

Value-Added Network Services... & Beyond

Robert S. Dixon

Acting Director
Instruction and Research Computer Center
The Ohio State University
1971 Neil Avenue
Columbus, Ohio 43210
(614) 292-4843
BOB_DIXON@OSU.EDU

The Ohio State University

45,933 undergraduates
13,061 graduate students
4,457 faculty
12,630 staff

IRCC supports academics, library and administration.

Staff: 12 FTEs, 7 part-time

Abstract

The campus computer networks of today run the gamut from nonexistent through rich functionality and connectivity. Network value can be enhanced by the addition of network-based high-level services such as file storage, printing, fax, fuzzy email addresses and information directories. The next step is to organize access to all these services in a consistent menu-driven way, so that the network itself becomes invisible.

The Stages Of Networking

Campus computer networks typically pass through several stages of development as they mature. These are:

Stage 0 — No Network

Computers cannot talk to one another, although there may be remote terminals connected to some computers.

Stage 1 — Local Networks

Independent groups of computers can talk to one another. Each group is generally run by a separate organization. Vendor-specific networking methods such as IBM, DEC, Novell, etc. are generally used.

Stage 2 — Campus-Wide Network

A single organization is made responsible for coordinating the network. Vendor-specific network methods are phased out in favor of a standard vendor-independent one, most often using TCP/IP protocols and fiber optic cables. Basic services such as electronic mail, file transfer and remote

login are provided. The campus network is connected to regional and national networks. The people who use the network are primarily those who already use computers, and who are willing to invest the effort to learn how to use the network.

Stage 3 — Value-Added Network Services

The realization sets in that the campus network can be used for far more than just the basic services. The network coordinating organization promotes and assists other groups in providing higher-level services, such as access to the Library catalog. These services attract the much broader group of users who need information, but not necessarily computing. (This concept is expanded upon in the next major section below.) Significant knowledge is still required to use the network effectively.

Stage 4 — The Network Disappears

A further realization occurs that even though all the network services are very valuable and useful, they collectively are a hodge-podge of different approaches to information dissemination. A standard menu-driven user interface is adopted. The concept of logging in to different computers is changed to the concept of logging into the network. The complexity of the network is hidden from the user, so that no special knowledge is required to use it. It is no longer called a computer network; it has become an Information System. (This concept is expanded upon in the last major section below.)

Permission to copy without fee all or part of this material is granted provided that the copies are not made or distributed for direct commercial advantage, the ACM copyright notice and the title of the publication and its date appear, and notice is given that copying is by permission of the Association for Computing Machinery. To copy otherwise, or to republish, requires a fee and/or specific permission.

Copyright 1990 ACM 0-89791-406-6/90/009-0099 \$1.50

Each campus now lies somewhere along this continuum of networking stages. No campus has yet fully achieved Stage 4.

Value-Added Network Services

The basic network services such as electronic mail, file transfer and remote login can be used as building blocks to create higher-level user services. Some of these services can be provided by central computing and networking organizations, whereas others can only be provided by other organizations (such as the Library). It is appropriate for the networking organization to aggressively promote creation of these higher level services, and to provide technical and financial assistance to the other relevant organizations, since more services added to the network will make the network even more valuable to the campus community. Some examples of value-added network services are outlined in the following paragraphs.

A. Services Which Can Be Provided By A Central Computing Or Networking Organization

1. File Storage

A central computer and disk farm can be used for storage of user data and backup. Infrequently used data can be automatically migrated to archival magnetic tapes. This provides a repository which is usually safer and better maintained than storage on user computers. Pre-existing

3. FAX Transmission

A PC may be used to connect a FAX machine to the network, as shown in Figure 1. This provides a faster and less expensive alternative to the use of telephone lines. OSU is now developing such a system for use by the Big Ten school libraries for interlibrary loan applications.

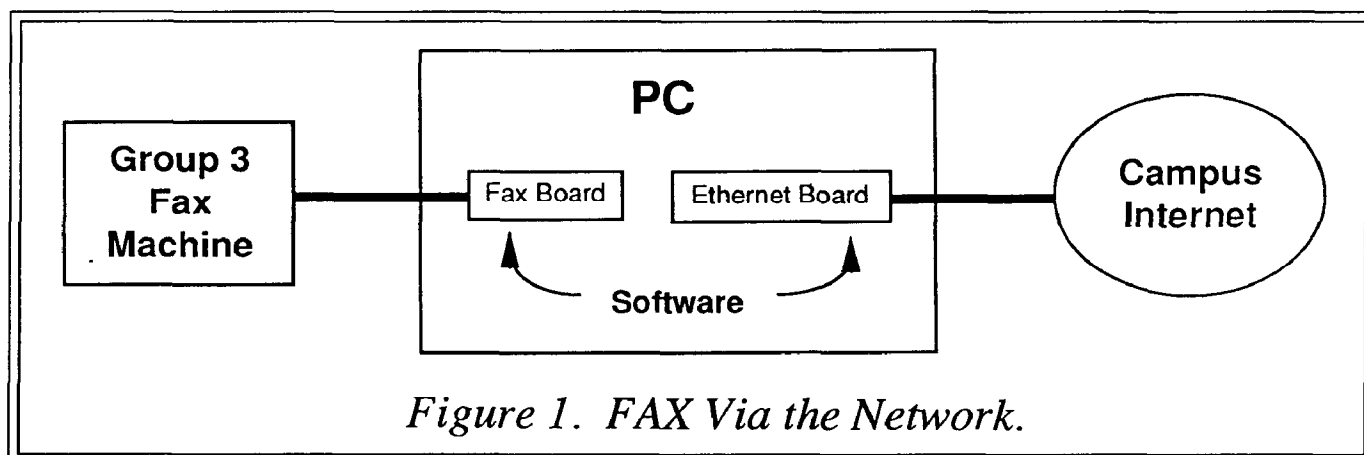
4. Network Security

Well-designed networks are inherently secure, but there are users who have special needs or who are concerned with the popular media hype about hackers. Data sent across a network can be completely protected by encrypting it before transmission and then decrypting it after reception. Encryption software is available from many vendors, although it is generally incompatible among different types of computers. For those who need more universal compatibility, OSU can provide the software.

Password and access control can be dealt with centrally through use of a system such as Kerberos, developed at MIT.

5. Graphics Equipment

Small computers such as PCs can be used to attach graphics equipment such as plotters, slidemakers and digitizers to the network, making them publicly available to all. Files can be transferred over the network to or from these devices as desired.



mainframe computers generally have these capabilities, and are well-suited to the purpose.

2. High-Volume Printing

Users generally do not have direct access to fast, high-volume printers. Network-attached printers can be located wherever needed, but controlled from a central computer through which users send their files to be printed. The central computer provides access control, accounting if needed, and queueing of the print material. Reliability is high due to central maintenance and monitoring of the printers. Here again a pre-existing mainframe computer may be appropriate for this task.

B. Services Which Require The Participation And Cooperation Of Other Campus Organizations

1. Electronic Mail Addressing And Delivery

A typical email address conventionally looks like this:

DIXON-R@OSU-20.IRCC.OHIO-STATE.EDU

In some cases, email addresses can be much longer and more complex. There is often no easy way for a user to find out the email address of someone else. Even if the address is known, it must be typed exactly correctly.

One helpful thing is to gather the email addresses of all

campus users, from the managers of all computer systems, and have them published in the campus telephone directory along with the street addresses. Another approach is to make an email "white pages" available electronically to network users. This is generally called a WHOIS facility. The WHOIS data file need not be limited solely to email users, and it is most helpful if it contains ALL faculty, staff and students.

The problem of long email addresses and requiring exactitude can be solved by provision of a fuzzy mail system. This allows users who have only a fuzzy idea of the address to make a guess at the address and send the message. The fuzzy mail system has the complete WHOIS database, and uses character string matching to

find the best match to the fuzzy address. For example, a user could send email to bob_dixon@osu.edu or dixon@osu.edu or R.S.Dixon@osu.edu and there is a good chance I will get it. The sender needs only to know that I am at OSU. If the fuzzy mailer finds more than one dixon, it will send a message back to the sender describing who each one is, what department they are in, etc., and giving sufficient information for the sender to choose the correct one and try again.

The fuzzy mailer can be made even more powerful by empowering it to send the message to a FAX address if no email address is known, and to send it to a printer in the campus post office as a last resort. There it can be put in the postal system for delivery. This is shown in Figure 2.

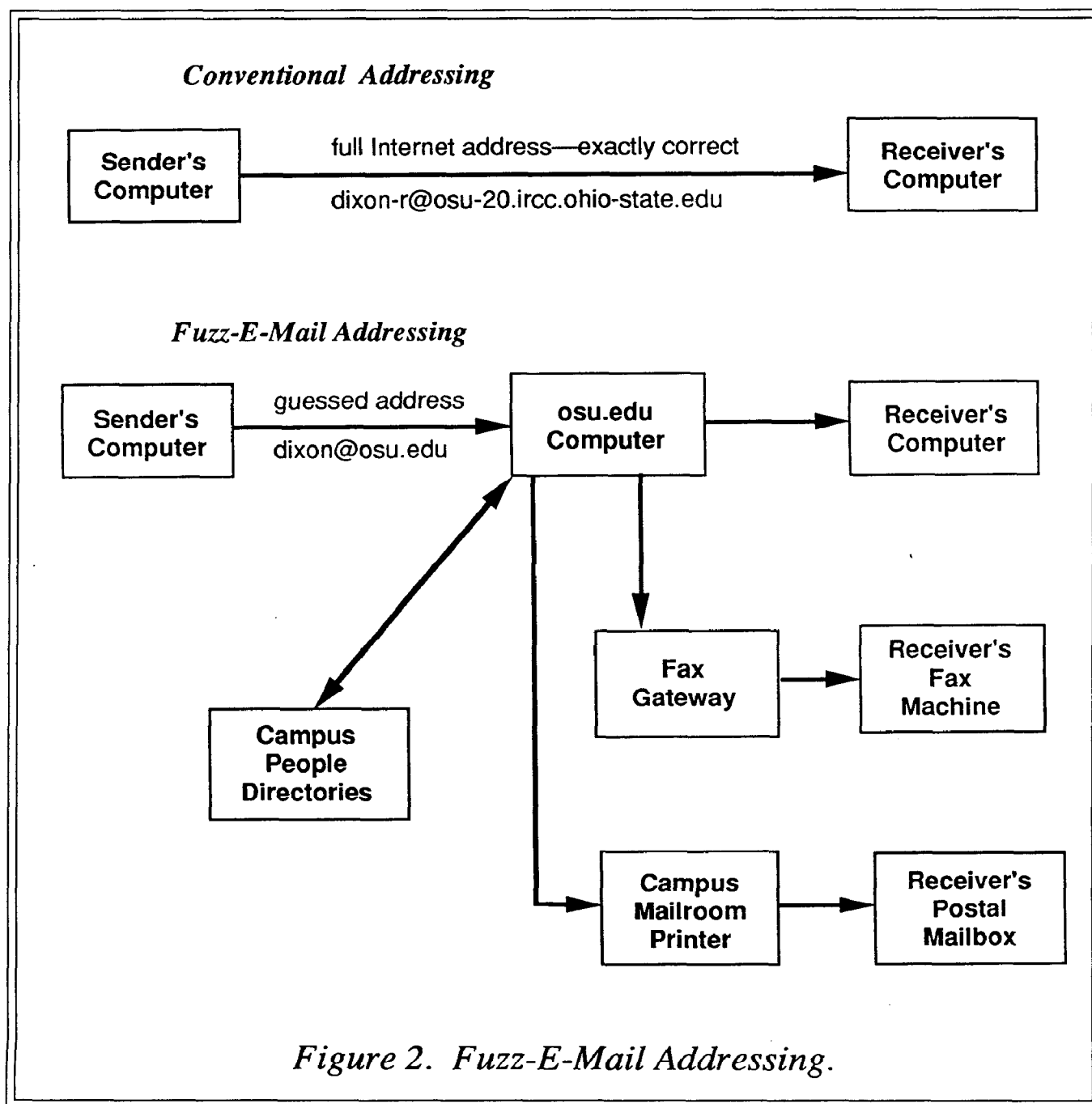


Figure 2. Fuzz-E-Mail Addressing.

2. *Printing And Reproduction Facilities*

Arrangements can be made to send data files to computers located in the campus print shop and in places that do copying and graphics preparation. This often avoids rekeying and is much faster than hand-carrying or using postal mail.

3. *Libraries*

Libraries are increasingly migrating to electronic media. Mainframe catalogs and CD-ROM databases are typically accessible from dedicated terminals in the library. These services can be connected to the network and made available campus-wide.

4. *Publications And Newsletters*

Today most publications are created electronically prior to printing. Often it is possible to preserve the electronic version and make it widely available over the network.

The Invisible Network

All the value-added services listed above of course are provided by computers. A user must know the name of whatever computer provides the service he wants, and how to get to it via the network. But casual users should not have to know all that. They should be required only to identify themselves and then get the information they require. The network should be transparent and the user unaware of where the services are actually coming from, even if from across the country.

In such a system, a user might log into the network and be presented with a menu like this.

```

Information System
Top Level Menu (Example)
  Announcements
    Computers
    Conferences
    Current Events
    Databases
    Electronic Mail
    Faculty Services
    Libraries
    People Directory
    Reproduction Services
    .
    .
    .
  
```

Note that "computers" are only one entry in the menu. That is for the small fraction of the users who actually want to "compute". The fact that computers are really being used to provide ALL of the services is IRRELEVANT.

Suppose the user chose the menu item "Libraries". The next menu might then be:

```

Information System
Second Level Menu Library (Example)
  Boston University
  California Statewide System
  Colorado Statewide System
  Emory University
  Florida Statewide System
  Ohio State University
  Research Libraries System
  University of Michigan
  University of New Mexico
  .
  .
  .
  
```

Selecting any of these libraries would connect you to their catalog system automatically.

Or suppose you had selected "Databases" at the first menu. Then you would get a menu like this.

```

Information System
Second Level Menu Databases (Example)
  Astronomy
  Earth Satellites
  Gene Bank
  Geography
  Mathematical Software
  Medieval Culture
  Molecular Biology
  .
  .
  .
  
```

Or finally suppose you had selected "Faculty Services" at the top menu. If you were an authorized faculty member, you would get a menu like this:

```

Information System
Second Level Menu (Faculty Services Example)
  Grant Status
  Student Class Rosters
  Student Grade Reports
  Tenure Procedures
  .
  .
  .
  
```

Selection of any final level menu item at any point would get to a menu offering:

```

  Tutorial
  Examples
  Explanation
  Help
  Go ahead
  
```

No doubt the presentation methods of the ultimate information sources will be different, since they can be anywhere in the world. But nevertheless, the method of getting TO those services can be made painless and transparent. The Implementation of such a system requires great effort, and the participation and support of a wide group of people. Off-the-shelf systems do not exist, although the building blocks do. Better and more global security systems such as Kerberos are needed.

Everything suggested here is possible today. All examples have been chosen from systems already in existence or under construction now. Someday we will look back at this and say "of course".