, for conducting surveys of colleagues, and for exchanging information with interest groups. Also explained are procedures for getting connected to a network, costs of network membership, and suggestions for using the networks efficiently and effectively. A bibliography of 13 items is included. Also included as appendixes are a list of countries connected directly to BITNET/NetNorth/EARN, a list of other networks with gateways to BITNET/NetNorth/EARN, and a list NSFNET Mid-level Networks. (JDD)

The Association for Institutional Research
Number 34 Winter 1989-90

AIR
for Management Research, Policy Analysis, and Planning

AIR Professional File

Electronic Mail and Networks: New Tools for Institutional Research and University Planning

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- An institutional researcher needing comparative financial information for a report to the provost sends electronic mail to a list of colleagues and has useful data from around the country the following day.
- A planner in search of AIDS statistics retrieves the latest Centers for Disease Control reports from an electronic archive at another university.
- A newcomer to the field subscribes to several electronic newsletters on institutional research and planning and soon learns about both current issues and knowledgeable authorities in the field.
- Three colleagues at different institutions collaborate on a joint paper, exchanging outlines, chapter drafts, and critiques.

Introduction

Use of electronic mail has grown rapidly in recent years, reflecting the proliferation of microcomputers and networks—departmental and other local-area networks, campus-wide networks, and inter-institutional networks. Institutional researchers have joined other administrators and faculty in making extensive use of these systems for convenient and inexpensive access to colleagues and data sources. Moreover, current and planned developments promise to make these capabilities even more accessible and powerful.

Those of us already using networks would benefit, of course, if more of our colleagues and their data were accessible. In addition, we observe that many people currently connected are using only a small fraction of the power and resources available on the world-wide academic networks. Thus this paper both introduces electronic mail and networks and provides a set of "next steps" for those who are relatively new to networking.

Given the wide range of computer sophistication among university administrators, we have tried to present the concepts and recommendations in non-technical language. The reader should be aware that networking is a fast-changing field, so some of this material may be different by the time you read or try to use it. Moreover, specific commands are for example only; consult local documentation if these commands do not work in your environment.

What Is Electronic Mail?

Electronic mail (or "e-mail") is a computer-based system for exchange of messages and other information, which may include textual and numeric data, computer programs, and (in some advanced systems) graphics. "E-mail" is one of the most common applications of time-shared computers, mainframe computer networks, and (more recently) local area networks of microcomputers, because of the widespread need for rapid, easy, inexpensive communication with individuals and groups, all of whom need not be available simultaneously.

Electronic mail should be distinguished from two related forms of electronic communication, voice mail and facsimile (fax). Voice mail is a computer-based system for exchanging voice messages, which can be recorded, reviewed, forwarded, filed, and retrieved from local as well as remote telephones; such systems are especially popular among non-typists and those who travel frequently. Fax is a system for transmitting images via telephone lines; the typical fax machine is a dedicated device containing a scanner for converting printed images into digital form, a modem for sending and receiving the data, and a printer. Faxes are extremely easy to use and have the advantage over most e-mail systems of transmitting graphics as well as text; unlike e-mail, however, the transmission is not easily manipulated on the receiving end, since most faxes produce only paper output.

Although it is useful to keep these three technologies distinct conceptually, they are, in fact, merging. For example, the computer workstation introduced last year by NeXT, Inc. features voice mail integrated with electronic mail, and several companies have recently announced add-on hardware and software for sending and receiving faxes on personal computers.

How Does Electronic Mail Work?

The specific implementations of electronic mail vary across many software and hardware environments, but the basic concept is a computer-enhanced memorandum:

- "Date" is included automatically.
- "To" is a computer user identification, which (depending on the system) could be "Smith," or "Q34P18," or "Dunn@Tufts," or "IRMUFFO@VTVM1," or "Updegrove@al.relay.upenn.edu." Alternatively, the memorandum could be sent to a predefined list, like "managers."
- "From:" is the sender's user identification, inserted automatically by the system.
- "Subject" is usually a few key words typed by the sender.

Once this "header" is complete, the content of the memorandum is entered either from the keyboard or by including a previously-composed file (perhaps from a personal computer).

The completed memorandum is "sent" to the recipient(s) who, at some later time, can issue a command (again depending on the local system) to "read," "reply," "delete," "print," "forward," or "file." Reply is especially convenient, since most systems can simply reverse the "To:" and "From:" then compose a new subject by preceding the incoming subject with "Re:".

This sounds pretty simple, but what does "send" mean? If both sender and recipient are users of the same time-shared computer (or local area network file server)[1] sending is simply storing a copy of the message on a system disk and alerting the recipient to issue some command to read the message. In the case of a networked campus, the message may travel from the sender's IBM PC through a departmental network connected to the campus backbone network, which relays it to another departmental network where it is accessed by the recipient using an Apple Macintosh. If the correspondents are in different institutions, the message could be transmitted via the rapidly growing national and international networks.

BITNET, Internet, NSFNET, and Other Academic Networks

Networks now interconnect the mainframe computers and campus networks of hundreds of colleges and universities in the U.S. and abroad. The earliest academic and research network, ARPANET, was established nearly twenty years ago by the U.S. Department of Defense to facilitate advanced research projects. Other specialized networks have been created to support specific fields—such as computer science (CSNET), magnetic fusion energy (MFENET), and high energy physics (HEPnet)—and specific operating systems such as UNIX (UUCP/USENET).

The largest general purpose academic network is BITNET, founded in 1981 by the City University of New York and Yale University. BITNET now links over 480 American colleges and universities with a similar number in Asia, Africa, Canada (where the network is known as NETNORTH), Europe (where the counterpart network is EARN), Latin America, and the Middle East (Figures 1-4 and Appendix I).

The primary uses of BITNET are electronic mail and file transfer, with transmission speeds typically limited to 9600 bits per second (bps) over leased phone lines. (At 9600 bps, one screenfull of text can be transmitted in under two seconds.) BITNET is governed by an independent Board of Trustees and is administered by EDUCOM, which works closely with NetNorth and EARN to ensure the dependable operations of a network that connects 2,600 computers and provides "gateway"[2] connections to numerous other networks (Appendix II).

(Effective September 1989, BITNET and CSNET have been merged under the aegis of the Corporation for Research and Educational Networking—CREN. The basic BITNET network services described in this paper are not expected to be affected by this merger.)

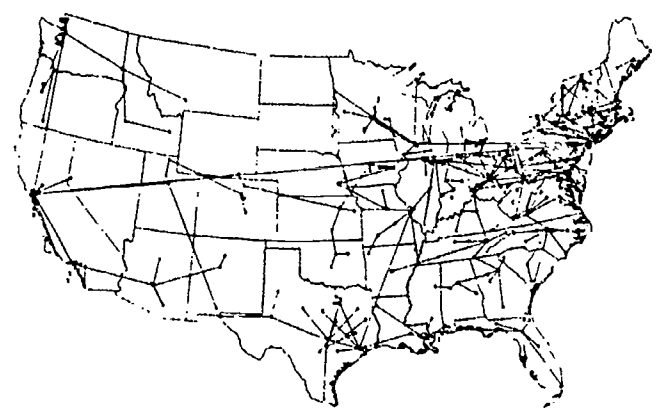


Figure 1. BITNET topology as of February 6, 1989.

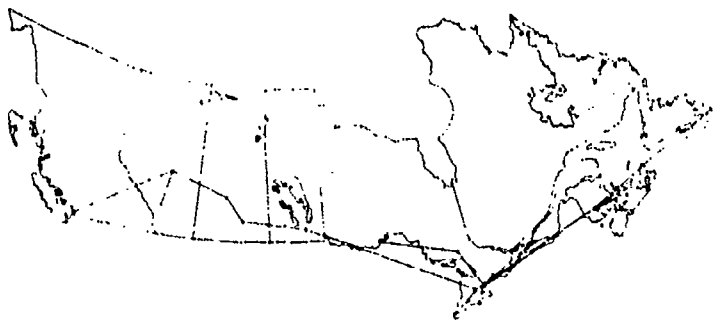


Figure 2. NETNORTH topology as of February 6, 1989.

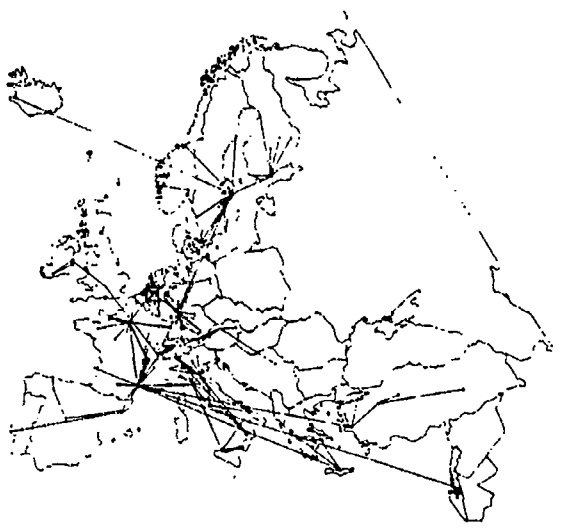


Figure 3. EARN topology as of February 6, 1989.

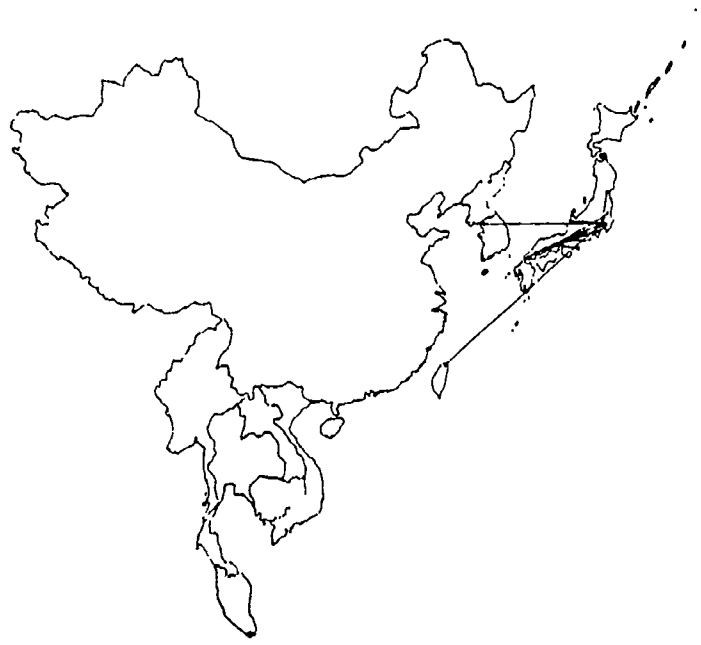


Figure 4. BITNET in ASIA topology as of February 6, 1989.

NSFNET is a newer, higher-speed network created with support from the National Science Foundation to provide remote access to supercomputers and other resources needed for advanced academic and commercial research and development. NSFNET is a three-level network: the backbone (national trunk lines) interconnects 22 mid-level nets, which in turn provide connection points for over 225 campus networks (Figure 5, page 4). Collectively the NSFNET backbone, mid-level and campus nets, plus several other interconnected networks—ARPANET, CSNET, but not BITNET—are often referred to as "the Internet."

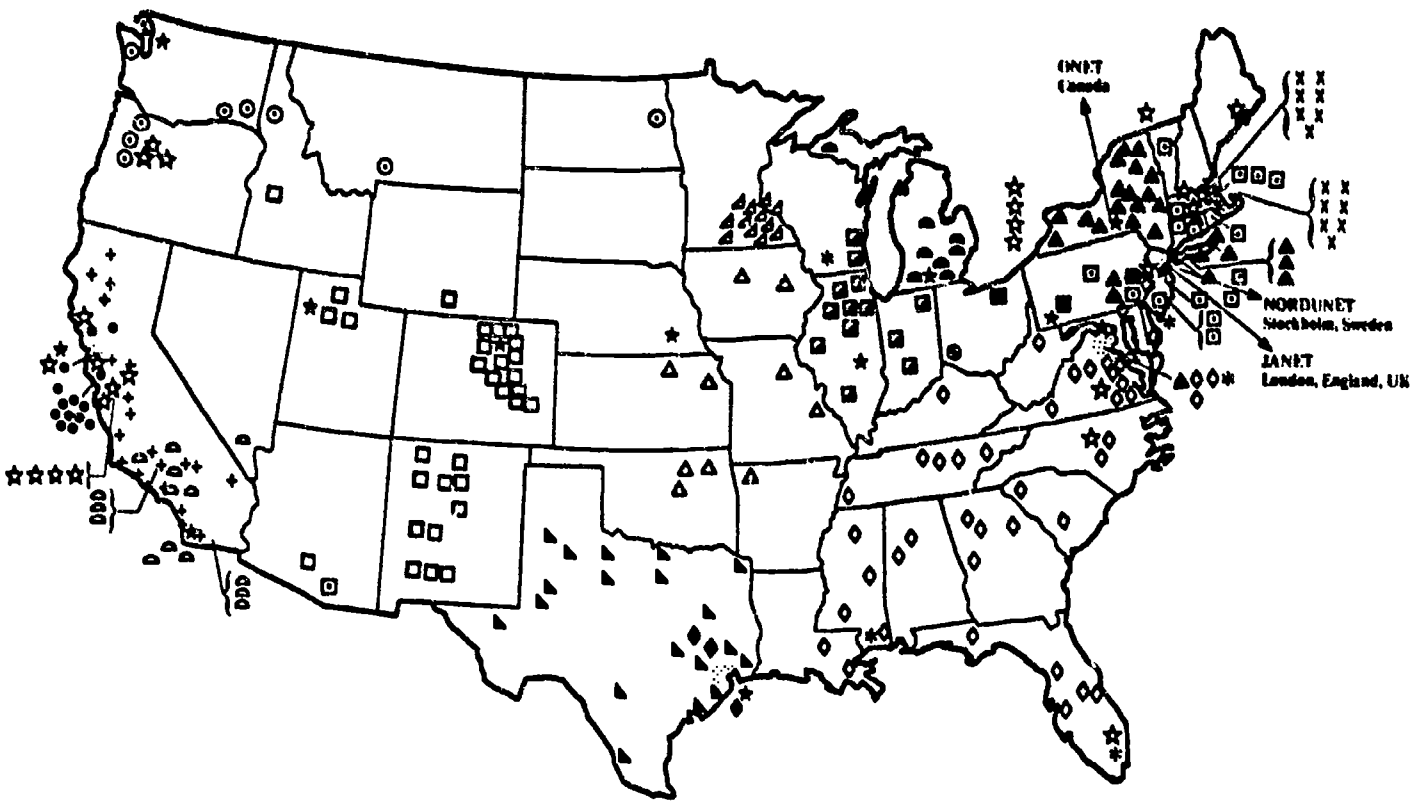
The NSFNET backbone provides 150 times the capacity of the typical BITNET line (1.5 million bps), to enable researchers to send large files to and from supercomputers and to support remote login.[3] That is, unlike BITNET, NSFNET allows users in one institution to login to another institution's computer (assuming that accounts and passwords have been pre-arranged), which might contain a specialized database, statistical analysis program, or even the university library catalog. Of course NSFNET also supports electronic mail. A list of the NSFNET regional nets is in Appendix III.

Although NSFNET offers much greater communications capacity than BITNET, an even more powerful network is being proposed. The U.S. National Research and Education Network (NREN) will support communications at 3 billion bps by 1996 if leaders in education, industry, and government are successful in attracting the necessary funding for research, development, and infrastructure. NREN is essential, according to proponents including Tennessee Senator Albert Gore, to support the R&D needed for long-term American technical and corporate competitiveness. Academic support for NREN is led by EDUCOM's Networking and Telecommunications Task Force (NTTF), a group of about 50 universities. While the average university administrator may not need remote access to supercomputers, we stand to gain from any developments that improve linkages among universities.

How University Administrators Use E-mail and Networks

Probably the most common use of electronic mail and networks is for day-to-day communication traditionally accomplished by phone, surface and air mail, and overnight courier. Electronic mail provides timely, convenient, and inexpensive access to colleagues (assuming that they read and answer their electronic mail). Committee work, program planning, plotting strategies for dealing with government agencies, and "just keeping in touch" are typical uses of e-mail. It should come as no surprise, for example, that the authors of this paper exchanged ideas, drafts, and critiques via network. Such communication is increasing across campuses, among campuses, and between campuses and organizations such as the Association for Institutional Research (AIR), CAUSE, EDUCOM, and the Society for College and University Planning (SCUP).

Another use of electronic mail is making data requests or conducting surveys of colleagues. Many of us have "peer" institutions with which we compare ourselves on a regular or irregular basis, exchanging data and policies on a number of subjects. The traditional way of soliciting quick responses from our network of peers is to make telephone calls—with all the attendant problems of "telephone tag." Data exchanges uses electronic mail have now become commonplace. A key advantage is



NETWORKS	ON-LINE AS OF 6/15/89	ON-LINE* AS OF 12/15/89	NETWORKS	ON-LINE AS OF 6/15/89	ON-LINE* AS OF 12/15/89	NETWORKS	ON-LINE AS OF 6/15/89	ON-LINE* AS OF 12/15/89
BACKBONE SITES	★	★	MIDNET	△	△	SURANET	◇	◇
BARRNET	•	•	MRNET	◢	◢	THEORY	◣	◣
CERFNET	+	+	NCSANET	▣	▣	THENET	◣	◣
CICNET	●	●	NEARNET	X	X	UNINET	*	*
CSNET	☆	☆	NORTHWESTNET	⊙	⊙	USAN	*	*
JVNCNET	⊡	⊡	NYSERNET	▲	▲	WESTNET	□	□
MERIT	▬	▬	PSCNET	■	■	*reported		

Figure 5. NSF-sponsored IP networks.

that information has to be entered into a computer only once. (A disadvantage is that the old excuse of the survey's being "in the mail" has very little credibility!)

A third application is subscribing[4] to interest group lists, which now number over 400 on BITNET alone. Topics range from agricultural expert systems and AIDS to yachting and yeast genetics. Some lists, like Data Administration (DASIG) operate as open forums, wherein subscribers pose questions and problems and anyone on the list can reply, either directly to the questioner or to the entire list. Others have moderators who receive all contributions and distribute a periodic (usually weekly, bi-weekly, or monthly) newsletter; examples are AIR-L for institutional researchers and SCUPNEWS for university planners. Some newsletters, like NetMonth, which is devoted to news and commentary about BITNET, run to 30 pages and feature cover art and regular columnists. Although a few lists are closed or open only with permission of a "list owner," most are open for subscription by anyone. Since there are no charges assessed for any of the lists, it is worthwhile to try several in order to find the optimal point between too little and too much information.

How To Get Connected

You may already be connected! Virtually all research universities and many comprehensive universities and liberal arts colleges are already connected to BITNET and/or one of the mid-level networks on the NSFNET. If you have an account (say for SPSS or SAS work) on a campus mainframe that is connected to one of these networks, you may be authorized to use the network facilities described above. Alternatively, if your departmental local area network is part of a campus-wide network that is, in turn, connected to the larger networks, you may need nothing more than some documentation. Thus our first recommendation is to contact your campus computing center. If there are separate academic and administrative centers, the academic side is probably the one to call first, since some administrative centers eschew networks for security reasons.

If your campus is not connected, you have two choices: find other colleges who would benefit from a network connection and lobby the powers that be, or obtain a computer account on the nearest campus with a network connection. In fact, the payoffs you report—and demonstrate to interested colleagues—from your personal guest account at a nearby institution could be instrumental in convincing the campus to join a network.

To obtain a guest account at another institution for network access, contact their (academic) computing center. Most centers have standard procedures for issuing such accounts and will inform you of charges for connect time, disk storage, etc. Depending on the rates charged and the time of day that you login, you can expect to pay $25-$100 per month for a moderately active account. In some cases, such accounts are made available to academic colleges without charge. Finally,

unless you want to use the public terminals on that campus, you will need a terminal or microcomputer with communications (sometimes called "terminal emulation") software, a modem, and a phone.

Lobbying the director of computing, or dean, or provost for a network connection will be more time consuming but could have greater long-term rewards. For one thing, you are likely to pay less (perhaps nothing or "soft money") for an electronic mail account on your own institution's computer. For another, fellow administrators, faculty, and students will share the benefits of connecting to this worldwide network of colleagues, computers, and information resources.

Institutional Costs for Network Membership

In the case of BITNET, current membership fees for campuses in the U.S. range from $750 to $8,000 annually depending on Educational and General budget; different fees apply for non-degree-granting institutions and corporate research labs. Additional costs include the leased phone line to the nearest connected campus (several hundred dollars per month); 9600 bps modems at each end of the line (several thousand dollars); e-mail and interface software (from free to several thousand, depending your hardware); plus personnel to provide technical and user support. For more information on costs and connection procedures, have your computing center contact the BITNET Network Information Center, EDIJCOM, Suite 600, 1112 16th St. N.W., Washington, DC 20036; 202 872-4200; fax 202 872-4318; BITNET address BITNET@BITNIC.BITNET.

Institutions do not join the NSFNET directly, but instead join one of the mid-level networks (Appendix III), each of which has its own schedule of fees. In general, costs of attaching to one of these networks are higher than BITNET, because of the greater transmission speeds and complexity of NSFNET. For more information, contact the NSF Network Service Center, c/o BBN Laboratories, 10 Moulton St., Cambridge, MA 02238; 617 873-3340; NNSC@NNSC.NSF.NET.

How To Use These Networks

Very carefully! This is no noke, as demonstrated by the graduate student at Cornell, who faces a federal indictment for transmitting a rogue "worm" program through the NSFNET last fall (for more on ethics and etiquette, see below). Even for those interested in exchanging simple e-mail with professional colleagues, the proliferation of software (terminal emulators for personal computers as well as e-mail systems) and networks is daunting. Here are some hints for getting started:

First, there is no universal microcomputer communications software, although Kermit, Red Ryder, VersaTerm, and MacTerminal are in widespread use. Most campuses support one or several, so check with the computer center for the best fit between your microcomputer, your needs, and their systems and support expertise.

Second, there is no universal interface to BITNET or NSFNET. Even the most common mainframes—Digital VAXes running VMS and IBM systems running VM/CMS—have several optional electronic mail systems, and some campuses make modifications or design their own. Our recommendation is to find—and read!—the campus documentation about e-mail and networks.

Third, campus support for e-mail and networks varies widely. Some campuses provide a comprehensive guide book on computing and networking to all entering faculty, staff, and students; others seem to operate on the perverse philosophy that "real networkers don't need documentation, since it's all available online through the network!" As in the days when you learned SPSS or SAS, the best way on some campuses may be to hang around the computing center and buy sodas for systems programmers and students until you catch on.

Fourth, there is not yet a universal equivalent to the telephone white pages and directory assistance, although some campuses and associations list e-mail addresses in printed or online directories, and some provide a "postmaster" account to which questions can be sent. In general, you will have to call or write to colleagues to determine their network addresses. They, in turn, would benefit from your including your network address on business cards and correspondence.

Fifth, although virtually all academic networks are interconnected, some require sophisticated "gateway" computers to convert their otherwise incompatible technical protocols. Fortunately, one protocol is used widely in the U.S., the "TCP/IP" protocol originally developed for ARPANET and now the basis for the "network of networks," including NSFNET, called Internet. Unfortunately TCP/IP is not compatible with the emerging international standard (X.400) nor with the protocol used by BITNET. Most electronic mail users need not concern themselves with the underlying protocols but may have to learn extra local tricks to send mail through certain gateways. Users with access to a TCP/IP network can, however, take advantage of remote login, an increasingly important option.

Finally, because e-mail is a relatively new medium, network ethics and etiquette are still evolving. Among the widely accepted guidelines are:

- Cover only one subject per message, which facilities replies, forwarding, and filing.
- Use upper and lower case text, because MESSAGES IN ALL CAPITAL LETTERS HAVE THE EFFECT OF SHOUTING.
- Be diplomatic. Criticism is always harsher when written, and electronic messages are easily forwarded.
- Be calm. You may have misinterpreted the implied criticism or missed the ironic humor in a message; don't send a reply while you are still hot under the collar. (Networkers call this "flaming.")
- To signal your humorous intent, use the "sideways smile:" :-).
- Don't use the academic networks for commercial or proprietary work.
- Be extremely careful about executing any programs that you receive over the network, since they may contain viruses that erase or damage your files or, by propagating themselves, disrupt the network.
- Don't send anything electronically that you wouldn't want to see on page one of *The Chronicle of Higher Education*. There is no assurance that a message you intend to be personal isn't being read routinely by a secretary or casually by a colleague or family member passing by a terminal. Moreover, as shown in the Iran Contra affair, even "deleted" messages might be saved on system backup tapes.

Additional Resources

On BITNET, the Network Information Center computer operated by EDUCOM is a great repository of online information, much of which is easily accessed by sending electronic mail to LISTSERV, a program that not only maintains many of the interest group mailing lists mentioned above but also functions as a general purpose file server. To obtain a directory of this information, send mail to LISTSERV@BITNIC.BITNET with a null subject and the following two lines of text:

index
help

Any of the files listed in the directory can be retrieved using the "GET" command. For three especially useful files, send mail to LISTSERV@BITNIC.BITNET containing these three lines:

get bitnet userhelp
get bitnet servers
get articles index

The first two are well-written introductions to BITNET and its information services, and the third is an index of articles on a range of topics from campus computing newsletters, which are compiled by EDUCOM staff on the CCNEWS project. For a "list of lists" send this line in mail to LISTSERV@BITNIC.BITNET:

list global

and you will receive a 20-page list of interest group discussions and electronic newsletters available for subscription.

To subscribe to any of the BITNET lists, send mail to the appropriate LISTSERVE shown in the list of lists. (Not all of the lists are maintained at BITNIC). For example, to subscribe to the Data Administration Special Interest Group (DASIG) maintained at Syracuse University, send mail to LISTSERV@SUVM.BITNET containing this line:

sub dasig your_first_name your_last_name-your_institution

and you will receive an automatic message confirming your subscription. Within the next few days or weeks, you will start to receive messages from the list. To send a message that will be distributed to all subscribers of DASIG, address mail to DASIG@SUVM.BITNET (not to LISTSERV@SUVM.BITNET). If you find this particular list is not of great interest, sign off by sending mail to LISTSERV@SUVM.BITNET containing the line:

signoff dasig

When replying to a message received from a list, note carefully what address your mail software places in the "To" field: depending on the list and on your mailer, it might be just the original sender or the entire list. (Especially if it's the entire list, don't be guilty of "flaming.")

Two electronic newsletters are focused on the Association for Institutional Research and the Society for College and University Planning, respectively. To subscribe to the former, send mail to LISTSERV@VTVM1.BITNET containing the text: sub AIR-L your_first_name your_last_name - your institution and to the latter, send mail to JCATE@UCBCMSA.BITNET containing:

sub SCUPNEWS your_first_name your_last_name-your institution

A list of more specialized newsletters in higher education, along with the person to contact for a subscription, is carried at the end of each AIR Newsletter.

There are a growing number of databases, bulletin boards, etc. available on BITNET for individuals with specialized interests. One worth exploring for many institutional researchers is the ISAAC bulletin board and database. While ISAAC was originally founded to help distribute academic software or "courseware" designed for IBM personal computers, it also maintains a bulletin board with a section (or "room") devoted to institutional research issues. One can subscribe to ISAAC's services by sending mail to ISAAC@UWAEE.BITNET. The ISAAC bulletin board is available to direct dialup as well, so that a personal computer and modem can be used to access it without going BITNET. For more information, phone (206) 543-5604.

For online information about NSFNET and its resources, send electronic mail to INFO-SERVER@NNSC.NSF.NET containing this text:

Request: Info
Topic: Help

and you will receive via return electronic mail an index of available files.

Conclusion

Some experts envision a worldwide academic network offering every scholar fast and convenient access to colleagues, libraries and other information sources, experimental devices, and supercomputers. In the not-too-distant future, we can expect to perform analyses using data from many sources and produce reports with imbedded graphics (and voice and video if appropriate), without having to know the location or format of the data (and we certainly won't have to worry about "protocols" and "gateways!").

In the interim, university administrators have a special need to stay abreast of developments in this area, since information access, analysis, presentation, and dissemination are at the very core of our profession. If your campus is already connected to one of the academic networks, we encourage you to learn how to use it effectively; if not, we urge you to take the lead in educating your colleagues about the advantages—for scholarship and administration—of joining the growing worldwide information community.

Footnotes

1. A local area network (LAN) is a group of computers, usually microcomputers, which are connected to each other, with one machine often connected to a larger mainframe as well. A file server routes correspondence on the local area network and, where necessary, to the mainframe.
2. A gateway is an interconnection or switching point between two networks which allows mail to travel from one network onto another network. It is simply a node (computer) which is connected to both and which is able to transfer files from one to the other.
3. Remote login allows an individual on the network to gain direct access to other computers on the network. The major advantage of remote login is that one can use it to access files directly which are maintained elsewhere, such as library holdings, databases, directories, etc.
4. A subscriber is simply one who would like to be included on the mailing list for a newsletter or interest group list. The normal procedure is to contact the list owner or a list server and request to join the group. For more details on how to go about this, see the section on Additional Resources.

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Appendix I

Countries Connected Directly to BITNET/NetNorth/EARN as of August 1989

Africa:	Egypt, Ivory Coast
Asia:	Japan, Korea, Singapore, Taiwan
Europe:	Austria, Belgium, Denmark, France, Finland, Great Britain, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, West Germany, Yugoslavia
Latin America:	Argentina, Brazil, Chile, Mexico
Middle East:	Israel, Saudi Arabia
North America:	Canada, United States

Source: File named INTERNTL SITELIST, available online from LISTSERV@BITNIC.BITNET

Appendix II

Other Networks with Gateways to BITNET/NetNorth/EARN as of July 1989

Internet	NSFNET, CSNet, ARPAnet, et al.
UUCP	Unix network
HEPnet	High Energy Physics Net
MFEnet	Magnet Fusion Energy Net
IBM-VNET	IBM Corporate Net
CDNnet	Canadian research and education network
DFNnet	West German research network
HEAnet	Irish higher education authority network
INFnet	Italian nuclear physics network
JANET	United Kingdom joint academic network

Source: File named BITNETTOPOLOGY, available online from LISTSERV@BITNIC.BITNET

Appendix III

NSFNET Mid-Level Networks as of June 1989

BARRNET	Bay Area Regional Research Network
CERFNET	California Education & Research Federation Network
CICNET	Committee on Institutional Cooperation (upper Midwest)
CSNET	Computer Science Network
JVNCNET	John von Neumann Supercomputer Center Network
LOS NETTOS	Greater Los Angeles Area Network
MERIT	Michican Educational Research Network
MIDNET	Midwest Network
MRNET	Minnesota Regional Network
NCSANET	National Center for Supercomputing Applications Network
NEARNET	New England Academic and Research Network
NORTHWESTNET	Northwestern States Network
NYSERNET	New York State Education and Research Network
OARNET	Ohio Academic Resources Network
PREPNET	Pennsylvania Research & Economic Partnership Network
PSCNET	Pittsburgh Supercomputing Center Network
SDSCNET	San Diego Supercomputer Center Network
SESQUINET	Texas Sesquicentennial Network
SURANET	Southeastern Universities Research Association Network
THENET	Texas Higher Education Network
USAN	NCAR's University Satellite Network
WESTNET	Southwestern States Network

Source: *NSF Network News,* Number 6, July 1989, and file NSFNET NETWORKS, available online from INFO-SERVER@NNSC.NSF.Net

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