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ABSTRACT

This educator-oriented handbook by "Virtual Dave" provides an easy-to-read, easy-to-understand guide to the Internet: what it is; how it works; and how one gets there. The book covers the basics of the Internet, with simple and concise explanations geared toward classroom teachers and school library media specialists. Each chapter contains a resource section of Internet addresses and chapter highlights which are helpful for novice and experienced Internet users alike. The book includes the following chapters: (1) Electronic Networks: A Primer; (2) The Internet Model; (3) E-Mail: The Net's Common Currency; (4) Telnet and FTP: The Internet's Forgotten Heros; (5) Gopher: What if the World Were One Big Menu? (6) The World Wide Web: Do Spiders Really Surf? (7) New Toys and Trends for the Internet; (8) Setting up the Internet for Your School; and (9) Conclusion. A presentation packet for educators to teach others about the Internet comprises the second half of the document and includes all materials ready for reproduction in hard copy or transparency. An annotated bibliography of related documents available in the Educational Resources Information Center (ERIC) database, background information about ERIC, and a glossary are also included. (Contains 13 references.) (SWC)

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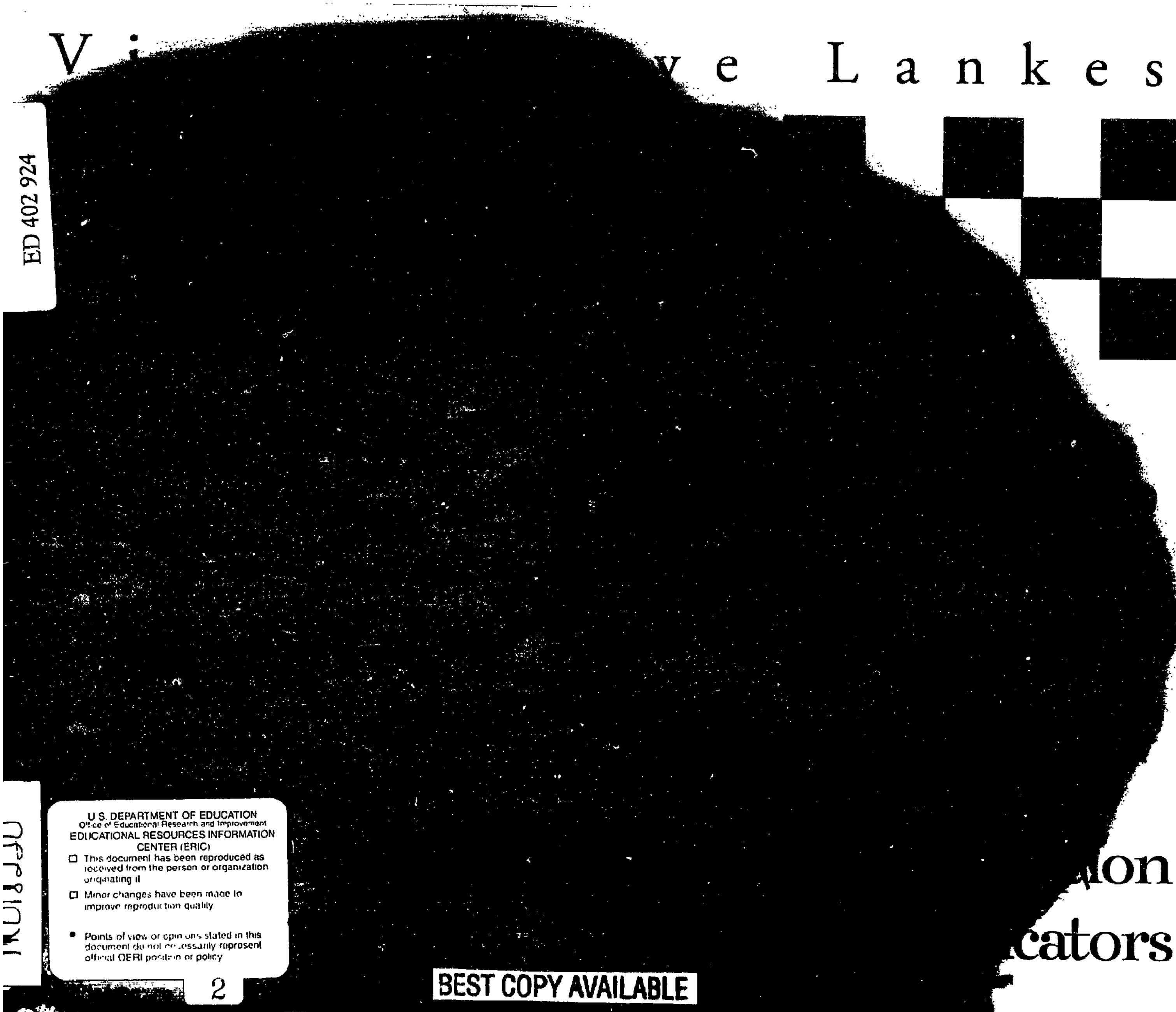

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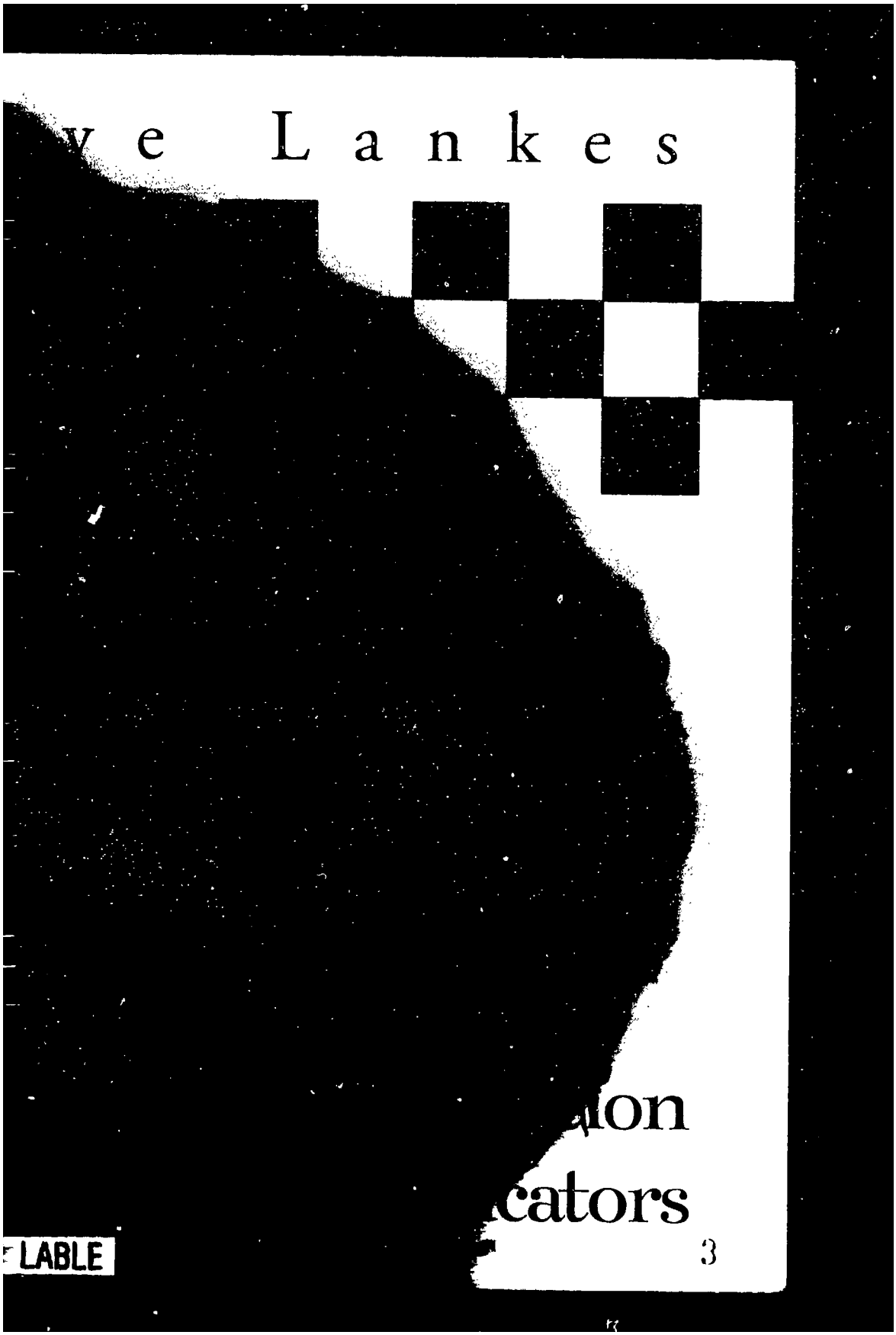
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The Bread & Butter of the Internet:
A Primer and Presentation Packet for Educators

by

Virtual Dave Lankes

June 1996

ERIC Clearinghouse on Information & Technology
Syracuse University
Syracuse, New York
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About Virtual Dave

Virtual Dave is a co-founder of AskERIC, the award winning project that provides high-quality education information to educators via the Internet. Dave is currently associate director of the ERIC Clearinghouse on Information & Technology. He is also an adjunct instructor for Syracuse University's School of Information Studies.

Lankes speaks and consults nationally on Internet issues in education and business. In his spare time, he works on his dissertation on "Building and Managing Internet Services."

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Foreword

Educators know that students learn more and retain information longer when they can explore and discover, when they can apply what they learn to real-life and relevant situations, and when teachers help them understand concepts and ideas. This comes as no surprise to teachers who plan their lessons and organize their classrooms to allow for inquiry and discovery. Many teachers do this innately and find that educational research substantiates what they have been doing all along. Now, we have a new tool to help students inquire and discover: the Internet.

The Internet is a vast, global, seemingly unending source of information that is available at our fingertips. Information, that just a few years ago would have taken many hours, even weeks, to retrieve, can now enter our homes or classrooms in minutes. Sharing ideas and communicating with people from all over the world is possible using the Internet. Primary source information in text, pictures, graphics, sound and even full-motion video can be accessed by teachers and students for information and research. Applications of Internet technology for education are numerous. Foreign language students can converse in Spanish with students in Mexico by electronic mail. Art students can access museum collections where they can view great works of art. History students studying the Civil War can retrieve information from the National Archives and study copies of original letters from Civil War soldiers and original photos of battlefields. Science students can communicate with NASA and see film of an actual space shuttle launch. Teachers can converse via e-mail with colleagues and other professionals in their field, share lesson plans and ideas, and devise interesting and creative lessons. The opportunities for teaching and learning are endless. Best of all, the computer and the Internet motivate students to learn. Searching an area of interest and then finding relevant information is exciting and rewarding. Surfing the Internet or browsing the Web is all about exploration and discovery . . . and learning.

In *the Bread and Butter of the Internet*, "Virtual" Dave Lankes provides educators an easy-to-read, easy-to-understand handbook on the Internet: what it is; how it works; and how one gets there. In each chapter, "Virtual" Dave includes a Resources section of valuable Internet addresses and Chapter Highlights which make this book a great Internet resource for the novice or the expert Internet user. Because Dave is an educator himself, he provides an entire section—a presentation packet—which can be reproduced in hard copy or on transparency, so that the information in the book can be shared and explained easily. *The Bread and Butter of the Internet* is a true educator's resource. Just like the Internet, this book is all about sharing information. I know you'll find the reading and the discovery rewarding.

Janice Dowling—Principal, East Syracuse-Minoa Central High School

—To my wife, Anna,
who taught me to teach everything I know.

Introduction

The Internet is becoming increasingly important in schools. Even if schools do not plan to connect to the vast array of resources on the global Internet, Internet technology can be used to create powerful internal information systems known as intranets. However, to get the most out of the Internet or out of intranets, one must understand how they work.

This book is called "Bread and Butter" because it is about the basics. It is not a large treatise on the implications of the Internet for education, nor is it an advanced look at Internet programming. Instead, it provides simple and concise explanations. Educators should be able to read this book and come away with enough knowledge to be able to explore the Internet, where the learning truly begins.

The concept for this book emerged from a lecture I presented about the Internet. The lecture was later expanded into a series of articles (roughly equivalent to the chapters in this book) published in *Information Searcher*. The articles were then actually placed on the Internet with the title of "Bread & Butter II" for a class I taught at Syracuse University (Building and Managing Internet Services http://error.syr.edu/~bmis/). I have taken all of this material and expanded the content for this ERIC Clearinghouse on Information & Technology monograph.

What . . . another Internet book?

If you have visited your local book store recently, you know that this is not the only book about the Internet. Some people say the only way to make money from the Internet is to write about it. Why, then, do we need another book? I believe this monograph has the following advantages:

It's educator oriented—This book is written specifically for educators. The topics and examples have appeal to a larger audience, but the target audience is classroom teachers and school library media specialists first and foremost.

It's small—This book does not seek to cover the Internet in depth. It is a primer in the most basic sense of the word. It is meant to give the reader the insight and confidence to go out and learn more. That learning will not come from another book. Learning will come only from experience using the net.

It's about connections—Many books treat the Internet and its applications as if they had no relationship to each other. This would be like talking about the human body as if the heart had nothing to do with the knee. Try using your knee without getting your heart involved. Everything on the Internet is connected. By understanding the connections, you are better prepared for the way the Internet will inevitably change.

It provides you with presentation materials—so you can teach others about the Internet.

This book is not a list of lists. It will not tell you about EVERY site or about EVERY Internet application. A book that claims to do so will be out of date by the time of publication.

This book is for beginners.

I hope you will find it useful.

Virtual Dave Lankes **June 1996**
Somewhere in Cyberspace

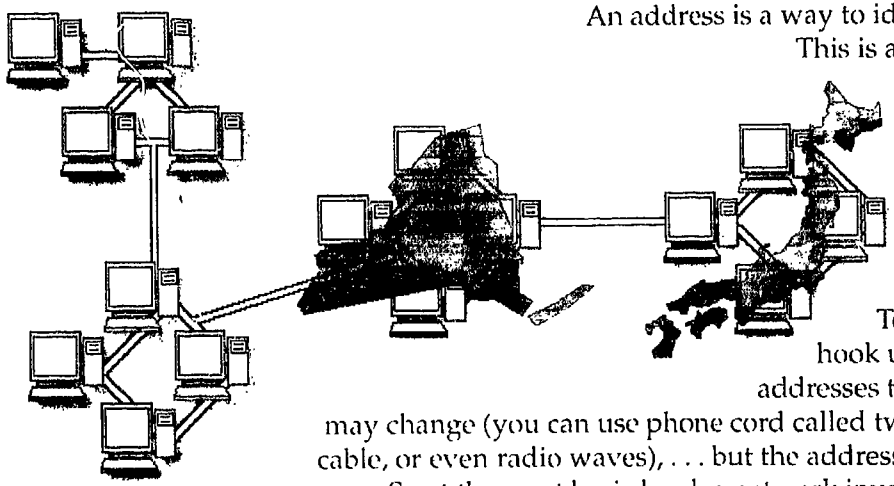
Electronic Networks: A Primer

1

I begin this book with a discussion about the basics of networks. If you already know the difference between a LAN, a WAN, and a MAN (not the kind with beards), then skip ahead. However, I've found that many educators who have been thrust into the task of connecting computers do not have a basic knowledge of the essentials of networking.

To put it very simply, an electronic network (what will be referred to simply as a network) is a set of wires, hardware and standards that allow two or more computers to share information and/or computer peripherals (e.g. printers). The most basic kind of network is the connection of two computers with a serial cable. You can communicate between the two computers with communications software such as *ProComm*, *Kermit* or even works programs such as *Claris Works* or *Microsoft Works*. Here you have the basics of a network: computers to communicate with; hardware for connection (the serial cable and the serial port); and a protocol (the communications software you use).

If you can hook up two computers, why not three? You will need some extra wire, and you will need some way to determine what information is sent to what computer. In the two-computer situation above, it was easy. You sent information to the "other" computer. When you have more than two computers, you need a way to determine which computer your message will go to (unless you want to talk to all the computers). We need to assign some sort of address to each computer.



An address is a way to identify each computer. This is almost always handled at the hardware level. The type of hardware you use to connect computers will determine the way a computer is addressed. Ethernet, Localtalk, and TokenRing are all ways to hook up computers and assign addresses to them. The wires you use may change (you can use phone cord called twisted pair, or fiber optic cable, or even radio waves), . . . but the addressing scheme stays the same. So at the most basic level, a network involves a set of computers and a way to address each computer.

A LAN, or Local Area Network, is a network on a small scale. All the computers in the network can "see" each other. A typical LAN consists not only of the computers, but also other shared peripherals such as printers and scanners. Often a LAN will have a file server attached. A file server is a computer dedicated to storing files and computer applications. Each computer on the network can reach the file server.

It makes sense that if we can connect two or more computers together, we can connect two or more networks together. By connecting two file servers, we can talk between LANs. This involves special hardware such as bridges or routers that allow information to flow from one LAN network to another efficiently.

Why hook up more than one network? Why not just keep adding computers to a single LAN? In most cases, the answer is speed. A limited amount of information can be passed around on a

network at a time. The amount of information that can be passed at a single time is known as bandwidth. When too many users try to use a network at the same time, the network gets slower. In order to speed up the network, you can get faster networking hardware (Ethernet, for example exchanges information faster than Localtalk), or you can create smaller specialized networks, so less information is exchanged on one network at a single time.

When you interconnect networks, you create what is called an internet (note the small 'i'). A MAN, or Metropolitan Area Network, is used to describe a set of networks over a large (but limited) geographical distance. It's a vague term, but normally MANs are limited to a large building, or a campus of buildings. You might set up a MAN to connect all the buildings in your district together. Each building might have a LAN or several LANs. If we can connect networks to other networks, why should we be limited by geography? For example, why just connect to networks in my school district? If I'm in Central New York, and I want to get access to files and programs in Florida, what's stopping me? Well, first I'm going to need a pretty long wire. But I can have that either through the phone company or have a long virtual wire through satellites. We can connect networks over large distances. Such networks are known as WANS or Wide Area Networks.

We can connect one computer to other computers, one network to other networks, and distance is not a limitation. In fact, the only thing we need is a common language to allow us to exchange information. After all, you can reach someone in Japan on the telephone, but that doesn't mean you can exchange information. Having the hardware and the connection is not enough. We need a protocol, or common language, for information interchange.

The Internet (with a capital 'I') is just that—a network of networks based on a common protocol, "TCP/IP." TCP/IP (Transmission Control Protocol/Internet Protocol) is a way of addressing computers on a WAN. In the next chapters you will learn about TCP/IP and the tools that allow you to access information via the Internet.

Chapter Highlights

- ✔ To connect two computers you need hardware (computers) to process information, wires (medium) to create a physical link between the computers, and a protocol to provide a communication link.
- ✔ To create a network with three or more computers (a LAN), you need to assign a unique address to each computer.
- ✔ You can interconnect LANs to form a MAN.
- ✔ You can interconnect networks in disparate geographical areas to form a WAN.
- ✔ The Internet is a network of networks.

The Internet Model

2

In order to use the Internet effectively, one must understand some basics about how the Internet itself works. How does it get information from one point to another? If we build a model of Internet transactions, the tools to be discussed later will not seem discreet applications, but rather as several connected services that can be used to meet your information needs.

Let's begin by breaking the Internet down into hierarchical levels. These levels build upon each other:

Level	Description	Example
Engineering Level	The hardware and protocols used to move bits from one place to another on the Internet	SLIP and PPP connections
Application Level	The software that allows information to be exchanged	*Netscape* and gopher
Resource Level	Information Resources built with Applications	AskERIC
Use Level	Issues, impacts, and methods in engaging resources	Curriculum

Many explanations of the Internet mix these levels and this often leads to confusion. We will begin by explaining the engineering level of the Internet, and we will talk about the fundamentals of the application level. Later, we will focus on specific application level concerns.

The Engineering Level

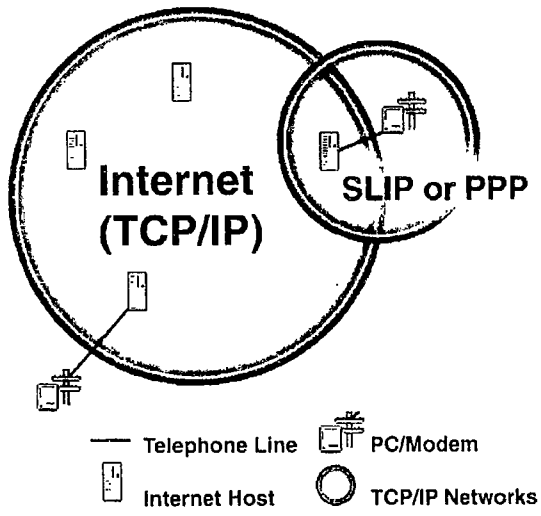


Fig. 2.1 Not every type of Internet connection actually puts you "on the Internet." If you use a modem, you'll need SLIP or PPP software to get a direct connection that will allow you to use a browser such as *Netscape* and receive files directly to your computer.

The rules and methods the Internet uses to get bits of information from one place to another on the Internet are called TCP/IP (Transmission Control Protocol/Internet Protocol). TCP/IP is merely a shorthand for the many smaller protocols that handle moving information like e-mail, connection information, management information, and other information. For you to be able to access all of the resources on the Internet such as graphics and sound, your computer will have to speak TCP/IP. If your computer does not speak TCP/IP, (either by way of a direct connection or special software such as Serial Line Internet Protocol (SLIP) or Point to Point Protocol (PPP), you can still access many of the net's resources by connecting to a TCP/IP host (i.e., a computer directly on the Internet that does speak TCP/IP) with a terminal connection. If you use a communications package like *ZTerm* or *ProComm*, you will have a limited text interaction with Internet

resources. Figure 2.1 should help you determine whether you are on the Internet (speaking TCP/IP), or connecting to a computer that is on the Internet (a terminal connection).

To understand what TCP/IP really does, we must ask a simple question: How does one find a computer on the Internet? The short answer is that every computer is given a number —a unique number for every computer (or host) on the net that speaks TCP/IP. You could think of these numbers as serial numbers. These numbers are broken into four parts divided by a period or "dot" as it is called. The numbers are called IP numbers (or Internet Protocol Numbers). The numbers are broken into sections to speed up the process of one computer finding another. The numbers are divided up so more than one group can assign them.

For example the computer I use has the following number:

128.230.33.81

This number goes from broadest category to narrowest. The first number '128' signifies the type of organization that owns the computer (in this case educational). So when connecting to my computer, another host disregards all computers that are not education related. The next number shows the institution that controls the computer. In this case, '230' represents Syracuse University. The third number denotes any subnetwork information if there is any. In other words, Syracuse University has a lot of computers and it needs some way to logically organize them all, so subnetworks are assigned for different buildings and academic units. In this case, '33' is the Center for Science and Technology building. The last number is the specific computer or host. Seem complicated? Well it is a very effective way to uniquely identify a computer in a pool of millions of computers.

Let me try and give you a quick comparison that might make this idea seem a bit more familiar. There are a lot of houses with telephones in the United States. Some houses even have more than one telephone line. You need a way to uniquely identify which phone is which. How many digits are in your phone number? Think it's seven? Remember the area code? How about the 1 to denote

it's within the U.S. or Canada?

The phone number works the same way (well, almost) as an IP number:

1	315	555	1234
Country	Region	Part of the City	Actual Phone Number

so we could write a phone number like this:

1.315.555.1234

See, simple.

People, however, usually prefer to use names rather than numbers. For this reason, the Internet uses a protocol called the Domain Name Service (DNS) that associates a name (an IP name) with a number. This name is also divided by dots with hierarchical information, but in the opposite direction. So 128.230.33.81 is aliased to 'ericir.syr.edu' where the parts go from specific to general. So, 'ericir' is my computer (subnet, or building information is not listed here, the University takes care of that for us) 'syr' stands for Syracuse University and 'edu' is to show it's an educational institution. Note that there can be more than one computer on the Internet named 'ericir' but only one at Syracuse University.

Application Level

This sophisticated naming scheme is useless without practical applications that utilize the connection ability of the Internet. The real power of the Internet lies in how computers share information with each other. So, for the simplest connection, you need to have two computers (the one you are connecting from, and the one you are connecting to). You don't want the whole computer you are connecting to, just the e-mail process, or the data on that computer. This is the power of the Internet—utilizing resources on remote computers.

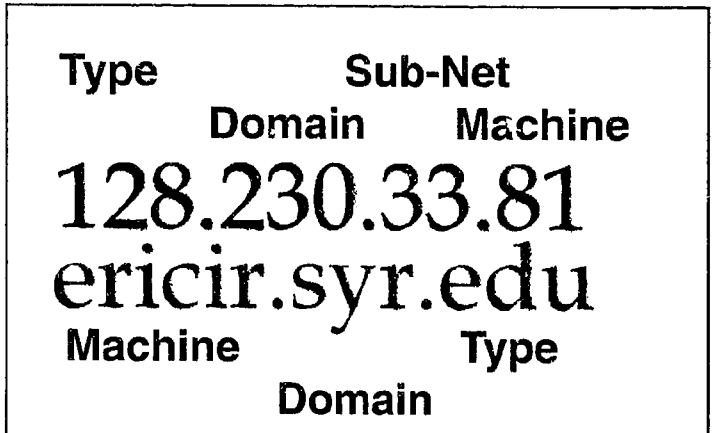


Fig. 2.2 IP numbers are aliased (or changed to) IP names. Note that the two systems are hierarchical, but names are reversed from numbers.

The computer you are connecting from is called the client or terminal. The process you are connecting to is called the server or host. The common language you use when exchanging information between the client and the server is called the protocol. This is called a client/server paradigm, and has many benefits in computing that extend well beyond the Internet. Let's take a closer look at the three components of the client/server model.

The Client

In the beginning of computing, almost all of the computing power, interface, and resources were stored locally on a powerful computer called a mainframe. The mainframe took all the commands and requests from user terminals (pieces of hardware that were little more than a screen and a

keyboard), determined appropriate action (including redrawing the screen, moving a cursor, etc.), and sent the response back to the user's terminal. This worked fine. Then the personal computer came on the scene. Personal computers were capable of much more than merely taking in keyboard data and sending it off to a mainframe. For many reasons, there was a need to make these clients, or terminals take greater advantage of the built in capability of the PC, and not make them completely dependant upon the mainframe. Clients became more than simple terminals. They became quite self-contained, and used the network and remote computers only when the client (the PC) could not accomplish a particular task. In an Internet environment, the client uses a remote computer when it does not have certain information (like a stock quote or curriculum guide).

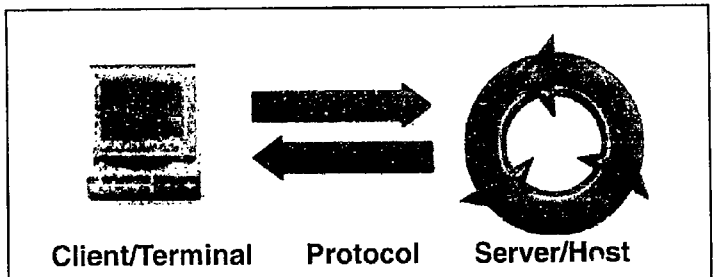


Fig. 2.3 The client/server architecture is composed of the client that handles all the user interface, the server which stores and sends information, and the protocol that determines how information is exchanged.

Clients are platform specific. That is they are written for and represent the look and feel of a given operating system (it looks like a Mac, or it works like a Windows application). The client takes full advantage of the local computer's capabilities (number of colors it can display, speed it can draw images, fonts loaded on the operating system). The user has control over the look of information—color for the background, the size of windows, etc.

The Server

In the days of the mainframe, the role of the server was much greater than it is in present day server applications such as gopher and World Wide Web. In the mainframe model, all user

functions were handled by the server. In the new client/server model, the server's role is limited only to basic information storage and retrieval functions. The server constantly waits for requests from clients. Once a request is received, the server will do only what it must do to fulfill the request. Normally, this means finding a given file, translating it into a common language, and then sending it off to the client via the Engineering Level of the Internet. See how everything builds? Sometimes, the server does more sophisticated functions such as handling database queries, or running a predetermined program. As with the client, the server is platform specific. Server programs are written to take advantage of the computer they are running on.

If a school wants to provide the information it has to other schools via the Internet (e.g. via FTP, gopher or World Wide Web), it must set up at least one server at the school so other schools or other people can contact it. You cannot use the same software you use to surf the net or gain information (such as *Netscape Navigator* or Microsoft's *Internet Explorer*). You will need server software (such as a web server, a gopher server, or an FTP server).

The Protocol

The protocol acts as an intermediary between the client and the server. The protocol is an agreed upon, platform independent, standard language used for transferring information from client to server. It is normally a highly structured line of text that sits on top of TCP/IP (the most basic set of Internet protocols).

For example, when a gopher client 'talks' to a gopher server, it uses a very simple protocol that consists of text divided by tabs (really, that's it). The first set of text is a number that indicates the type of document being transferred or requested (0 is a directory, 1 is a text file, and so on), the tab character, and then the name of the item being requested and so on. If you want to see this in action, telnet to a gopher server and send some raw gopher protocol and see what happens:

`telnet ericir.syr.edu 70` (this telnets to a specific computer . . . the 70 is a specific process running on that computer)

then hit **`return/enter.`**

What you get back is the information your gopher client reads and makes sense of for you. Gopher uses the protocol to transfer its information.

As we look at further Internet applications, we will use this client/server model to explain what the applications do, and how they do it.

Chapter Highlights

- ✔ The engineering layer provides the infrastructure for the Internet. The engineering layer is the hardware and software that is transparent to the user and allow bits to be exchanged between computers.
- ✔ The application layer deals with the development of software. It provides a user interface, but contains no information.
- ✔ In the resource services layer, information is combined with applications.
- ✔ The use layer matches information to a users situation.
- ✔ IP names and numbers provide a hierarchical method that uniquely identifies computers on the Internet.
- ✔ The Internet is a large client/server system.
- ✔ The client provides the user interface to the Internet.
- ✔ The server houses information and waits for clients.
- ✔ The protocol is a platform independent means of communication between the client and the server.

E-Mail: The Net's Common Currency

3

In the previous section, we looked at some underlying protocols used on the Internet, and we set up a model for client/server computing. In this chapter, we will begin putting that model to work. We will look at some of the applications (the application level mentioned in the previous chapter) that we can use on the Internet to communicate and get to information.

Let's start with the most common Internet application, electronic mail. E-mail is considered the minimum application for using the Internet. E-mail sends a memo-like message from a "user" (this user might be a program) to another user or group of users. E-mail is one of the main reasons electronic networks exist in the first place. The ability to send a message from one point to another in fractions of a second has changed organizations and destroyed the free time of many an unsuspecting library media specialist or teacher. It can be addictive, overwhelming, annoying, and down right useful.

E-mail - The Server

We will start our look at e-mail by talking not about how to send e-mail, but how to receive it. In other words, we will take a look at the host you are going to be sending mail to.

The Internet is populated by many big and powerful computers. When the net started, the personal computer wasn't even a dream yet. A large computer (or host) might have hundreds of different people using it to access the Internet. How could one find one's own mail? Some sort of dividing mechanism had to be created so each user would not have to sort through all the mail sent to a computer in order to find his or her own mail.

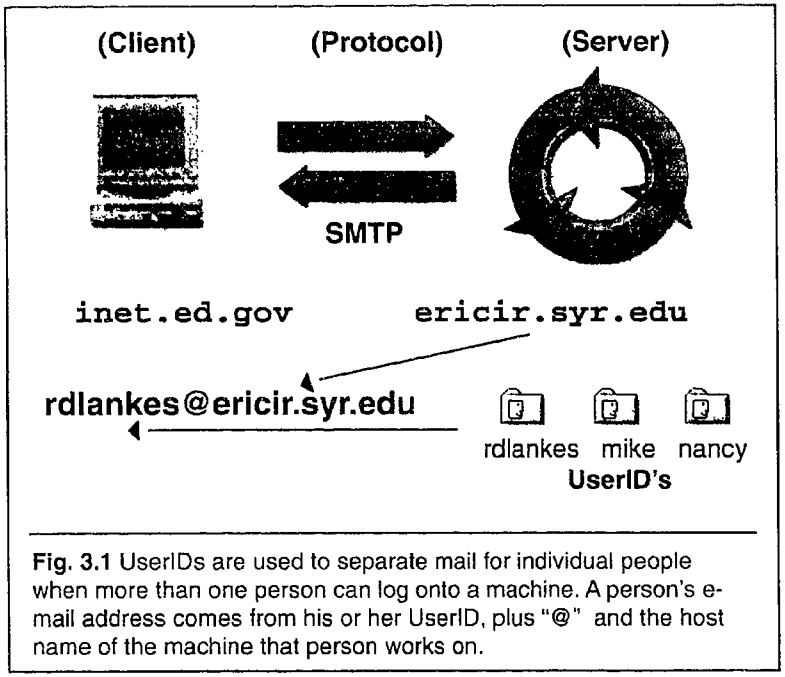


Fig. 3.1 UserIDs are used to separate mail for individual people when more than one person can log onto a machine. A person's e-mail address comes from his or her UserID, plus "@" and the host name of the machine that person works on.

Luckily this problem had already been encountered with files and programs on shared computers. When a user connected to a computer, he or she had to have a way to distinguish his or her personal files and software from everyone else's. In order to do this, special unique identifiers were assigned to users. These identifiers were called UserIDs or logins. These UserIDs and the soon associated passwords, allowed users to protect their own information. This scheme was logically extended to electronic correspondence or e-mail.

A user is given an ID on a host computer. By sending a message to that host and specifying the intended receiver's ID, the host (server) can then protect the message and deliver it only to the proper user or users. Someone's e-mail address is his or her UserID on his or her host computer.

The "@" (read "at") sign is used by the mail delivery protocol to divide UserID information from host information.

So, for example, I work on a computer named ericir.syr.edu (see previous chapter for how that name was assigned) and I log on with a UserID of rdlankes. Therefore my e-mail address is rdlankes@ericir.syr.edu (please see 'Mail Servers' below for exceptions and extensions to this).

This can be seen in figure 3.1.

E-mail - The Protocol

The protocol that moves e-mail from one computer to another is called the "Simple Mail Transfer Protocol" or SMTP. SMTP is one of the myriad of small protocols that make up TCP/IP and is the software that adds a header to all the mail you receive.

The protocol itself is very simple indeed. It is a combination of numbers and words that one host uses to identify itself to another host. A simplified exchange might look something like this:

```
SERVER: Hello
CLIENT: Identity of Client and sending UserID
SERVER: Ok
CLIENT: Identity of Receiving UserID
SERVER: UserID Ok
CLIENT: Data
SERVER: Send Data
CLIENT: [The data]
SERVER: Ok
CLIENT: Quit
```

It should be noted that this protocol is *NOT* very secure. It is easy for an individual to telnet to the specified mail server address and type this information in manually—in essence forging information. *[NOTE: The above example will not actually work, and you must know the proper IP Port to telnet to and the specific SMTP codes in order to do this.]*

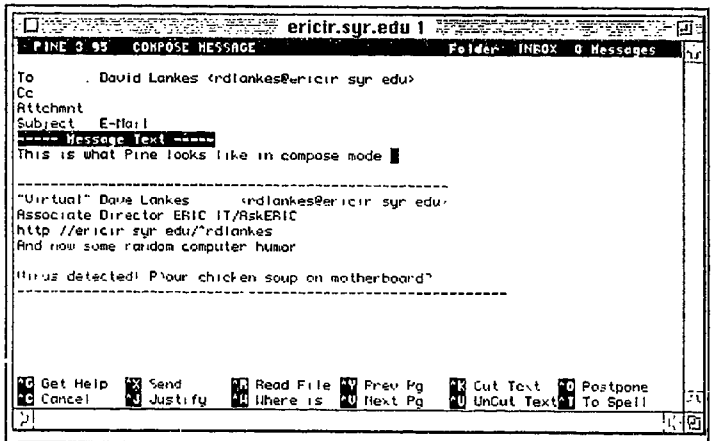


Fig. 3.2 A sample Pine e-mail message.

E-mail - The Client

Ok, now we've covered everything but what you want to know. How do I actually send an e-mail message. Well, here's the bad news. There is no way I can actually tell you how to send e-mail. As much as I'd like to show you a step-by-step process about how to compose and send an e-mail message, I can't. There are many (hundreds?) of different interfaces to e-mail with names such as *Pine (Fig. 3.2), Elm, Eudora (Fig. 3.3), MH,* and just plain *Mail.* Many commercial systems (*Microsoft Mail, CCMail* and Apple's *PowerTalk Mail*) have gateways that allow e-mail to move from the local area network to the Internet. The most used e-mail interfaces might be those used in commercial services like America Online and Prodigy. There is no one way to send e-mail. However I can introduce you to the basic steps:

1. *Identify who you are sending the e-mail TO.*
   For this you will need to know the receiver's e-mail address (see 'Server' above). What's the best way to find this out? I still think a quick telephone call is the fastest way, or you can have your receiving party send you an e-mail message (you should know your own e-mail address by now). There are more Internet ways, but frankly none of them are guaranteed, and some are more cryptic than they are worthwhile.

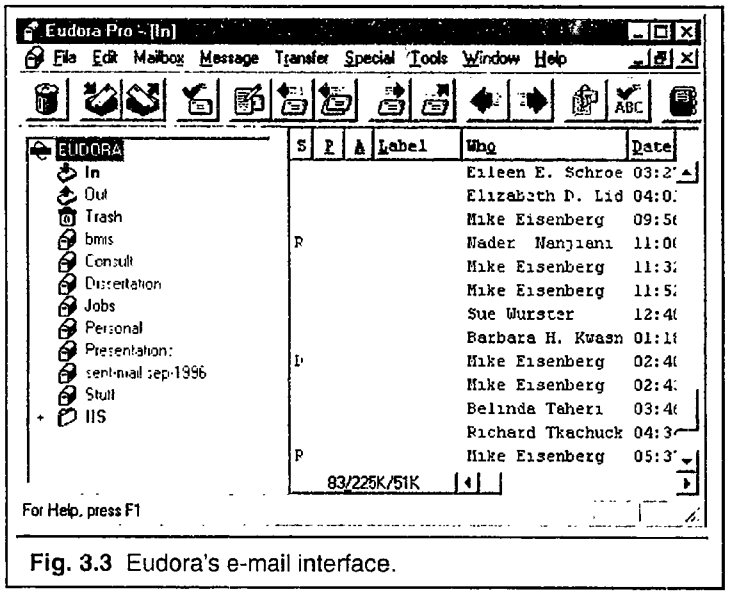


Fig. 3.3 Eudora's e-mail interface.

2. Identify who the e-mail is FROM.
In almost every e-mail system, this is done automatically by the e-mail software.

3. Give your e-mail a SUBJECT.
Please, please, please give your e-mail a subject. In most e-mail software this is optional, but as a person who receives over 100 messages a day, I know a subject line really helps.

4. Compose the body of the message.
The Internet etiquette, or Netiquette as it is called, suggests keeping the message small, informal, and with enough information from previous conversations to give the receiver a clue what this new message is about.

5. Send the e-mail.

Mailing Lists and Listservs

Sending e-mail is very popular and is still the biggest use of the Internet today. Once people saw how they could send e-mail to a single user, it soon became clear that e-mail could also be used to distribute information to groups. Special mailing list software was written to do this. This soft-

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ware takes all the e-mail sent to a specific address and re-mails it to a list of other users. So you send a single message to a single UserID and it is distributed automatically to a list of other users as seen in figure 3.4.

The most common mailing list software is called *Listserv*. When you are on a listserv, you are using *Listserv* software to distribute your mail to a mailing list. One of the best listservs for school library media specialists is called LM_NET. To get on this list you must first subscribe to the list. Send an e-mail message to listserv@listserv.syr.edu with the message:

```
subscribe lm_net YourFirstName YourLastName
```

Once subscribed, you can send any message to lm_net@listserv.syr.edu and your message will be redistributed to thousands of other library media specialists.

If you want a complete list of listservs indexed by subject, you can send the following message to **listserv@listserv.syr.edu:**

```
list global
```

You will receive an e-mail message back with a 60-page list of listservs on all sorts of topics.

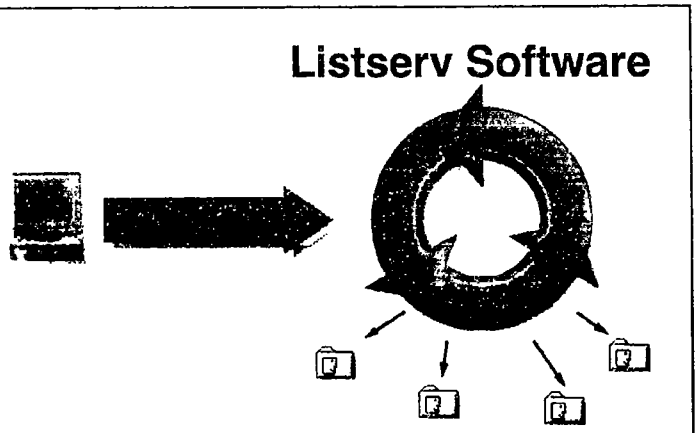

Fig. 3.4 Listserv software takes an incoming e-mail message and re-mails it to the mailing list subscribers.

Mail Servers

E-mail has become more complicated in recent years. Many people use personal computers to read and compose their mail. However, there are big problems with PCs and e-mail:

- **Personal computers often get turned off when not in use.** Computers trying to send e-mail directly to a computer that is turned off will cause the e-mail to "bounce" back to the sender and remain un-sent. This can cause huge problems for mailing lists that might send many messages in a day.

- **Personal computers weren't built for large volumes of e-mail.** Personal computers can become easily overwhelmed with large numbers of small e-mail messages, thereby slowing the performance of the personal computer.

- **Personal computers crash . . . a lot.** Even if you have a very stable computer, it is likely that you will have to reboot the computer several times a week. Larger multi-user computers tend to get restarted once a month or less.

Despite the above, you still want the convenience and ease of using your own PC to read and work with your e-mail. For this reason, new mail server/protocol software was written. The two biggest mail server protocols are POP and IMAP. These protocols create a client/server connection between your PC and a multi-user computer that handles e-mail (called a mail server). Mail comes or goes to a mail server that is always on and holds the mail. You use your own PC to access the mail server at your convenience. You will still need to follow all of the steps outlined in the client section above, but instead of connecting to the receiver's host, you will connect with your mail server and it will, in turn, connect to the receiver's host.

Resources

AskERIC: Educators seeking education information can send e-mail questions to an AskERIC network information specialist. Send e-mail to: **ASKERIC@ERICIR.SYR.EDU**

LM_NET: Library Media Listserv serves nearly 5,000 library media specialists. Discussion includes issues related to school libraries. Send e-mail to: **LISTSERV@LISTSERV.SYR.EDU**
In the body of the e-mail message type: **SUBSCRIBE LM_NET yourfirstname yourlastname**

EDTECH: This listserv allows discussion about educational technology topics. Send e-mail to: **LISTSERV@MSU.EDU**
In the body of the e-mail message type: **SUB EDTECH yourfirstname yourlastname**

The AskERIC Listserv archive: If you want to browse other education related listservs they are archived on AskERIC's gopher and are available at:
URL: gopher://ericir.syr.edu:70/11/Listservs

Chapter Highlights

- ✔ E-mail addresses consist of a UserID and a host name divided by an "@" sign. This arrangement allows a computer to keep e-mail private.
- ✔ Mailing lists and listservs are software that take e-mail messages from a central e-mail address and redistributes the messages to those interested in a given topic.

Telnet and FTP: The Internet's Forgotten Heros

4

All right, I admit that I might suffer from Good Old Days syndrome. This terrible condition forces one to say "I remember when we didn't have the web, we didn't even have point and click interfaces . . . why in my day, we had archaic text commands and we liked it!" My father is smirking somewhere in America tonight. For many people, FTP and telnet are viewed as relics of the Internet's growing pains, to be cast off and forgotten. Not so fast, I say.

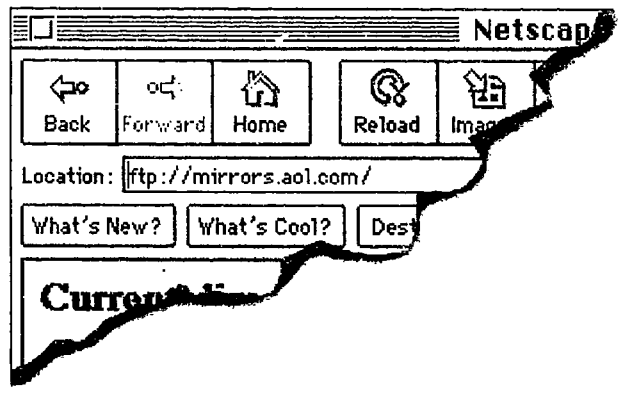

Fig. 4.1. . . .Check out the URL. . . even though you think you're surfing the web. . . you are using FTP.

First of all, these venerable old methods of Internet navigation are still very much in use today. You just may not realize it. For example, even though you think you're surfing the web with *Mosaic* or *Netscape Navigator*, check out the URL (Uniform Resource Locator or Universal Resource Locator). Chances are, if you are downloading software, the URL you are using will start with 'file://' or even 'ftp://'...Yup, you guessed it, FTP in disguise. There's a lot of information out there in anonymous

FTP servers, and system administrators are very reluctant to convert everything over to the web (to be discussed later). And telnet? If you use any text interface to the Internet, like checking e-mail, you are using telnet. And there are things you can do with these "old" protocols you can't do with anything else.

Ok, venting over. Let's get down to business. FTP, or File Transfer Protocol, and telnet are two different ways of doing the same thing—controlling a remote computer. We will start with telnet.

Telnet

The neatest thing about the Internet is that it gives you the ability to travel from one place to another almost instantaneously. How many times have you ever turned to a friend or colleague and said "Wow, we're in China" or Japan . . . or you name it. We act like virtual tourists moving from place to place. Doing this with the World Wide Web is easy and fun, but it only shows you a little of the "local culture." It's like driving to the Grand Canyon, staying in the car, and taking pictures through the windows. You "see" the canyon, but only at a surface level. Wouldn't you love to get down into the canyon, feel the soil, and really experience it? Sure it's a little harder to get around, and sure it might be confusing at first, but you get to do so much more. This is telnet.

Telnet allows the user to open a "virtual terminal" or window on a remote computer. Even though the window is obviously sitting on the computer screen in front of you, the text and things you type are created and processed on the remote computer. You type a letter. It is sent to the remote computer where it is processed, and then the results are sent back and displayed on the screen in front of you. As far as the remote computer is concerned, you are sitting in front of a screen directly attached to the remote computer (wherever it may be).

This is a good thing and a bad thing. The good thing is you get to work on the remote computer in its native environment. If the remote computer has a program that accesses a database you want,

you can telnet to that computer and have access to that database. If you want access to some of the most powerful software and hardware in the world, you can get to it if you have telnet access. Pretty neat isn't it? The bad thing about telnet is you get to work on the remote computer in its native environment. (Didn't I just say that?) That means if it is running an archaic and obscure operating system like UNIX, you have to learn that operating system to do anything. The good news is that most "public services" tend to create simple interfaces to their services. AskERIC, for example, gives the user a menu driven interface to access its services. The guest doesn't get access to the whole computer, but also doesn't have to be bothered by the messiness of the operating system. For consistency, let me quickly describe telnet using our client/server model.

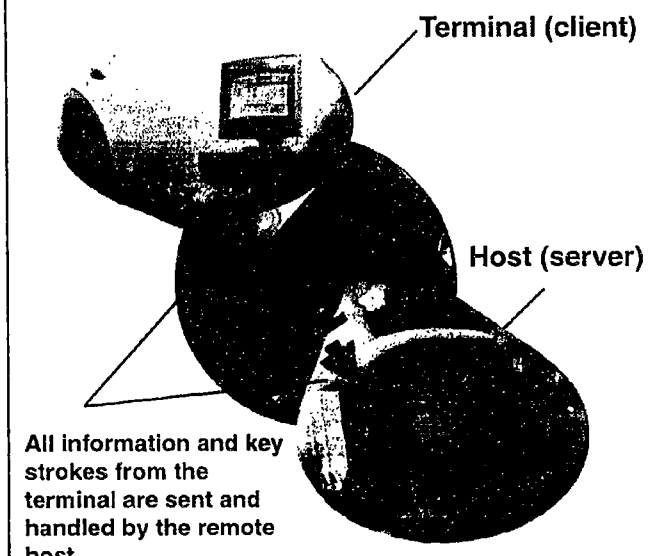

Fig. 4.2 In telnet, your computer merely acts as a "virtual screen" to a remote machine that receives and processes all information.

Telnet - The Client

The client in telnet is a very simple element. Often, it is just a piece of software that opens a text window. It sometimes has extra capabilities like capturing text that scrolls beyond the top of the window. The whole point of telnet is for the client computer to do virtually nothing, because it is the remote computer's capabilities we are interested in using.

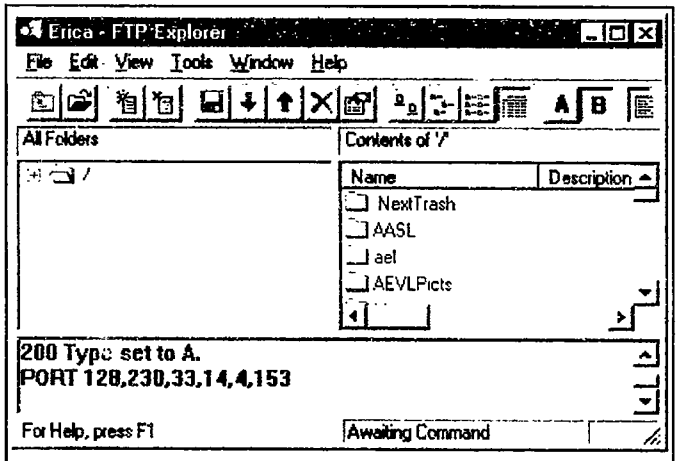

Fig. 4.3 FTP screen for the Windows environment.

there are a few basic and important things to realize. The client and server need to know some information about each other to communicate. The most important thing they need to know is how to display text on the "virtual terminal" or window of the client computer. This is normally accomplished with a screen description, often referred to as a terminal type. Remember, as far as the remote computer is concerned, the client is just that— a hardware terminal. There are several different

A quick technical note. Just because you are in a text based environment, it doesn't necessarily mean you are telnetting. When you use programs like *Z-Term*, *ProComm*, or *Microphone* to interact with remote computers, or to control a modem, you are using a serial hardware protocol to make the connection, not telnet. It really doesn't matter, but I suppose I have a passion for technical accuracy.

Telnet - The Protocol

The telnet protocol is rather complex, but

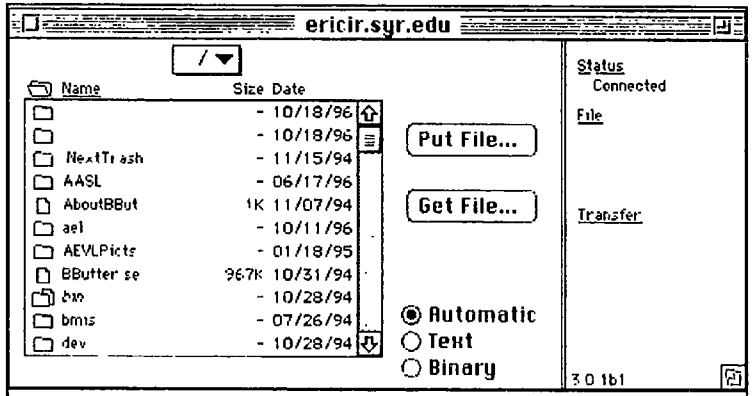

Fig. 4.4 Fetch, FTP screen for the Macintosh environment.

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types of terminals available, but the de facto standard, and best guess, is vt100. A vt100 terminal was a piece of hardware created by Digital Equipment Corporation when the Internet was getting started. It has become the most common screen description in use. The terminal specification tells the server how much text can be displayed on the screen at one time and if it can invert video (make things bold, or put white text on a black background). If the screen doesn't display text well, and the text looks "messed up," there is a good chance the server thinks the client is the wrong type of terminal.

Telnet - The Server

The server creates a virtual terminal for you on the remote computer, and gives you access to that computer's operating system (or a set up program). It should be noted that the server needs to have multi-user capabilities. Chances are you work on a PC of some sort running Windows, or on a Mac. The operating systems on your PC or Mac let only one user use your computer at one time. That is, you can't have two people use the same computer to do two different things at the same time. Server computers that allow users to telnet to them allow several users to be logged on at the same time (from 5 to hundreds of users). Each of these users can do very different things (word processing, navigating the Internet, etc.). You can't telnet into your colleague's computer, but you can telnet to the computer on my desk because it is running UNIX, a multi-user operating system. That is, you could only telnet to my computer if you have an authorized username and password, of course. Remember that?

FTP

When you use telnet, you actually work on the remote server computer. There is no need to transfer documents from the remote computer to you, because as far as the remote server is concerned, you are right there. The server you telneted to can't transfer files back to your client computer.

Here's where FTP comes in. FTP's sole purpose is to move files from one computer to another, hence the name, File Transfer Protocol. When you use FTP, you can transfer files from the remote server computer to your client computer. I like to compare telnet and FTP to shopping at a mall versus shopping from a catalog. Just as going to the mall lets you interact with the things you want to buy, using telnet allows you to interact and work with the resources on the remote computer. When you shop from a catalog, however, you see descriptions of the items for sale, but you can't interact with those items until they are sent to you. FTP is just like shopping from a catalog. You see a list of files available, but until you retrieve the files (get them sent to you), you can't work with them.

Because of the obscure protocols it uses to do its work, you need to learn certain commands in order to use FTP. However, unlike telnet, once you know these commands, they work on every computer that has an FTP server, no matter what type of computer/operating system the remote server is using. This rigid command structure means that your client computer can perform these commands for you, and as client computers have become much more sophisticated and user-friendly, they are able to hide the obscure nature of the underlying FTP protocol. FTP is also important in the creation of web sites. Often web files are produced on "PC development work stations" and then transferred to more powerful servers via FTP.

FTP - The Client

There are many FTP clients available, from simple text-based ones, to very sophisticated ones. The most popular FTP client for the Macintosh is called *Fetch*. In almost all cases, you will have some way of selecting a single remote FTP server. The program will then display the files and folders available on the remote computer. Some programs will split the screen into two windows, one showing the files on the remote computer, and one showing the files on your computer. The client will allow you to select files to upload (move from your computer to the remote computer) or download (get files from the remote computer). The FTP client is similar to the Macintosh finder, or the Windows file manager. It allows you to move through directories, and see the names of

files, but not run the files or read them. If you want to interact with these files, you need to either download them or telnet to the remote computer.

FTP - The Protocol

In an FTP protocol, it is important to distinguish between ASCII files and Binary files. ASCII files are text files. Binary files are programs, graphics and software. Often, you need to tell your client which is which. If you download a graphics application in ASCII format, it won't run. If you download text in Binary format, there is a good chance you will destroy the formatting of the document.

FTP - The Server

The FTP server only waits and listens for clients, and then describes the files it has available for downloading. One thing the server does is ask who you are. No remote computer wants to let in just anyone. That's why you need to log into FTP server computers with an authorized username and an associated password. This is very important to me because I use FTP to move my personal files from a computer at work to a computer at home. Because that same computer at work allows public users to get files, usernames and passwords are necessary to keep you from getting to my files (and me getting at your files). An FTP server uses the same usernames and passwords that telnet uses. So how do servers allow the general public to get files without setting up separate accounts for everyone on the Internet? The answer is they make one user account, and everyone uses the same username: anonymous. Anonymous login is simply an agreement that if a server allows the public to get files, they will use the username "anonymous" and that instead of a password, the system will accept the user's e-mail address. This address information can be used to track which files are uploaded and downloaded to and from the server.

Reflections

Ok, I feel better. I hope you now have a little more respect for these older protocols. The truth is, I probably use web browsers as much, if not more, than FTP, and I only use telnet to get to my e-mail, but it's good to know I can use these protocols. FTP is still very useful, and telnet will never go away.

On the Internet, a protocol never dies, it just gets a different face. New users may never see FTP commands like **`user, passwd, get, mget *, ls, dir, hash,`** and such, but they will no doubt use FTP in a different guise.

Resources

AskERIC: If you want access to Gopher or the web through a text based system, or just want to try telnet and FTP, you can use AskERIC.
Telnet to: ericir.syr.edu, log in as "gopher" and follow the instructions on the screen.

FTP to: ericir.syr.edu, log in as "anonymous" and use your e-mail address as your password. Education files are in the directory "ael."

NASA Spacelink: For NASA information aimed at a K-12 audience.
Telnet to: 192.149.89.61 log in as "guest."

AOL: For a great site for shareware (includes a mirror of info-mac, the definitive source for Macintosh shareware including *Fetch*) use America Online's FTP site.

FTP: mirrors.aol.com, login as "anonymous" and use your e-mail address as your password.

Chapter Highlights

- ✔ Telnet allows a user to work directly with a remote computer in its native environment.
- ✔ In Telnet, the remote host (server) does most of the work.
- ✔ Terminal preferences (e.g., vt100) are important in order to format a user's screen.
- ✔ FTP (File Transfer Protocol) is an Internet means of sending and receiving files to and from a remote computer.
- ✔ Files on the Internet can be placed into two classes, ASCII for text files, and Binary for other types of files e.g. graphics and programs.
- ✔ Anonymous FTP is a standard for allowing the public to access files on remote computers. The UserID is anonymous. The password is an e-mail address.

Gopher: What if the World were One Big Menu?

5

People often forget that it was gopher, not *Mosaic* or *Netscape*, that really got the Internet rolling for the masses. Gopher started in 1992 as an effort by the University of Minnesota to create a Campus Wide Information System (CWIS). Rather than use one big system to house information for the entire university, the University of Minnesota decided to let each department or group take care of its own information—distributed information. This rather nifty idea lead to some rather elegant ideas about how to

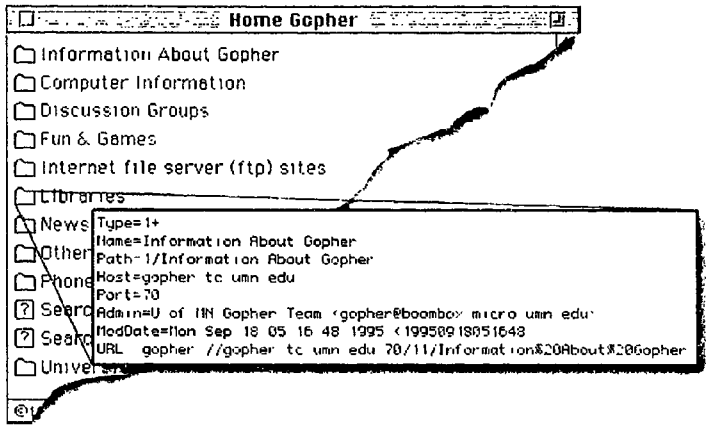

Fig. 5.1 While the client may display things as simple icons, it stores a lot of information on each item. This extra information tells the client not only what pictures to use, but what server to use to gather the information. This use of pointers, or links, allows information from a wide range of sources to be displayed as a single menu.

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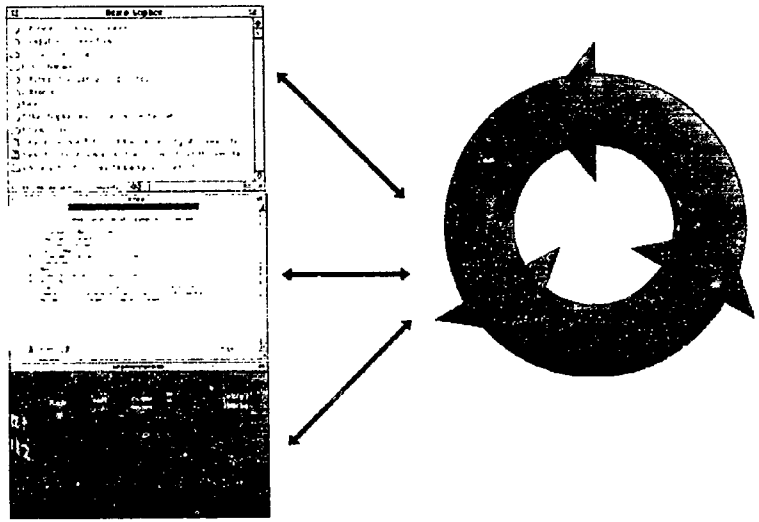

Fig. 5.2 The client/server architecture allows the clients (on the left) to determine how things are displayed, not the server (on the right). Here three different gopher clients display the same information.

link information and make those links seamless. Before gopher, in order to move from one set of information to another, an Internet user would have to disconnect from one source, and reconnect to another—much like using the phone book and making multiple calls to find something out.

In the process of creating their CWIS, the University of Minnesota did something unprecedented in Internet development. They created and made available software that other Internet users could use to set up information systems which could interoperate with the University of Minnesota's gopher. (Ever wonder why it's called gopher? Guess what animal is the mascot for the University of Minnesota?) This was software that anyone could use on almost any kind of computer. No compilers needed. Just a low end personal computer and an Internet connection.

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The ease of setting up the server side (the information provider side) lead to gopher's explosive growth. Believe it or not, the World Wide Web was developed at about the same time, but it was very difficult to implement a WWW server at that time. With gopher, everyone could become a publisher on the Internet. Not only could you publish your information, but it was very easy to link your information with others' seamlessly. The Internet became one huge linked "gopherspace."

How Gopher Works

The main difference between gopher and the previously described software/protocols like telnet and FTP is the form of connection. In telnet and FTP, the client (the software you use) makes a connection (via the protocol) to a server (that houses the information). This connection, once established, stays established until you are done (you log off or disconnect). This is like making a phone call. If you telephone your local Department of Motor Vehicles to get some information, you stay with that phone call until you get the information (or are too frustrated to wait any longer). That means that even if you are on hold, you are still connected. This is a very big waste of bandwidth (think of bandwidth as the total number of calls that can be received by the DMV). It means that if you called the wrong place for information, you have to hang up the phone, and make another connection. In essence, the state of the connection is always active, or stated.

Gopher does things very differently. It makes a connection only when it needs to. Gopher takes the client server model we've been talking about and really puts it to work. Imagine that call to the DMV again, but this time, you tell the person on the other end what information you need, your phone number, and then hang up (for the sadistic satisfaction alone, this would be worth a try). The DMV (the server with the information) finds the information, and calls you back, tells you the information and then hangs up. If they don't have the information, they call you back and give you another number to call (a pointer). You can keep this calling/disconnecting process up until you get the information. Since a permanent connection is never made, it is called stateless.

Ok, enough metaphors. Summing up in computer lingo, the client connects to the server via the gopher protocol, and makes a request for a specific file, or a list of files available on that server. The client then breaks the connection. The server processes the request, then connects to the client and sends the information. The server then breaks the connection. See figure 5.3.

Now this scheme has some advantages and some disadvantages. A disadvantage is that you can't do real time "stuff." You can't do anything interactive like you can with telnet. Those of you who are big into database searching will find this scheme problematic. Did you ever try and progressively restrict a search? Well, that assumes a stated (ongoing) connection. Once a transaction is made with gopher, it forgets you ever existed. So every time you search the database (even to narrow a search), you have to start from scratch. Nevertheless, there are big advantages to using gopher. A gopher server doesn't have to send back just the information it is storing on its own site. It can also send back pointers to other information housed somewhere else on the Internet. The use of pointers, or links, allows information from a wide range of sources to be displayed as a single menu.

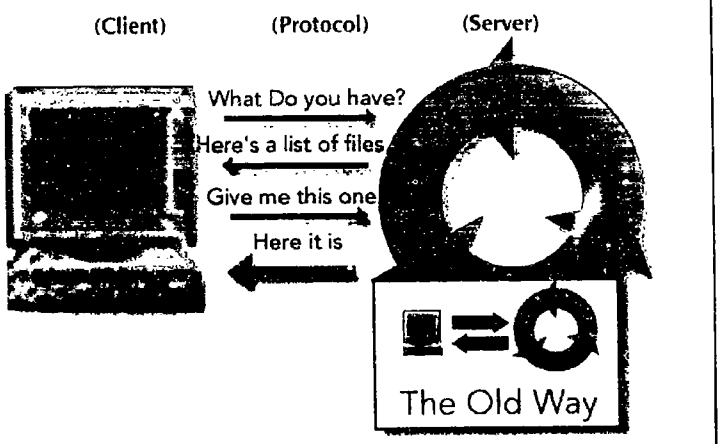

Fig. 5.3 Gopher uses stateless connections. This way, the network is used only when information is exchanged. With telnet and FTP, the connection is maintained even when no information is actively exchanged.

Gopher allows many more simultaneous connections than telnet or FTP, since each gopher connection

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takes less time and computing power. Where a computer might be able to handle 50 telnet connections at a time, it can handle thousands of gopher transactions at a time. Gopher also allows more connections because the server does less work. Here's where things get very interesting.

In gopher (and the web), the gopher server does not handle anything but information storage and retrieval of data. The gopher client does much more of the work. In telnet, if you move your cursor around the screen, the host computer (the server) has to compute every change in position and make all the changes the user commands. In gopher, if you move the mouse or cursor around the screen, it is your computer that does the work of redrawing the screen. Here's where it gets real interesting. The client also dictates how the information is presented. So if you are using a Macintosh, the information can be presented as a Mac, with folders and windows. If you are using DOS, it looks like DOS. In fact, even though most people think of gopher as a presentation of hierarchical menus, the information can be displayed any way you want. The Minnesota folks released *TurboGopherVR* software which presents gopher items as 3D objects that you can fly around.

Reflections

It's fun to impress your friends and family by sitting them in front of a gopher screen, clicking away and saying, "Presto! We're in Japan, and now we're going to Italy . . . now California . . . " Gopher is what brought this feeling of travelling the globe to a reality. You could always do that with telnet and FTP, but it was much more tedious. You had to deal with a huge number of different operating systems and interfaces. Gopher separated the interface from the underlying technology. With gopher, as you are travelling the world, you don't have to worry about where your information is, or what type of operating system is providing that information. And though it may look like you are making a huge chain of connections, in fact you are making a bunch of small connections, and only talking to one computer at a time.

Gopher is losing it's luster these days because the World Wide Web and web browsers are much more exciting. However, there are still a lot of gophers out there, and a lot of people who use them. We can all thank gopher for making Internet navigation easier.

Resources

Gopher: Gopher software is housed at the University of Minnesota:
URL: ftp://boombox.micro.umn.edu

You can also get plenty of technical and other information at their gopher site:
URL: gopher://gopher.micro.umn.edu

Chapter Highlights

- ✔ Gopher menus can contain files or point to remote files.
- ✔ Gopher transactions are stateless. They maximize the use of bandwidth and don't maintain a connection between the client and server when that connection is not being used.
- ✔ Gopher clients can represent information in a wide variety of ways (3D, Mac format, Windows format, etc.).

The World Wide Web or Do Spiders Really Surf?

6

No Internet discussion would be complete without talking about the technology that truly brought the Internet to the masses (mass media that is). In this section, I will show you how the World Wide Web works in relation to the general Internet client/server model we've been using.

First, what's the big deal with the web? Before I show you how the web works, let me explain why you should care. Forget the hype. Forget the nice pictures. The true advance of the web lies in its expandability. Today, new Internet software is being developed to work with the web. People are writing software that gets incorporated into web browsers and servers. Gopher on the other hand, was meant to run independently. Web software incorporates the ability to do animation, develop courseware, and even access databases and encyclopedias over the network.

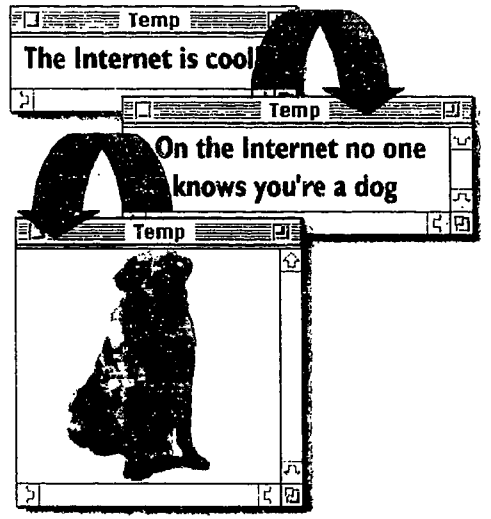

Fig. 6.1 Hypermedia is where you can link text (or other media) to other related media or text.

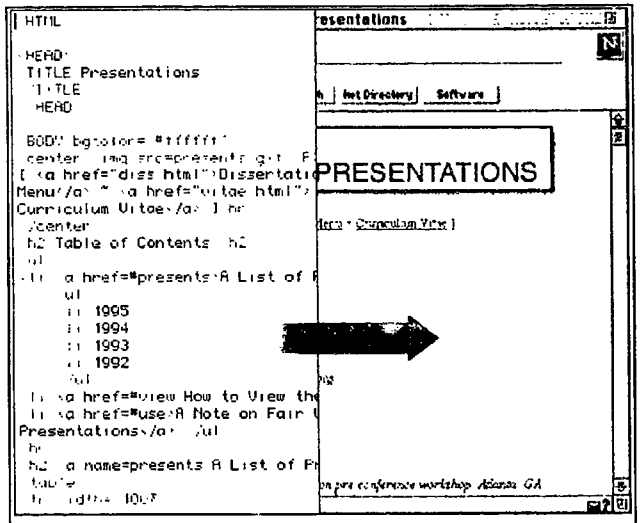

Fig. 6.2 The illustration above shows the raw HTML code, and the way *Netscape Navigator* displays this information.

Second, a nit picky point. The World Wide Web is a set of standards that function on the Internet. It is not a separate network, nor is it really a "thing." It is instead, a set of definitions that dictate how information is passed around and displayed on the Internet. It is different because for the first time, the information is linked not at the site level (as with telnet and FTP) or even at the file level (as with gopher), but at the concept level. The web is also unique because it provides the first wide spread means of integrating different media together in a single display.

Ok, ok, what am I talking about? First, the World Wide Web was developed at CERN, the European Laboratory for Particle Physics in Geneva, Switzerland to help physicists link their research. It was a way for one scientist to link his or her bibliography to other articles if that information was online. It was developed as a hypertext system. That is to say, one could choose a word or phrase and "link" that word or phrase to some other text in the same document, or in another document. Those of you who use *HyperCard* or CD-ROM encyclopedias will be very familiar with this concept. If you click on a word, its definition pops up, or you click on a word, and it takes you to another part of the program. (See figure 6.1)

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The Web - Protocol

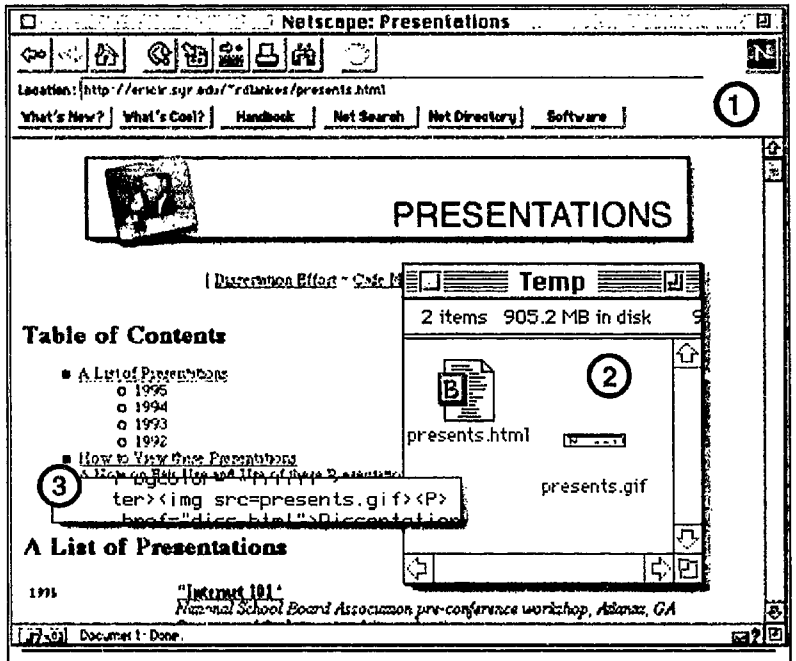

Fig. 6.3 In order for *Netscape* (1) to display this web page, it needs two files (2), the HTML code and a separate image file. This is because of an image tag (3) in the HTML code (the file presents.html) that points to the file presents.gif. Note the URL in the Location box at the top. This tells *Netscape* where to find the file presents.html.

In order to make this linking possible, Tim Berners-Lee defined two standards: HTTP and HTML. HTTP (HyperText Transfer Protocol) defines how information is transferred over the network, and HTML (HyperText Markup Language) defines how the information is formatted. HTTP is a structured series of ASCII characters that are exchanged via TCP (much like gopher). To put that in English, HTTP defines how letters and numbers are sent between two computers on the Internet. This is the protocol portion of our client server model.

HTML (HyperText Markup Language), however, is where the fun starts. First, realize that HTML was a pretty revolutionary idea on the Internet. Information to be distributed via the WWW needs a special format. Before this time, most of the information appeared in ASCII format—boring old text with no formatting information at all. In order to share information on the World Wide Web, one had to take the boring old ASCII text and add

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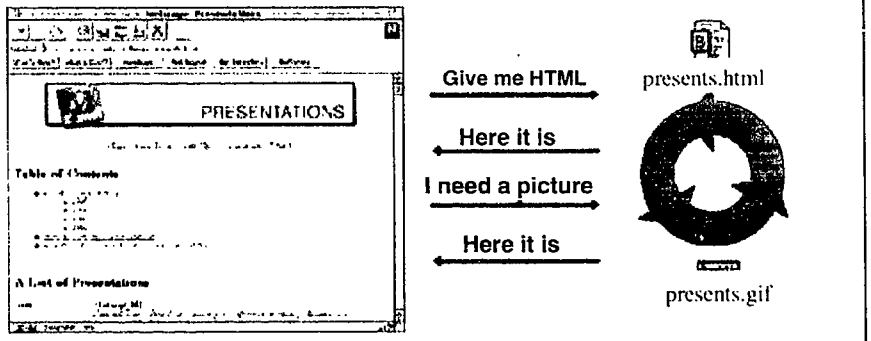

Fig. 6.4 A sample interaction. The web client, or browser (*Netscape* here) makes a request (via the HyperText Transfer Protocol) to the web server. The server replies. If the client needs more information, it needs to make another, separate, request. Note, if the user clicks on a blue underlined link, this process will occur again (not necessarily with the same server).

formatting information, thereby telling the web browser (the client) on the other end which text was a link, which text was bold, etc. HTML code tells the client (a web browser) where to place pictures, what size text to display, and where to put space for user input or forms.

HTML is a page description language (based on Standard Generalized Markup Language (SGML) for the archive librarians in the crowd). It tells the software what type of text to display, not specifically how to display it. That means the client determines the special formatting instructions. This is different from word processors where the file format dictates the specifics of display.

An example: Imagine writing the following sentence in *Microsoft Word*:

"**Virtual Dave Lankes** is my favorite Internet *personality*."

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When you save that file, Word saves not only the text, but also the font used, the font size, the specific style (bold or italics), everything. The same file also saves any graphics and other media as a single file.

This is what the same sentence looks like in HTML:

Virtual Dave Lankes is my <u>favorite</u> Internet personality.

What's the difference? I may set my web browser to show anything contained between and (these are known as Tags) as Times bold, but you can set it to be Helvetica bold. The client, not the file itself, determines specific formatting instructions. Any other media (graphics, sounds, etc.) are stored separately from the HTML file, and are simply pointed to within HTML tags. Why? HTML is designed to be platform independent. DOS programs can't change their font—not all computers have H ' tica. Remember, in client/server, the client is in charge of the display. The files and the ser t contain information— and as littl of that as possible to minimize network bandwidth.

The Web - Client

All of this leads to a favorite topic of web users—browser wars. Different browsers represent HTML in different ways. Some browsers support different tags altogether. So if you look at the same HTML document in two different web browsers (clients), e.g. *Netscape Navigator* and *NCSA Mosaic*, the documents may look radically different. *Netscape*, for example supports tables while some browsers don't. Some browsers don't even support images.

All clients support hypertext links. Hypertext links are created with a set of tags and pointers to other files. These pointers are in URL (Uniform Resource Locator also or Universal Resource Locator) format. A URL is a standard way to locate something on the web. Remember the old days when telling a friend how to find a file went something like this:

"First FTP to this site, then change to the 'pub' directory, then to the mac directory, then . . . "

With the WWW, you simply give them the URL. A URL is really like a sentence squashed together. Here's one:

http://ericir.syr.edu/~rdlankes

It starts with the protocol (in this case the HyperText Transfer Protocol), then the host computer (ericir.syr.edu, an IP name), then any subdirectory of file information (in this case a UNIX shortcut to my home directory). The "://" and "/" are just used to divide up the sentence. This is the URL equivalent to:

"Use your web browser. Go to the computer ericir.syr.edu, and then to rdlankes' home directory."

So an HTML link would look like this:

Click here to go to Dave's Home Page

The "href" stuff is just HTML lingo for HypertextREFerence (the "a" and "/a" just tell your browser what text to make clickable). There are plenty of good HTML references on the net (see resources at the end of this chapter). It will take you about 15 to 20 minutes to create your first page (really). (See figures 6.2 and 6.3.)

The Web - Server

So what does the server do in all of this? Well, much like gopher, the web server holds all of the documents, and then sends them to a web client. In the web's case, however, the server also does other things. It processes user input in forms. So you can write an HTML document that asks for a

user to fill in a survey. The user's response is sent to the web server, and a program (known as a CGI or Common Gateway Interface program) processes the user input and performs the appropriate action. Possibly the most common use of a CGI program is an image map. This program takes the coordinates of a user's click within a picture and then determines what document to send the user based on where the click was. This makes "hot spots" on an image. So you could display a graphic of your building, and the room the user clicks on determines which HTML document is sent to the user (click on the library and up pops the library's home page. Click on Mrs. Smith's classroom and a picture of Mrs. Smith appears.)

Reflections

One of the main features of the World Wide Web is its use of HTML markup. HTML code allows clients to format information better. HTML and HTTP (HyperText Transfer Protocol) are also very expandable. In the next section, we'll see just how the web is being expanded into a network operating system of sorts.

Resources

HTML: NCSA's Beginners Guide to HTML
`http://www.ncsa.uiuc.edu/General/Internet/WWW/HTMLPrimer.html`

Web Browsers: *Netscape Navigator*
`http://www.netscape.com`

Webrefence.com's excellent list of browsers:
`http://www.webreference.com/browsers.html`

General World Wide Web References: The World Wide Web Consortium
`http://www.w3.org`

Internet Resources: A Starter Kit

The following Internet addresses represent only a sampling of the K-12 resources available on the net.

AskERIC Toolbox: a selection of the AskERIC Network Information Specialists' favorite resources.
http://www.askeric.org/qa/toolbox

ERIC Clearinghouse on Information & Technology homepage: contains links to library and information science and educational technology sites.
http://ericir.syr.edu/ithome

Peter Milbury's School Librarian Web Pages: lists web pages created or maintained by school librarians.
http://wombat.cusd.chico.k12.ca.us/~pmilbury/lib.html

The Big Six' Information Problem-Solving Approach to Library and Information Skills Instruction: a systematic approach to information problem-solving.
http://ericir.syr.edu/big6/

Chapter Highlights

- ✔ The World Wide Web is a hypertext system. It allows the linking of text, graphics, and media to other documents.
- ✔ The web uses HTML to format text. Each client can display HTML in a different way.
- ✔ The primary advantage of the web is that it integrates disparate media types in a single display.

New Toys and Trends for the Internet

7

It's 9:30 P.M., and Jane forgot her homework at school. She sits down and turns *it* on. It's not exactly a computer—no disk drive, no peripherals. It's a box with a monitor, mouse and keyboard. An Internet terminal. Up flashes her personal web page, smiling and waving. A few clicks with the mouse, and she is looking at the front door of her school building. She pushes forward with the mouse. The door opens and she glides into the main hallway. On either side of her, images of her classmates move to different rooms or mill about and chat. Jane navigates to her room, scans the walls, and finds the assignment posted on the bulletin board. She clicks on the assignment, and it opens the assignment in her web browser. She prints out the assignment and does her homework.

The above scenario is not from science fiction or even from "two to five" years away. It is a possibility right now. It would take a little money and a lot of work, but the software exists to create this scenario. VRML (Virtual Reality Modeling Language), *QuickTimeVR*, and *QuickDraw 3D* already allow Internet users to download navigable 3D worlds that link to other worlds. Java and Macromedia's *Shockwave* bring true interactive multimedia and animation to the web today.

In previous sections, I've shown you the Internet and described (some would say in gory detail) Internet applications such as gopher and the World Wide Web. In this chapter, I want to talk about things yet to come. These are not psychic predictions, but a synthesis of existing software and trends available on the Internet today.

The Internet will be Interactive

The Internet is already interactive, of course. That's why people like it. But think for a moment how you still "interact" with Internet information . . . one screen at a time. The web may seem to be a multimedia environment , but what the vast majority of us still see are downloaded static pages of text punctuated by graphics. Would you get really excited by a CD-ROM encyclopedia that gave you a bunch of book like pages with no good index, no way of making queries, and no sounds or movies? Or, if you did ask for a sound or movie, would you be happy if you had to wait an hour to see or hear it? A new set of tools is now available to solve this problem.

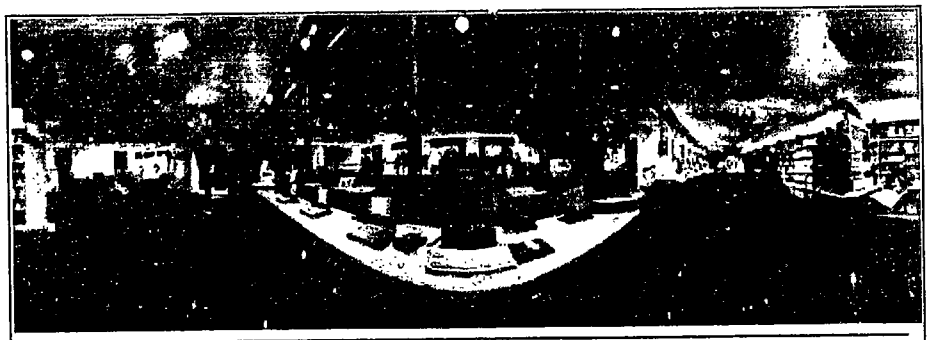

Fig. 7.1 With *QuickTime VR* you can navigate around a room.

Java is a buzz word in Internet circles these days. It was developed by Sun Microsystems and is now being integrated into web browsers such as *Netscape Navigator* and Microsoft's *Internet Explorer*. Java is a programming language, very much like C++. The advantage of Java is that it is interpreted and platform independent. That means you can download pieces of code (or applets as they are called) on the fly, and your computer can interpret and run the applet no matter what platform it was written for. You have the ability to place these applets like images on a web page. Instead of a picture, you could "place" a spreadsheet, animation, game, scrolling banner, or another small program on a web page. No need for a server on the other end of the transaction either. Java "teaches" your web browser how to become a spreadsheet, or other such thing.

Java is cool, but it is not easy like HTML. It is more like C programming language. If you want easy and interactive, then *Shockwave* may be for you. Many of us know about Macromedia's *Director* authoring software. It's been used to produce a lot of CD-ROM programs. It is pretty easy to use and is great for doing animation and interactivity. With *Shockwave*, you can transform your *Director* movies into applets that can be played on web browsers such as *Netscape Navigator.* Up pops a page, and a director movie is downloaded and played right on the web page. *Shockwave* movies can do anything from providing flying logos to sophisticated courseware. The disadvantage? You have to wait for the movie to download.

The Internet will be Real Time

What people really want from the net these days is information in real time. Increasingly, that's exactly what they're getting.

Real Audio is what my students would refer to as, "very cool." You simply click on the audio segment you want and it starts playing in the background. We're not just talking about a beep or quick sound bite, but hour long radio programs and real time baseball simulcasts. A stream of audio is sent to your computer and played as soon as the stream arrives. You don't play the whole file, but bit by

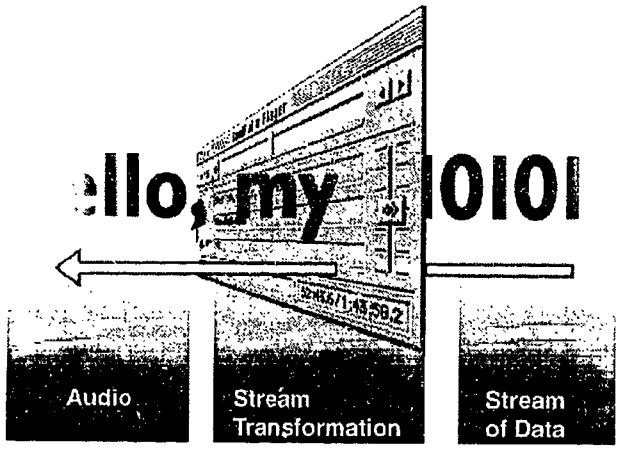

Fig. 7.2 *Real Audio* changes data from an encoded string of ones and zeros to audio as soon as it gets the data, and does not wait for the whole file to download.

bit. The audio is even indexed so you can jump 30 minutes into the program, or 2 hours ahead. And it's good quality (getting better all the time). Because you can play it in the background, you can listen to music as you surf the web. You can get this software for free, but you have to purchase a server if you want to provide your own audio information to the world.

Real time video is not far behind either. Several companies (including Microsoft) have announced software that plays streamed (real time) video in the browser windows. So say good-bye to helper applications and long waits . . . even over a 14.4 modem.

The Internet will be in 3D

One of the most unexploited computing technologies of our time is 3D. We live in 3 dimensions, work in 3 dimensions, but compute in two. There are many reasons for this: the amount of computing power required to manipulate 3D data, the complexity of creating 3D images, and the lack of spatial organization in computing. The Internet promises to change all of this. Three new technologies are becoming popular for representing worlds in 3D.

VRML or Virtual Reality Modeling Language was one of the first technologies to allow people to fly through the Internet. It has not gained the wide scale acceptance everyone originally expected. There just aren't a lot of "worlds" out there. The software has been slow to develop and is not commonly available on all platforms. However, with this software, you can download small files and view them in helper applications. You can embed hypertext links within these worlds so that you can move through a museum, click on a painting, and bring up that painting and a description on your web browser.

Apple has also been busy on the 3D front with two new technologies: *QuickDraw 3D* and *QuickTime VR*. *QuickDraw 3D* is virtually identical in function to VRML. It is intended to be a part of the MacOS (Macintosh Operating System), so you can copy, paste and manipulate 3D models in

programs just like any other graphic (that's right . . . copy a model in *ClarisWorks* and paste it into *Excel*). *QuickTime VR*, on the other hand, is a cross between 3D and movies (just like the name implies). You download a *QuickTime* movie, but then instead of running it like a movie, you pan around a scene. Or, you download a movie of a fashion model in the latest creation, and then "spin" her around to see the outfit from all angles. You can even link from one movie to another, so you can pan around your classroom, and then - click - you can pan around the hall - click - you're in the gym.

The Internet will be about objects

If we have all of these functions, how do we tie them together? I'm all for demos, but if they don't interoperate, I don't need them. This is where objects come into play. Object technology, also known as components, or compound document architectures, have the promise to radically change how we compute. Think about how you would put a newsletter together. How would you start? By typing? Nope. You would start by launching an application—one for word processing, one for graphics or scanning, one for spreadsheets. Even with Works applications you would have to constantly shift from one part of the application to another. This has lead to the creation of huge application suites such as *Microsoft Office*. This is application-centric computing, and it's how we do things today. You

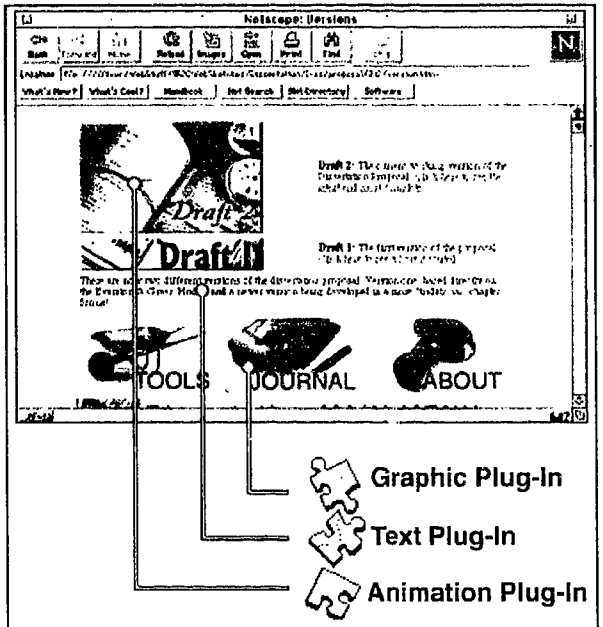

Fig. 7.3 With objects technology, program software is dowloaded along with the file you would like to read.

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have to pick applications (and learn them too) to do parts of documents. In the new component or object paradigm, you work on the document first. There are no applications, only functions you can add to your document.

Imagine this. You open a document. You decide you need to add text, so you drag in a word processing component (or object or applet). Then as you are typing, you decide you need a graphic, so you drag a graphics editor right in the same document. You never change applications, and the interface remains consistent. You only add new functions.

Now, where do these applets come from? They don't have to be on your hard drive. They can come from the Internet. Have you ever downloaded a file and not had the right software to use that file? With software such as Java, *OpenDoc*, and *OLE* you can download the software with the file. When you download Dave's image file format, you also download software I've written to read that file. You can extend the capabilities of your web browser on the fly. No waiting for version 2.0. There are no new versions. You gain functionality as you need it. You concentrate on the document, not on the software that manipulates the document.

Netscape has taken a first step in this process with Plug-Ins. A Plug-in is a piece of software that increases the capabilities of *Netscape Navigator*. *Shockwave*, for example, is a plug-in. *Navigator* doesn't know how to display movies, but the plug-in does. It's like *Legos* where you snap together what you need to build.

Reflections

It is an exciting time to be on the Internet. It also can also be a confusing time. New software appears daily. However, the new object architectures promise to simplify life. Complex and bizarre things will happen, but we can let our computers sort the complexity out for us. We don't have to comb the Internet for the right application. The software will arrive automatically. We won't have to wait for new versions and updates. They'll come on the fly.

Resources

RealAudio:
`http://www.realaudio.com`

Apple: for information on *QuickTime VR, QuickDraw 3D,* and *OpenDoc*
`http://www.apple.com`

Sun Microsystems:
`http://www.sun.com`

Java:
`http://www.javasoft.com/`

VRML:
`http://vag.vrml.org/VRML_FAQ.html`

Chapter Highlights

- ✔ People will download more than text and pictures and will truly interact with the programs.
- ✔ The Internet will be real time. Rather than waiting for huge files to completely download before users can access them, new protocols will allow data to be played as it is received (bit by bit).
- ✔ The Internet will be 3D. Users will be able to navigate the Internet in all three dimensions. These files and environments will act as linked worlds.
- ✔ The use of object frameworks will allow users to concentrate on documents instead of switching between a myriad of programs. These object frameworks will be downloaded from anywhere on the network.

Setting up the Internet for Your School

8

The big word in the trade magazines these days is "intranet." No misspelling. The Internet is the world wide network we've come to love, but intranets use Internet technologies within an organization. An intranet may never connect to the larger world. The Internet provides some great tools for running a business and or school. The software tends to be inexpensive and widely available.

Apple, for example, ships every new Macintosh with TCP/IP, the language of the Internet. Microsoft includes TCP/IP in Windows 95. Why not simply plug in some numbers and make your own intranet? You can download a web server, mail server, FTP server, and gopher server for free (or at least very inexpensive) from the Internet. What happens when you combine TCP/IP with server software without an expensive leased line to the outside world? Intranet. If you do have a connection to the Internet, great. Who said when you put up a web server you have to invite the world to watch?

Why the Library Media Center?

I believe that any Internet or intranet effort should start in the library media center (LMC). The Internet is ultimately about information and organization of information. The LMC is a natural match. Just as the LMC works across curriculum and grade levels, so should the Internet and intranet. Setting up a school intranet provides an opportunity for the whole school and commu-

nity to become involved. It is a great way for the library media specialist to get involved and build bridges to teachers, students, and parents.

Student Help

You will be tempted to have students set up your web site. Don't do it. I don't mean you shouldn't have students help, or even do a good part of the work, but realize that setting up a web site is one of the best "teachable" moments you have. Take advantage of it. Use this opportunity to teach students about information organization, design, and interpersonal skills. All too often, teachers, librarians, and administrators use their own lack of Internet knowledge as an excuse to let students run the whole Internet show.

Constantly urge the students to ask the following questions:

- Who are we doing this page for?
- What does that audience want to achieve with this page?
- What am I learning from this experience?

It's too easy for students to do what they think is right and not consult with the people they are doing it for. This has two negative impacts. It cuts the students off from learning new skills and ideas (e.g. design and negotiation), and it lulls the students into the belief that they are not learning or accomplishing anything new. If you don't challenge the student, the Internet could become as boring as a text book.

Creating a web page is a chance for students to gain valuable "real-world" experience, and is also a chance for school faculty to gain new knowledge. If a student sets up the server, have the student make a presentation about the technical details. Make it the student's responsibility to teach you.

Make it a Community Effort

Schools constantly seek a closer relationship with parents and the larger community. Why should the school web site be any different? Even if you never plan to make the web site available outside the school or district, it's a good time to bring the community into the planning process. Some advantages are obvious, such as asking community members familiar with the Internet and computers to lend a hand. However, why not use this experience as a learning experience for parents and the public? Use what you learn from setting up your site to teach others to do the same. Small businesses and organizations are clamoring for this knowledge. Have students and teachers help businesses in the community set up web sites. It's great real world experience and builds a stronger relationship with community businesses which can lead to other mentoring and shadowing experiences.

Schools have a chance to take the initiative and provide services to the community by creating intranets. Consulting and intranet services can be excellent ways for schools to raise funds. One of my favorite terms today is "web farms." Web farms build and manage multiple web sites in a single location. If a school district gets an Internet connection and sets up a web server, it can place web pages on the server for local businesses and organizations. Such a hosting service can eventually cover the school's cost of getting connected in the first place.

Don't forget to use your local university or community college as a resource. Many programs in library and information science, telecommunications, and/or computer science search for real world experiences for their students. Partner with a class of undergraduate or graduate students to help set up your school's site. Not only will you receive assistance, but the college students will serve as role-models for college-bound, primary, and secondary students.

Never let anyone (consultant, student, college class) consider their work to be finished unless they show the school faculty what they did, and how it was done.

Recommendations

- **Don't use the best computer you have for your web server, or for any Internet service.** Run your web server on one of your slowest computers at first. Keep the biggest and best computers for student and faculty use. You can always move the server to a larger computer as demand increases. Internet software is written to economize computing resources.

- **Pay for support only if you need it.** Many people ask me if they should continue to use free software for web servers or if they should pay for commercial packages. The free shareware available today is incredibly good. The only thing a school should consider paying for is security and support. If you plan to post any confidential information (student records for example), you should consider commercial software that will provide a high-level of security. I wouldn't recommend putting confidential data on the web at this point, but if you do, pay to do it right. The other reason to buy (rather than to use shareware) web server software is to get a telephone number to call if something goes wrong. But if you are the type of person who prefers to rush in, by all means start out with what you can get for free.

- **Beware of liability.** Ultimately, the school is responsible for what is put on the school's web site (either internally or externally). Make sure you understand what information is being provided to your building from the Internet and what information is being provided to the Internet from your building. Also think twice before putting your students' pictures and e-mail addresses on a public web server.

- **Plan, plan, plan.** Before you start, decide why you are setting up the server and who will use it. If you are setting up the server for your faculty, do you really need to show them a huge graphic of your school every time they connect? You want this service to be used . . . not to just look pretty.

- **Think beyond the web.** Once your intranet is in place, you can run any software that works on the Internet itself. Start some listservs for faculty and students. Give students e-mail accounts so they can communicate with each other and with faculty. Run "virtual" classrooms in real-time text environments after hours.

- **Use the intranet for daily work.** Announcements and memos sometimes look better on the screen than in ditto ink. This is a chance to set up real horizontal communication in a district. E-mail makes a great medium for interlibrary loan as well.

- **Get your administration involved early.** Grass roots efforts are to be commended. However, don't be surprised when the administration decides to get involved. Getting administrators on board early will prevent losing turf battles and hard feelings later.

- **Work with an Internet Service Provider.** These are the people that could connect you to the Internet if you wanted. If you don't have the funds for an Internet connection just yet, see if you can get a valid Internet domain and a range of IP numbers to use within your school. This way, if you do ever connect your school networks to the larger Internet, you won't have to change all the IP numbers you used in your intranet.

- **Pay for shareware if you are asked to.** I keep saying this software is free. Some is, but sometimes a small fee is asked. If you use the software, pay the fee. Often you get a huge reward for doing so in terms of valuable advice and good will.

Reflections

If someone offered your school thousands of dollars of software for free (almost), would you turn the offer away? Today's Internet software is there for the taking. It doesn't take a computer genius, or even a new investment in hardware. Chances are your school (or part of your school) is ready for the Internet or an intranet right now. This can be an opportunity for you and your students to

work with the same tools the world's largest organizations are using. Take advantage of this chance to not just try something new, or add a bit of flash, but to make a fundamental contribution to your faculty, students, and community.

Resources

Intranets:
http://www.yahoo.com/Computers_and_Internet/Communications_and_Networking/Intranet/

Web Server:
http://www.yahoo.com/Computers_and_Internet/Internet/World_Wide_Web/HTTP/Servers/

Electronic Mail:
http.//www.yahoo.com/Computers_and_Internet/Software/Electronic_Mail/

Schools on the Web:
http://www.yahoo.com/Regional/Countries/United_States/Education/K_12/

Chapter Highlights

- ✔ Intranets utilize Internet technology for internal organizational use.
- ✔ When a school becomes an Internet information provider, new opportunities will open up for teaching, community outreach, business relationships, and leadership.
- ✔ Building an intranet should be a community effort.

Conclusion

9

The question I am asked most often as I travel the country is "Why the Internet?" Schools want to know why they should invest money and time in this technology. They want to know if it is safe, if it is worth it, or if it is a fad? These are very good questions, and ones that every school should wrestle with before getting connected. I will give you my opinion.

The Internet is a new medium. Like television and radio, it can be misused. The Internet is not completely safe, nor does it come with ready made curricula for a school to plug into. The Internet can be dangerous, and the Internet can be frustrating. The Internet will not change how we teach, how we learn, or how we live. Only we can do that. The Internet is a tool, and it can be an incredibly good one.

If we bring the Internet in our schools as an afterthought, or as a matter of course, we waste our money. Only by including it into a comprehensive plan of change can we make it work. We must use this new medium to increase communications for teachers on a national (and international) scale. We must use the communications potential of this medium to reach out and involve our communities and parents with the process of education.

Television was supposed to change the way we taught. Instead it changed the way our children learn. And yet, television is a passive medium. The Internet once again has the promise to change how we teach and how we learn. We can make our voices, and those of our students, heard worldwide. We can gather information at the speed of light and transport our classrooms to the ends of

the earth. We can go to Antarctica, and we can share what we find with the rest of the world. At the touch of a button, we can make our students good consumers of information, and excellent providers of knowledge.

Our schools, as organizations, are also finding the Internet a means of change. Schools can still help shape the course of the Internet and lead in its use. Schools can use the Internet to become leaders and contributors in their communities. Schools do not have to wait. They can act now.

The Internet will not bring change. People bring change. The Internet is a tool and a medium for schools to realize change. Should every school be connected to the Internet? Yes. Is every school ready? No. What do schools need to do to get ready? They need to educate themselves and experiment with this new educational medium. Don't wait. Make the Internet part of a larger mission—better education.

Good luck!

Annotated ERIC Bibliography

ERIC Documents

Anderson, J. (1995). *An introduction to the Internet. Consumer Guide, Number 14.* Washington, DC.: National Inst. on the Education of At-Risk Students (OERI/ED), 5 pp. (ED 387 143)

This newsletter presents an introduction to the Internet. A definition of the Internet and its three principle uses—electronic mail, USENET newsgroups, and information files—are provided. A discussion on how to explore the Internet includes equipment needs, university Internet accounts, commercial vendors, navigating the Internet through the gopher, the World Wide Web, and software that gives the user a graphical interface. Examples of types of information available on the Internet and a description of six governmental resources are presented. Potential problems, including roadblocks, complications in searching, useless information, and information unsuitable to children are also discussed.

Barron, A. E., & Orwig, G. W. (1995). *New technologies for education: A beginner's guide. Second edition.* Englewood, CO: Libraries Unlimited, Inc. (ED 382 160)

In the midst of an information explosion, it is increasingly important for educators and students to learn how to effectively use new technologies. Technologies impacting education are examined, including school LANs (Local Area Networks), the Internet, and multimedia, and the best use of these technologies in an educational setting is demonstrated. Compact disc, interactive videodisc, digital audio, digitized video, hypermedia, local area networks, telecommunications, and teleconferencing are examined. For each technology, advantages and disad-

vantages, educational applications, and implementation techniques are considered. Contact information about software and hardware vendors, lists of appropriate reference materials, and a glossary of terminology are offered. Chapters have been written to function independently to facilitate in-service workshops, and relevant topics are cross-referenced. Each entry includes a summary of the topic on a camera-ready brochure that can be copied and distributed. Detailed graphics throughout the book illustrate hardware, software, and applications. This guide can be used as a professional resource, a guide for in-service education, or a textbook for multimedia and technology courses at the undergraduate and graduate levels.

Bush, J. E. (1995, June). *Internet publishing: An introduction and discussion of basics.* Paper presented at the annual meeting of the Air & Waste Management Association (88th San Antonio, TX) (ED 384 536)

The internet has been considered the world's largest experiment in chaos. This paper presents a look at Internet applications and some considerations for preparing materials for utilizing these applications. The goal of the paper is to help bring order to the chaos and allow preparation of materials for Internet distribution by informing about the tools and resources used by the Internet community. Discussions include historical perspective, methods of accessing information on the Internet, publishing and distributing files on the Internet, and grades of Internet service. Software applications for retrieving Internet information include: Telnet, FTP, Electronic Mail (e-mail), Network News, Gopher, and World Wide Web. Also discussed are sending e-mail through a reflector; listserves; setting up a server; and finding resources using the search tools Archie, Jughead, and Veronica. A table of suffixes used for converter and compression programs is included.

Eisenberg, M.E. & Johnson, D. (1996). Computer skills for information problem-solving: Learning and teaching technology in context. *ERIC Digest*. Syracuse, NY: ERIC Clearinghouse on Information & Technology. 4 pp. (ED number pending, IR 055 849)

Firek, H., & Purcell, S. (1995). *Cruisin' the information superhighway: Using the Internet to teach English in a transdisciplinary context*. Paper presented at the Annual Spring Conference of the National Council of Teachers of English, Minneapolis, MN. 14 pp. (ED 380 821)

This paper presents information on using the Internet (electronic mail, listservs, world wide web sites, and gopher servers) to teach English in a transdisciplinary context by linking subjects thematically. The paper discusses how the Internet allows students to compose for a real reason and for a real audience. It also discusses listservs and presents addresses and brief descriptions of 12 listservs and 14 e-mail based projects, as well as a "netiquette" primer. The paper briefly describes the world wide web and lists 35 web sites. The paper also briefly describes the Gopher information delivery system and lists 11 gopher sites.

Lankes, R. D. *Building and managing Internet services*. Internet WWW page, at URL: <http://error.syr.edu/~bmis/> (version current at 2 July 1996).

Lankes, R. D. (1994). The Internet model. *Information Searcher, 7*(1), 3-6.

Morgan, N. A. (1996). An introduction to Internet resources for K-12 educators. Part I: Information resources, Update 1996. *ERIC Digest*. Syracuse, NY: ERIC Clearinghouse on Information & Technology. 2 pp. (ED 391 460)

Morgan, N. A. (1996). An introduction to Internet resources for K-12 Educators. Part II: Question answering, listservs, discussion groups, Update 1996. *ERIC Digest*. Syracuse, NY: ERIC Clearinghouse on Information & Technology. 2pp. (ED 391 461)

Recently, Internet resources for the K-12 community have been appearing all over the United States. This updated digest lists various information resources available to K-12 educators over the Internet. Topics covered include: guides to Internet resources; lesson plans; keypals and penpals; acceptable use policies; technology plans for K-12 schools; Internet projects for the classroom; grant information; government information; state education departments; elec-

tronic books; reference resources; library catalogs; world wide web sites; and other resources.

Tennant, R. & Others. (1993). *Crossing the Internet threshold: An instructional handbook.* San Carlos, CA: Library Solutions Press. (ED 366 335)

This handbook is addressed to people who have access to the Internet and want to learn how to use it and to people who want to teach Internet skills to others. It includes the content of a 14-hour training institute and beginning and advanced level exercises, as well as discussion topics, sample overheads and other materials, and a checklist of reminders for trainers. Introductory materials provide a conceptual framework oriented to users. The easiest methods for using the Internet are explained clearly and concisely and will work, in most cases, for everyone who can log on to an Internet-connected computer. Chapters are designed to stand alone so that users can choose which of the resources they wish to pursue. Topics covered are: (1) information needed by beginners, including a glossary, instructions on getting connected, Internet service providers, and a bibliography; (2) electronic mail, including listservs and electronic journals; (3) Internet remote login (Telnet) and Internet file transfer protocol (FTP); and (4) fact sheets on other resources, such as Archie,Gopher, Hytelnet, Usenet News, and Wide Area Information Servers (WAIS). Three graphics showing the extent and organization of the network are appended.

Periodicals

Boldt, D. J. & Others. (1995, May-June). The Internet: A curriculum warehouse for social studies teachers. *Social Studies, 86*(3),105-12. (EJ 510 826)

Provides an introduction to the Internet with special focus on access issues, electronic communication, and tools for making the Internet easier to use. Identifies selected Internet resources appropriate for social studies. Includes three lesson plan ideas and five tables listing Internet resources.

Collins, M. P. (1993, January). Computer networks and networking: A primer. *Interpersonal Computing and Technology Journal, 1*(1). (EJ 485 258)

Provides a basic introduction to computer networks and networking terminology. Topics addressed include modems; the Internet; TCP/IP (Transmission Control Protocol/Internet Protocol); transmission lines; Internet Protocol numbers; network traffic; Fidonet; file transfer protocol (FTP); TELNET; electronic mail; discussion groups; LISTSERV; USENET; and guides to further information.

Glossary of Internet Terms. (1995). *Microcomputers for information management, 12*(1-2),133-44. (EJ 510 354)

Provides definitions for 71 terms related to the Internet, including Archie, bulletin board system, cyberspace, e-mail (electronic mail), file transfer protocol, gopher, hypertext, integrated services digital network, local area network, listserv, modem, packet switching, server, telnet, UNIX, WAIS (wide area information servers), and World Wide Web.

How to Order ERIC Documents

Individual copies of ERIC documents are available in either microfiche or paper copy from the ERIC Document Reproduction Service (EDRS), 7420 Fullerton Road, Suite 110, Springfield, VA 22153-2852, some are available only in microfiche. Information needed for ordering includes the ED number, the number of pages, the number of copies wanted, the unit price, and the total unit cost. Sales tax should be included on orders from Maryland, Virginia, and Washington, DC.

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The prices of paper copy are based on units of 25 pages (and/or any fraction thereof) at the rate of $3.97 per unit. The prices for microfiche are based on the number of microfiche for each document. The price for one to five microfiche for a single document is $1.34 (up to 480 pages).

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WWW sites

Professor Gigabyte's world wide web primer. Internet WWW page, at URL: <http://www.dana.edu/~dwarman/primer.htm> (version current at June 1996).

Welcome to TCI-METS Internet primer. Internet WWW page, at URL: <http://www.tcimet.net/tutor/tutprime.htm> (version current at June 1996).

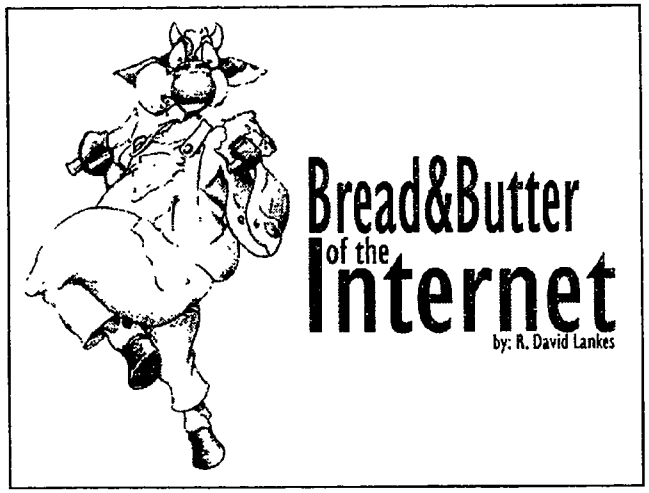
The Bread and Butter of the Internet

Presentation Packet: Overhead Transparency Masters and Presentation Notes

The "Presentation Packet" that follows consists of a set of overhead transparency masters and accompanying presentation notes. The topics covered are the same as those covered in this book. I encourage you to use these materials to teach the "bread and butter of the Internet" to teachers, administrators, and others in your school and in your community.

Bread & Butter of the Internet

by R. David Lankes

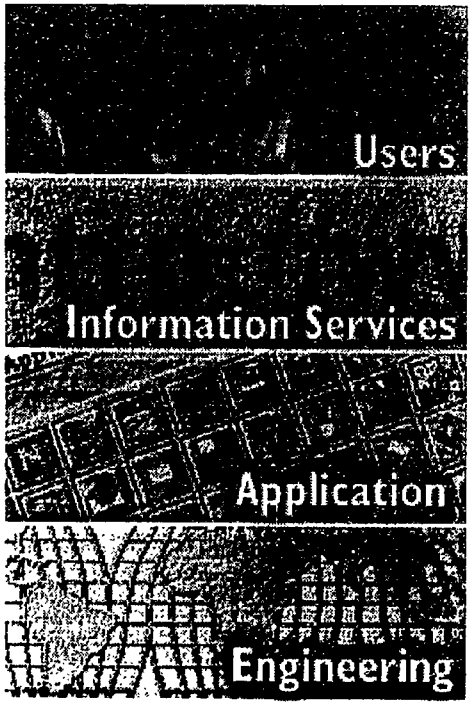


This presentation is about the very basics of the Internet—the bread and butter of everyday operating on the "net." It covers not only the tools of the Internet, but also how they inter-relate. It also gives you some basics of connecting to the "network of networks."

This presentation is geared towards schools and educators, but the technology and ideas apply to a wide variety of settings.

The Four Layer Internet Model

- Engineering
- Application
- Information Services
- Use



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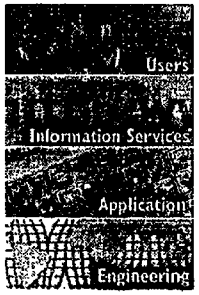
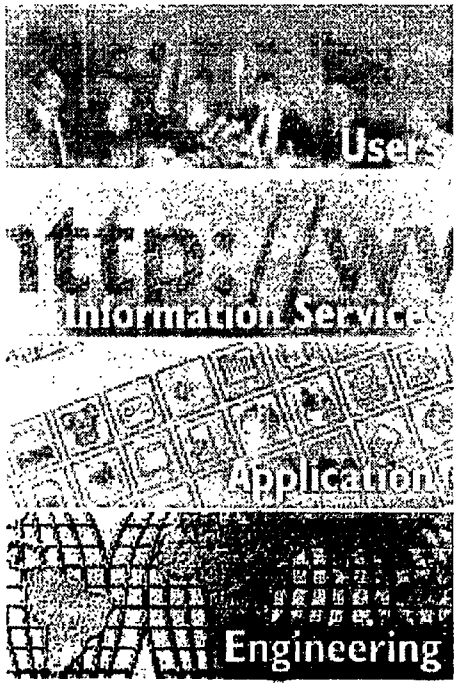


The Internet can be divided into four layers. Each layer has special issues and special vocabulary associated with it.

The "Engineering" layer addresses the hardware and software that allow the most basic type of communications between computers. The "Applications" layer addresses the software that can both gather information and share information. In the "Services" layer, software is joined with information. The "Uses" Internet layer deals with issues encountered by end users when they seek to gather or apply Internet information. This presentation concentrates only on the Engineering and Application layers.

Engineering

- Hardware and Software that enable information transfer
  - The road
- Transparent
- Engineering level



Engineering

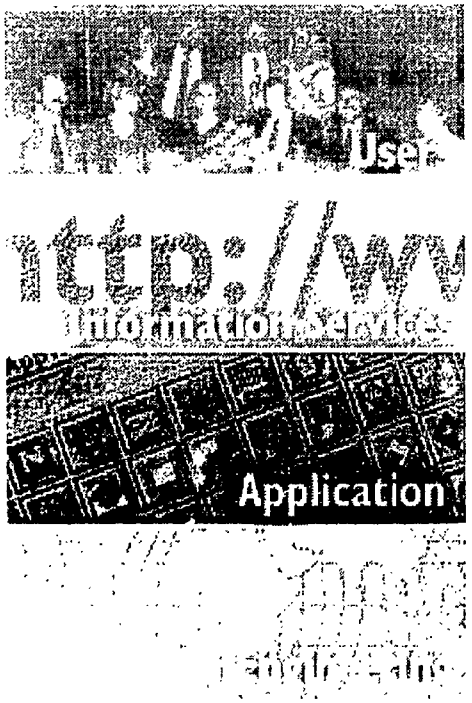
- Hardware and Software that enable information transfer
  - The road
- Transparent
- Engineering level

The Engineering layer is the most basic and "technological" layer of the Internet. It provides the basic infrastructure of the Internet. It is everything that is (or at least should be) transparent to the end-user. In fact you can identify problems in the Engineering layer by how visible they are to the end user. If a user gets an error message like "unable to make socket connection" it is an engineering problem.

The Engineering layer covers things like routers, wires, protocols and such. In the Information Superhighway metaphor, this layer makes up the roadway. The Engineering layer does not have information or content, only a method for moving bits from one computer to another computer.

Applications

- Software that provides a face to the net
  - The cars on the road
- Gathers and provides information
  - Clients get information
  - Servers put information
- Technical Training



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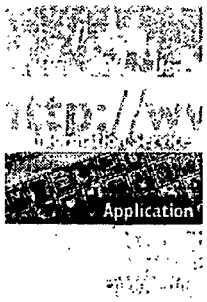


The "Applications" layer has two parts—the computer you are using to gather information and the computer on the other end that is providing the information.

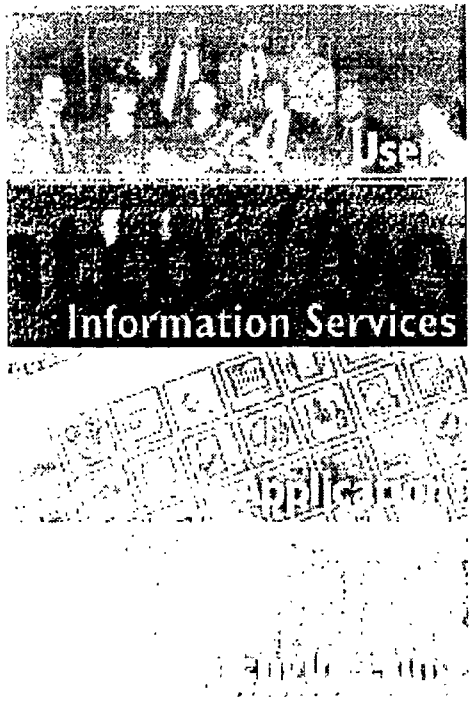
Web browsers such as *Netscape* and *Internet Explorer* are part of this software only layer. Teaching people how to use the software of the Internet is an Application layer activity.

The software used by organizations to provide information to the end-user is also part of this layer. Web servers and FTP servers are examples of these applications. The same computer science issues involved in the creation of browsers (or clients as we will call them) are present in the creation of servers. While older software (like telnet) provides information that is very visible, current systems like the Web conceal the server.

Following the Information Superhighway metaphor, Applications are the vehicles on the road (the Engineering layer). These cars and such have nothing in them (information) and need some direction to know where to go.

Information Services

- Adds the information to the applications
  - Who's in the car and what's the car carrying
- Organizations and Procedures
- Information systems
  - traditionally an MIS function (data processing)
- The sites on the net



Information Services

- Adds the information to the applications
  - Who's in the car and what's the car carrying
- Organizations and Procedures
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- The sites on the net

The "Information Services" layer is what the Internet is all about. This layer accounts for the information on the Internet . . .the content. This layer deals with issues such as: how do organizations provide information . . . in what form . . . to what audience . . . with what consequences?

Every time you see a URL, you are dealing with the Information Services layer. Anytime a school puts up a web site (providing information to the world or the district) it is working in the Information Services layer.

To continue the Information Superhighway metaphor, this is the "cargo" the cars are carrying.

Use

- Matching information/ application and information need
  - Why the cars are on the road
- Context specific
- Curriculum, Strategic Planning, Reference
- Issues

Use

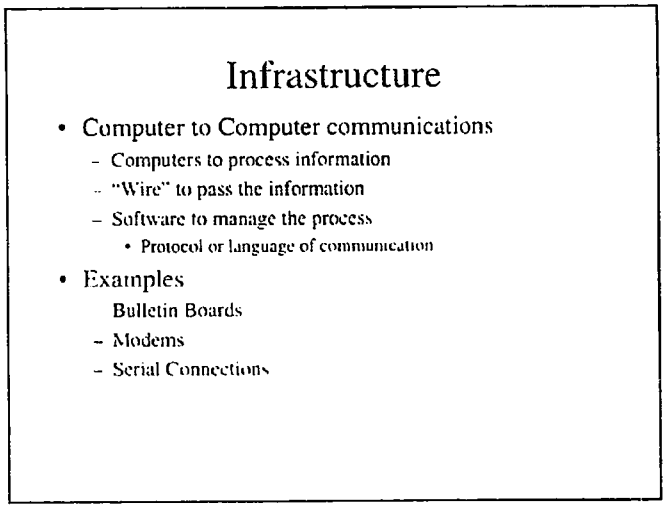
- Matching information/ application and information need
  - Why the cars are on the road
- Context specific
- Curriculum, Strategic Planning, Reference
- Issues

The "Use" layer is where people gather information for their specific information needs and apply the information to their contexts. For comparison, Engineering layer questions tend to have concrete answers (how many bits can be transmitted on a wire, what does TCP/IP stand for, etc.), while User concerns tend to be vague and complex. User concerns may include, "How do I find user information when surfing the net? What is appropriate use? What is the best source of information on a given topic?" These take a different type of answer.

Schools seeking to use Internet information in the classroom are involved in this layer (quality of information on the net, appropriate use, etc.). In the highway metaphor, the Use layer talks about why the vehicles are on the road, where they're going, why, and who should care.

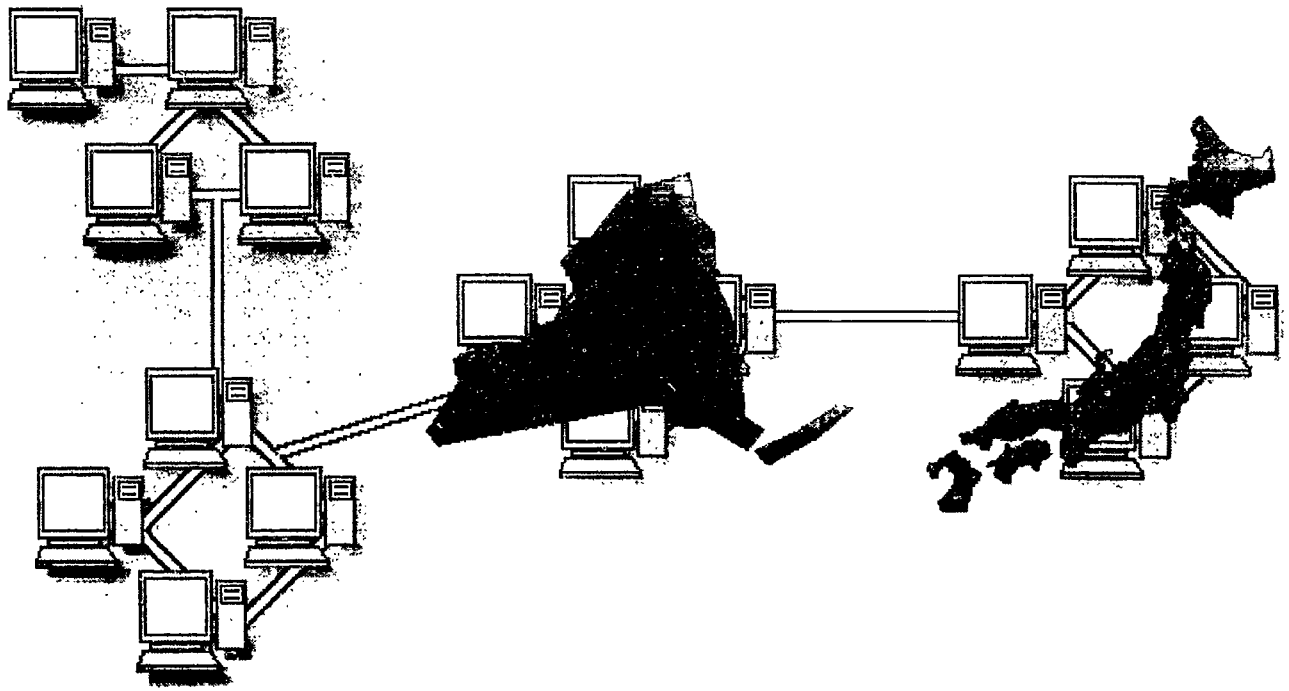
Infrastructure

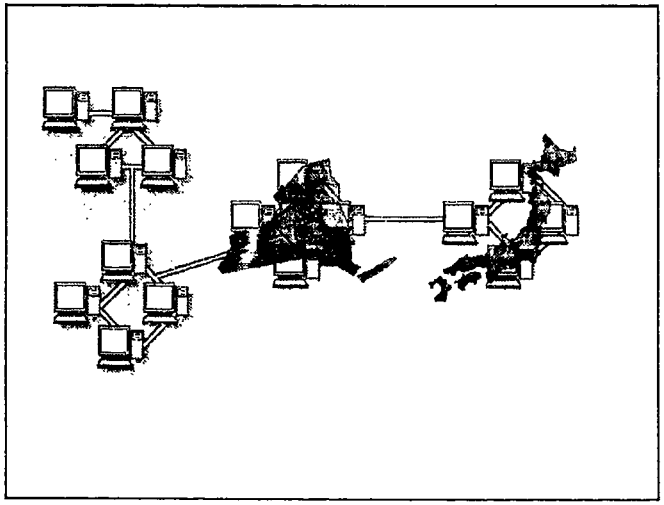
- Computer to Computer communications
  - Computers to process information
  - "Wire" to pass the information
  - Software to manage the process
    - Protocol or language of communication
- Examples
  - Bulletin Boards
  - Modems
  - Serial Connections



Let us take a closer look at the Infrastructure of the Internet. For computers to share information, there must be at least two computers, a wire (medium) to pass information, and software protocol to allow the two computers to speak to each other.

Examples of infrastructure components include bulletin board software, modems, and serial connections where you literally plug one computer into another for communications.





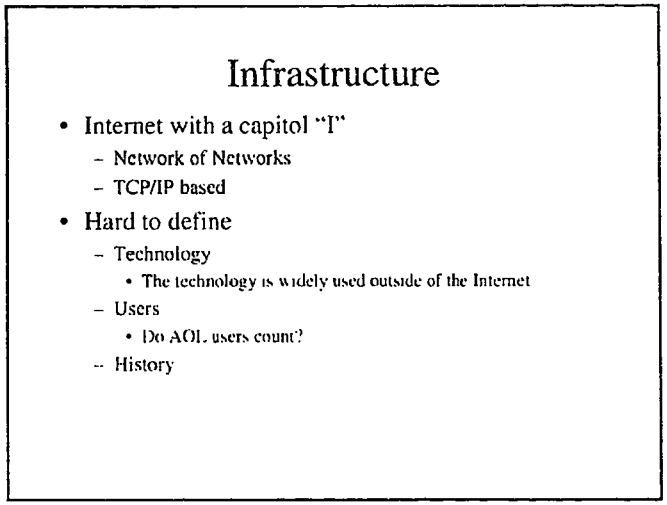
If we can hook up two computers we can hook up more than two. We call this hook-up a network or local area network. Networking computers allows us to share files or devices (e.g. printers) among several computers.

If we can connect computers to form a network, why not connect networks together? Connecting two networks is called "internetworking" with a small "i." To do this we need hardware to communicate with (routers and bridges can be seen as specialty computers for communicating between networks), a medium (copper, fiber, infrared, etc.), and a protocol (such as AppleTalk, Novell's IPX or TCP/IP). If we can connect networks together, what restricts us from interconnecting networks that are a great distance apart? Nothing. The phone company can provide us with virtual wires to cover any distance. So we can connect networks from building to building, city to city, state to state or even country to country.

This is the notion behind the Internet. A network of networks all speaking a common language (TCP/IP).

Infrastructure

- Internet with a capitol "I"
  - Network of Networks
  - TCP/IP based
- Hard to define
  - Technology
    - The technology is widely used outside of the Internet
  - Users
    - Do AOL users count?
  - History



So we see that by scaling up the internet notion we come to the Internet with a capitol "I." The Internet is a network of networks speaking a common language (TCP/IP). However, it is difficult to specifically define the Internet. The Internet can be defined as a set of technologies or a population of users. But it can also be defined by its history.

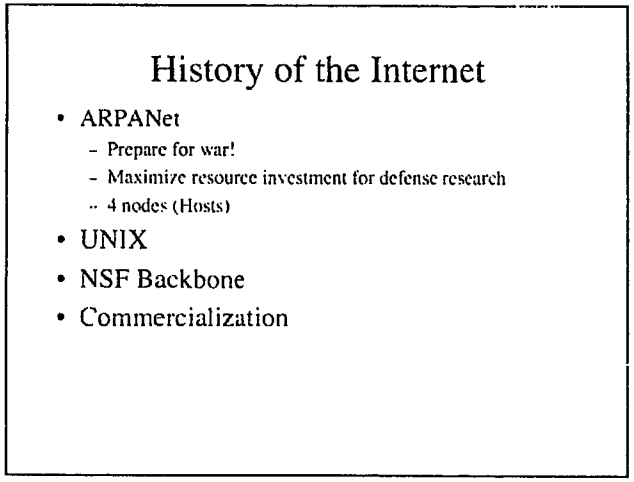
A technology definition is problematic because most of the "Internet technology" does not connect to what we commonly think of as the Internet at all. Many large corporations use TCP/IP networks internally and never connect to the outside world. So the technology of the Internet does not provide an adequate definition.

A users definition is also difficult to understand. Many Internet users don't know they're on the Internet at all. Many access Internet information through non-Internet technology via commercial online services like America Online (though this distinction is quickly changing). No one really knows how many Internet users there are. Estimates vary from 9 million to 80 million users.

This presentation uses an historical approach to define the Internet.

History of the Internet

- ARPANet
  - Prepare for war!
  - Maximize resource investment for defense research
  - 4 nodes (Hosts)
- UNIX
- NSF Backbone
- Commercialization



The Internet is a world wide network of networks. It grew out of a wide area network called the ARPANet (the Advanced Research Program Administration), established by the U. S. Department of Defense in the 1960s, to allow communications to be "routed" over a system of networks. Why not just use telephones? Well, put yourself in the cold war mindset. If a nuclear bomb takes out Chicago (a major telephone hub for AT&T) communications are effectively cut off between one half of the country and the other. ARPANet utilized a system of packets and routers. Messages were broken down into pieces, and each piece was sent on its merry way towards it's destination. If a packet didn't make it in a specified time, it could be resent, using a totally different route.

The UNIX operating system and TCP/IP (the language of the Internet) was used on a wide variety of computers, was freely available, and its most popular version (developed by the University of California, Berkeley) included everything one needed to connect to the ARPANet.

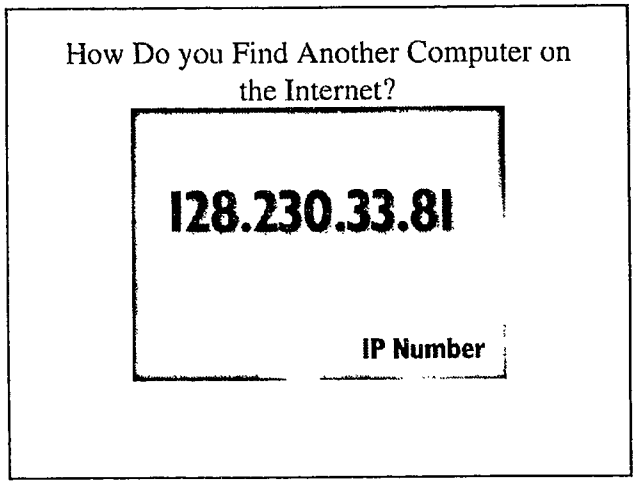
When ARPA decided to get out of the networking business, the National Science Foundation (NSF) took over. NSF ran the backbone of the Internet . . . .a high capacity network that moved information between smaller regional networks.

In the 1990s, NSF got out of the networking business and let private enterprise route information from network to network. This privatization removed all restrictions on for-profit information on the Internet.

How Do you Find Another Computer on the Internet?

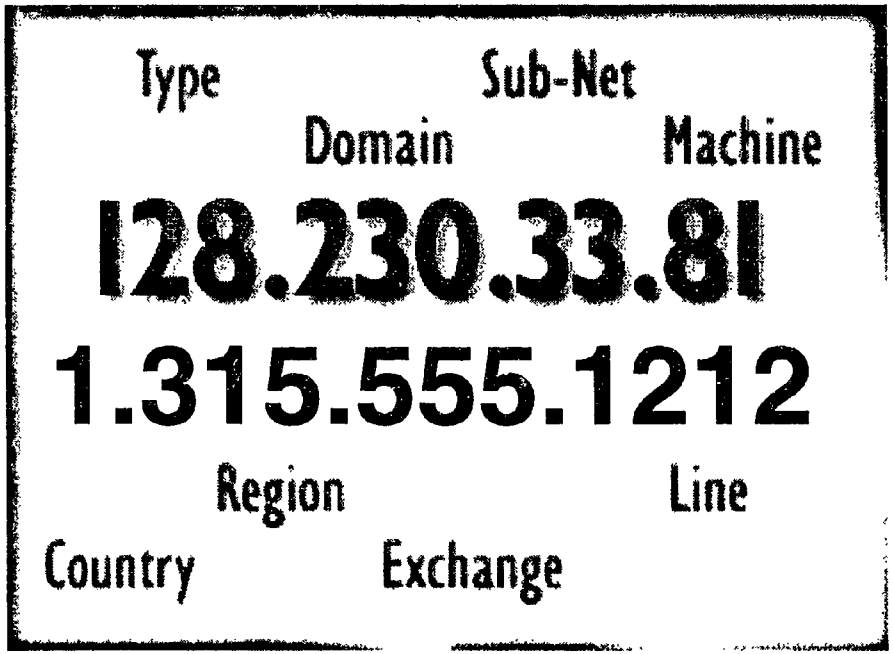
128.230.33.81

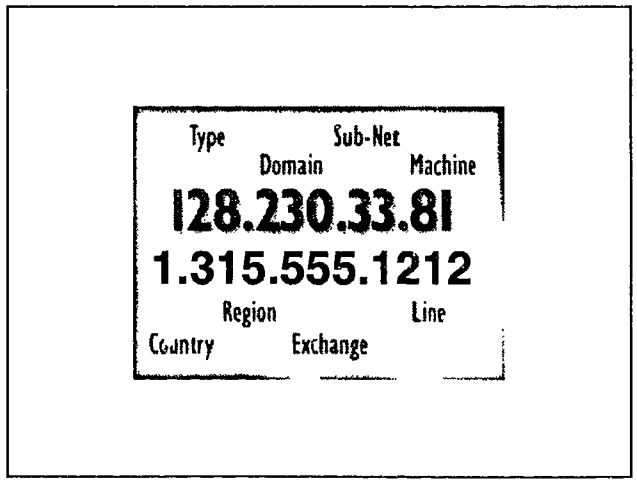
IP Number



How does information find its way from one computer to another computer? You give every computer on the network an address. The addressing scheme for the Internet is controlled by the Internet's common language or protocol, TCP/IP (Transmission Control Protocol/Internet Protocol). The IP, or TCP/IP is the method of assigning unique numbers to computers, called IP numbers or IP addresses.

This transparency shows an IP number. IP is a hierarchical system. It is a series of numbers (called octets) broken into four parts. The first set of numbers can range from 0-255. This set identifies the most general type of network. In this case, the 128 indicates that this system is an educational system. The next set of numbers (230) identifies the specific institution the computer belongs to. The third set of numbers (33) identifies the subnet. The last set (81) identifies an actual computer. This may seem complicated, but it makes finding computers much easier.

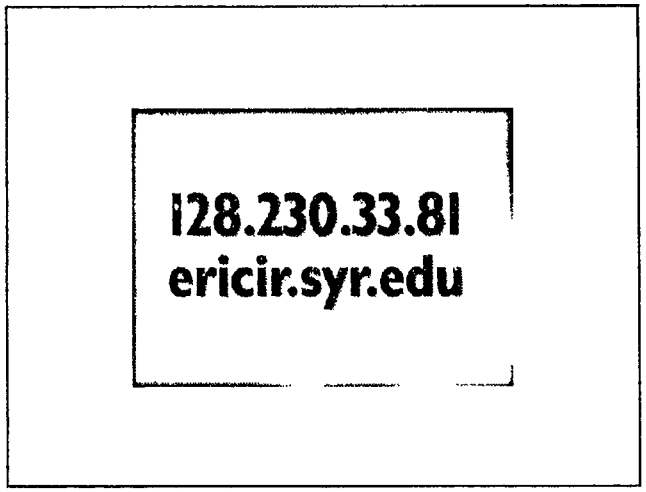

Type
Sub-Net
Domain
Machine
128.230.33.81
1.315.555.1212
Region
Line
Country
Exchange



If an IP number seems complicated to you, compare it to a telephone number. There are 11 digits in a U.S. phone number. You need to dial 11 numbers to reach a U.S. phone number long distance. The first number, (1), is the long distance access code. The next three numbers, (315), the area code, designates the region you want to call. The next number, (555), designates the telephone exchange, and the last four numbers, (1212), identify the actual phone you wish to reach.

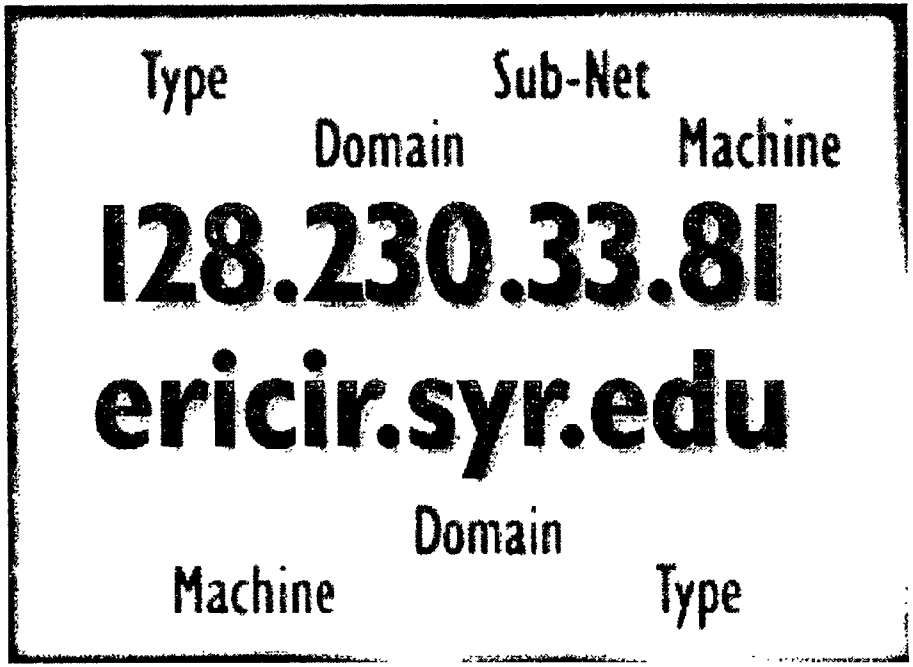
When you compare these two addressing schemes, they are remarkably similar. They are both hierarchical systems designated by a set of numbers.

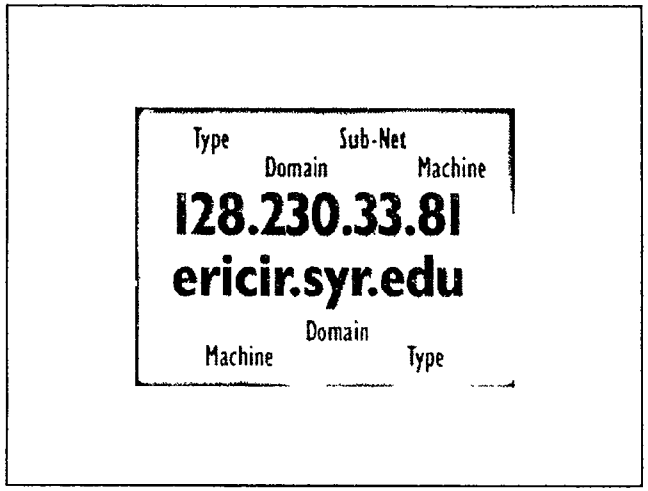
128.230.33.81
ericir.syr.edu



Because computers are better at remembering numbers than most humans, the IP protocol allows for something called IP aliasing. This allows us to assign a name to a number (through the Domain Name System or DNS protocol). So in this transparency, the 128.230.33.81 is aliased to (the same thing as) ericir.syr.edu. These aliases are also broken up into a hierarchical system (though it is reversed from the numerical identifier). Instead of going from general to specific in the numerical version, the IP name goes from specific to general in the alphabetical version. The letters 'ericir' identify the specific computer. The subnet is not shown here, but could be. The next set of letters identifies the institution that houses the computer ("syr" stands for Syracuse University). The letters "edu" identify that this address comes from an educational institution.

So while there may be other computers named "ericir," there can be no other computers with the same name at the same institution. There could be an ericir.syr.com, or an ericir.syr.org, but there cannot be another ericir.syr.edu.

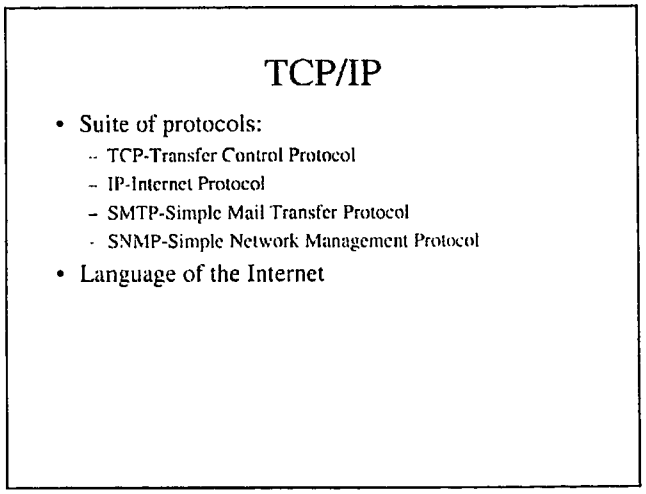

Type
Sub-Net
Domain
Machine
128.230.33.81
ericir.syr.edu
Domain
Machine
Type



This transparency indicates the parts of the IP address. Note the reversal between the IP number and the IP name.

TCP/IP

- Suite of protocols:
  - TCP-Transfer Control Protocol
  - IP-Internet Protocol
  - SMTP-Simple Mail Transfer Protocol
  - SNMP-Simple Network Management Protocol
- Language of the Internet



TCP/IP is a shorthand for the protocols that control information on the Internet. Transmission Control Protocol is a way of sending information between computers. Internet Protocol tells the parts of the message where they're going, and how to put the parts into the right order once they get there.

TCP/IP is a packet switching protocol. That means it takes the information (e.g. sound, text file) we want to send from one place to another and breaks it up into small pieces (called datagrams or packets) and sends this information on the Internet. Why packets? Packets can be re-routed (if one telephone line goes down, the packet can find another way to go) and packets allow us to multiplex. Multiplexing allows packets from different sources to be mixed. Multiple messages on the same line. . . multiplexing.

Basics of Connecting

- Modem
  - SLIP/PPP/Text
- ISDN
- LAN Dial
- Direct Connection
  - Leased Line Services
    - 19kb-T3
- Bridges, Routers and Servers OH MY!

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  - SLIP/PPP/Text
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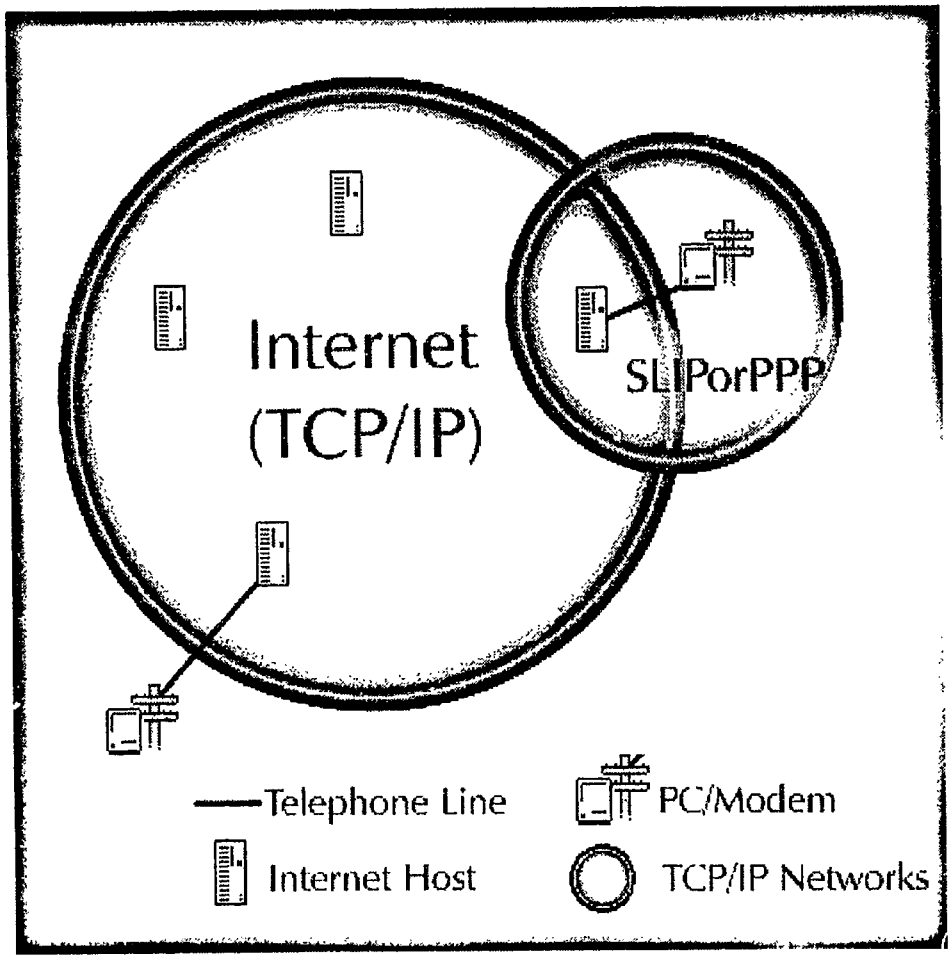
How do we actually connect computers to the Internet? One way we can connect computers is with a modem and the telephone company (an analog connection). We need to use special software to create this type of connection (SLIP or PPP).

Integrated Systems Digital Network, or ISDN, (a digital connection) is a faster way of making a connection from one computer to another.

Another way to connect computers is to place a shared modem on a LAN (Local Area Network). When any computer on the LAN wants Internet access, this high-speed modem (LAN dial) connects to the remote computer. If more than one computer on the LAN wants access, the LAN Modem multiplexes the connection.

If you have a relatively high demand for using the Internet, and you don't want to wait for dialing, you can get a dedicated line from the telephone company. This type of connection maintains a constant connection to a remote Internet host. It's like picking up the phone and never hanging up. These dedicated connections are called leased lines (because you have to lease them from a telecommunication company). They come in a variety of bandwidths from 19 kilobits per second to T3 (several hundred megabits per second). To use these dedicated lines, you need special communications hardware called routers.


Internet
(TCP/IP)
SLIPorPPP
Telephone Line
PC/Modem
Internet Host
TCP/IP Networks

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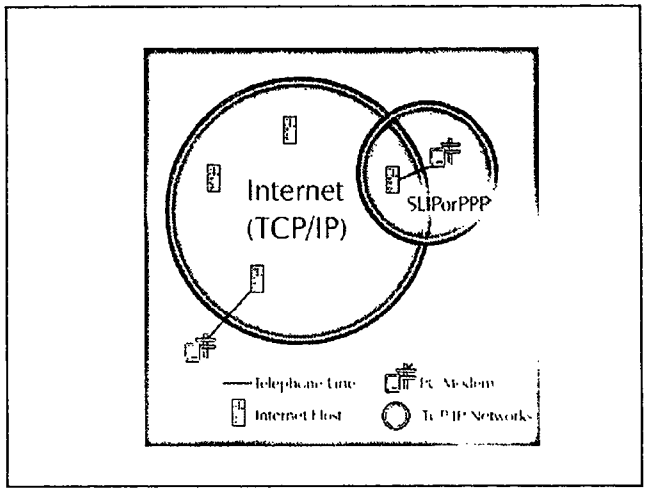
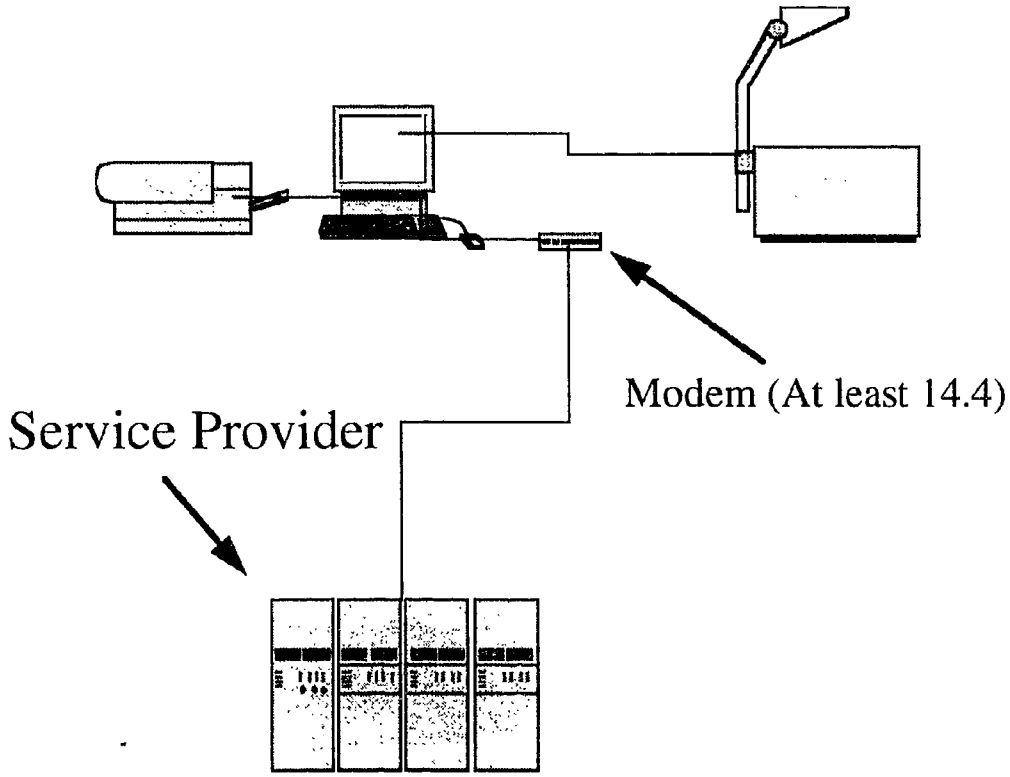
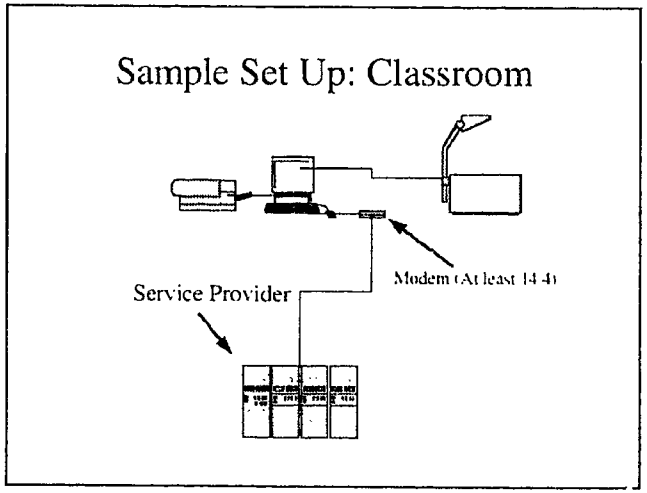


The computer you are using may be on the Internet or it may only be using another computer as a proxy to the Internet. To be on the Internet, the computer must "speak" TCP/IP. When TCP/IP was first developed, the thought of being on the internet over modems seemed absurd (remember when a, 300 baud modem was high tech?). So, the Internet was never developed for modem-to-modem communications. Two software programs have been developed to solve this problem . . . Serial Line Internet Protocol (SLIP) and Point to Point Protocol (PPP). You must use one of these software programs if you use a modem on the Internet. If you are not using SLIP or PPP, but instead are using a terminal communications package like *Kermit, ZTerm* or *Procomm,* you are not on the Internet. You have a text based or terminal connection.

Why do you care? For one thing, without SLIP or PPP you can't use the new graphical Web browsers like *Netscape Navigator* or *Internet Explorer*. For another thing, the kind of connection you use will dictate where the files you retrieve on the Internet will go. A file downloaded using SLIP or PPP comes directly to your computer. You cannot download a file directly to your computer from a remote computer using a terminal connection like *Kermit, ZTerm* or *Procomm*. All you will see on your computer is a virtual window on the remote computer. The Internet thinks you are on the remote computer. If you download a file using a terminal connection, it downloads to the remote computer.

Sample Set Up: Classroom





Now let's talk about what kind of connection you might have in your school. Let's say you just want to connect one classroom to the Internet. If you want to be able to print out any information you find on the Internet, you will have to hook up the Internet computer to a printer. If you want to show this information to the whole class, you might want to hook your computer up to a projection system. The Internet computer will need a modem to call to an Internet service provider. You need at least a 14.4 baud modem.

The Internet Service Provider (or ISP) will charge a fee to use their Internet connection. They'll give you the software you need to connect, a phone number for the modem to call, and they will assign your computer an IP number.

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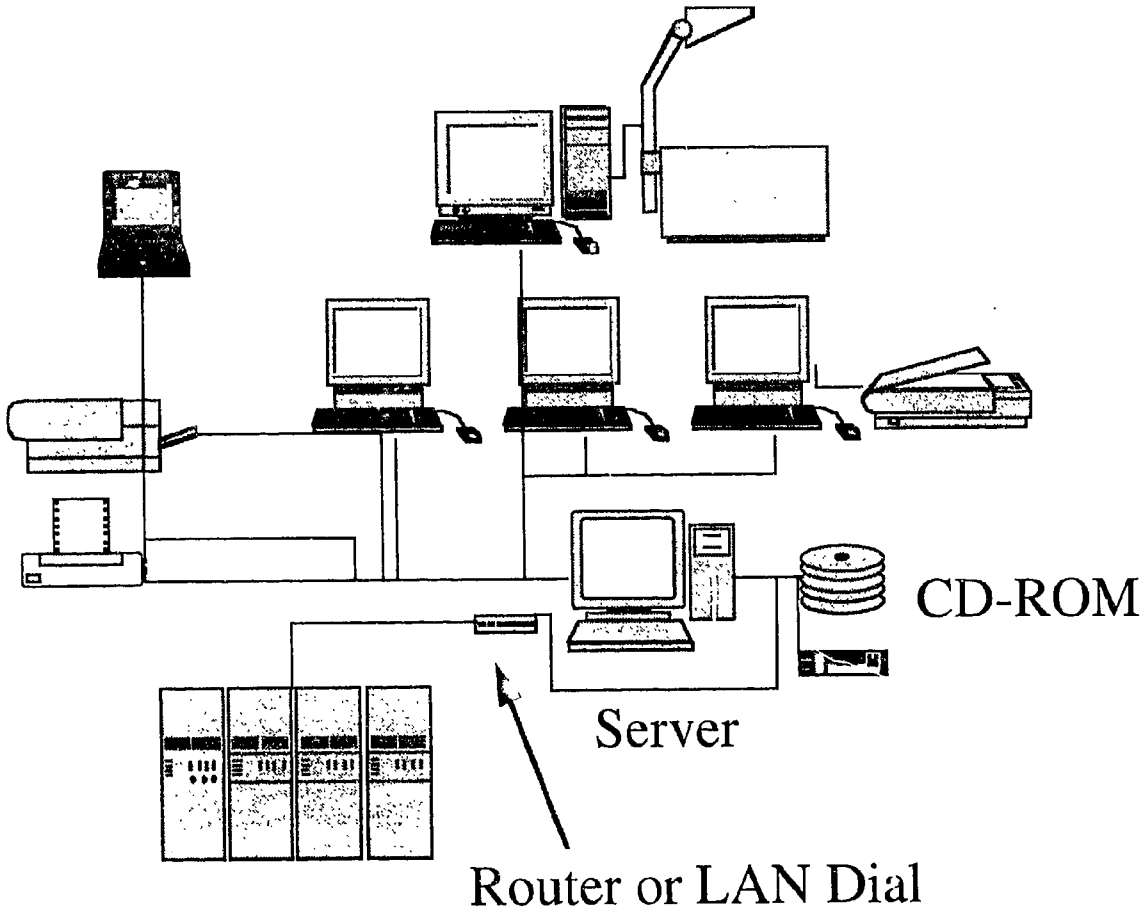
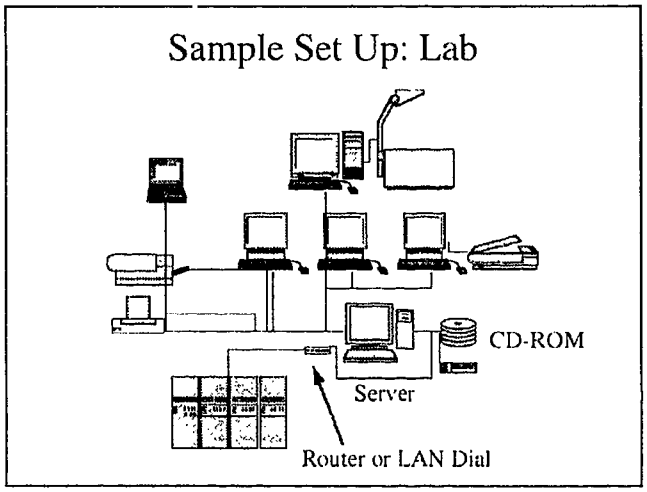
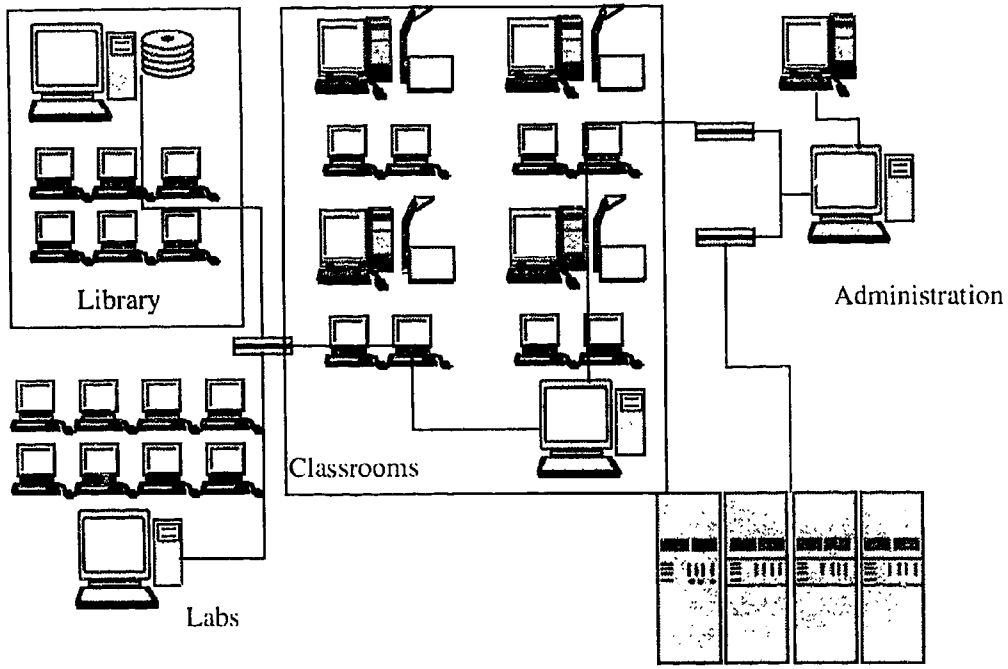
Sample Set Up: Lab

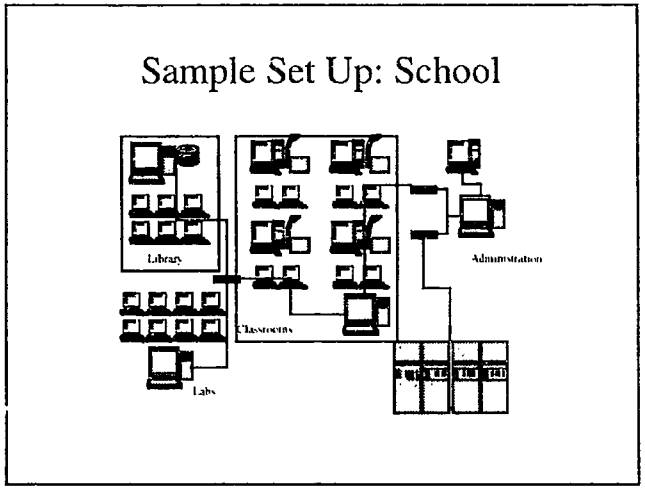




This transparency shows how you might hook up a computer lab (or a LAN) to the Internet. The illustration shows a LAN with a file server, printers, and scanners. In this case, the arrow shows where we've hooked up the connection point to the file server. This connection can be a router for a leased line, or a LAN dial. LAN dials are high-speed modems that allow multiple computers on the network.

Sample Set Up: School





To connect an entire school, you need only one point of access to the Internet. As long as the school LANs are interconnected, one Internet router will give the entire building Internet access. Remember that the Internet is just a network of networks. It's built around the idea of linking LANs together.

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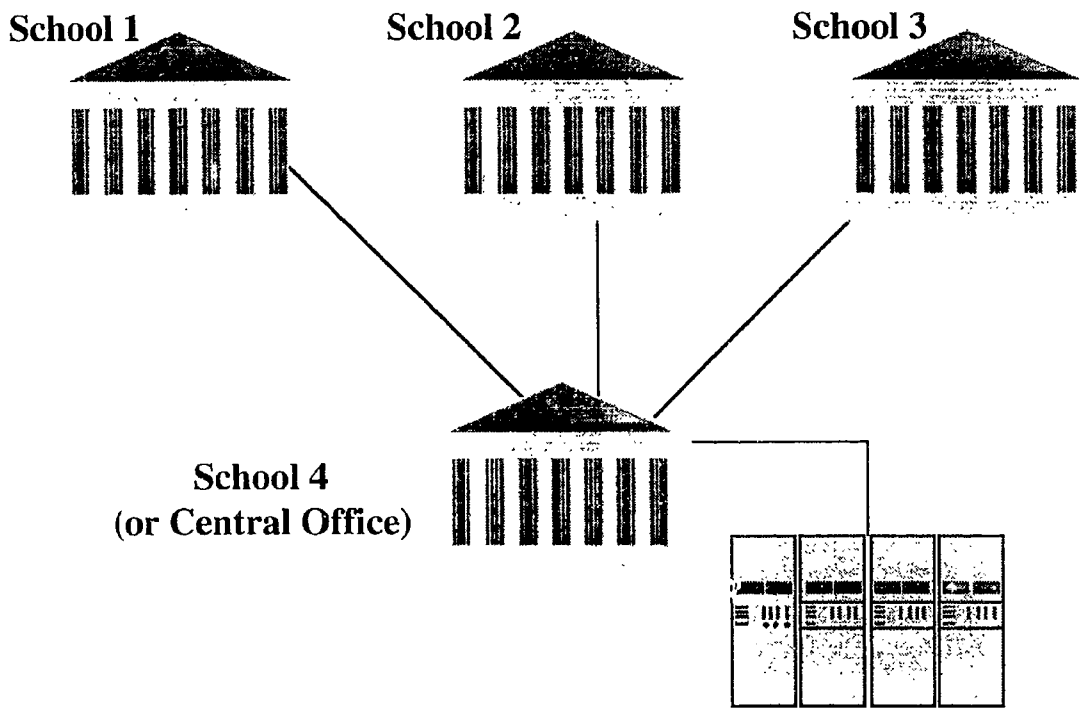
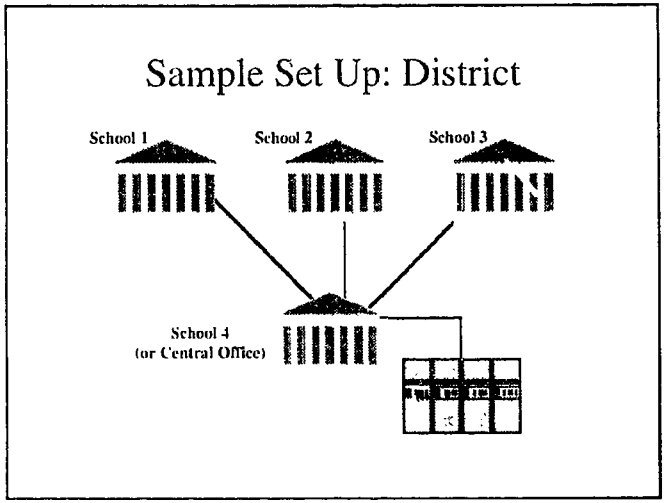
Sample Set Up: District





We can extend this idea of linking networks together to an entire school district. If each building is networked, you can connect the building networks to form a Metropolitan Area Network (MAN) with leased lines, or with cable the district installs (fiber optics for example). You can then simply connect one of the buildings to the Internet.

You can do this in stages (first the high school, then the elementary school, etc.). You can also connect other buildings such as the public library or local businesses to this network.

Who Connects Me?

- Commercial Network:
  - AOL, CompuServe, Prodigy, Delphi
- Network Access Provider (Internet Service Providers)
- Phone Companies
  - AT&T's WorldNet Service
  - Network MCI
- Cable Companies

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To get started, you can connect to the Internet through a commercial network like America Online or CompuServe. These are great services for individual accounts, but it is not theway to connect your entire school or district to the Internet.

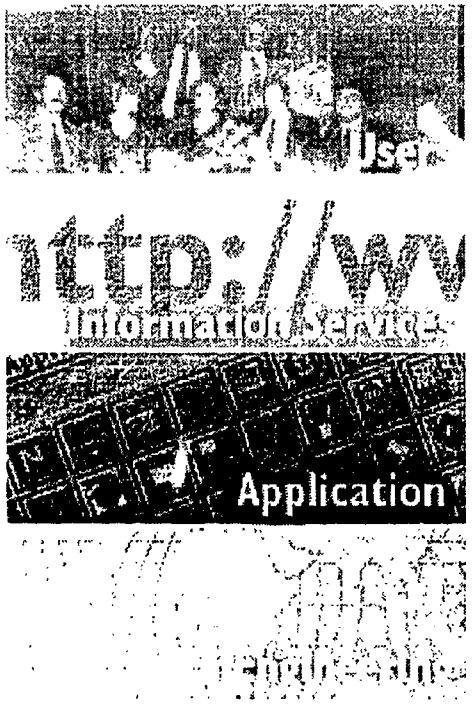
To connect your entire school or district to the Internet, you will need to hook up with an established network access provider. Internet Service Providers (or ISP's) operate much like telephone companies (in fact, many are telephone companies). Internet service providers are already on the Internet, and they allow you to link to their connections (usually for a fee). ISP's vary from region to region, so you'll need to do a little research to find out the best one in your area. In most cases, ISPs will help you set up your connection. You may need to pay the ISP for Internet access, and a telephone company for a line between your school and the ISP.

Large telephone companies are getting into the Internet game. AT&T and MCI have already announced plans to provide Internet access. Changes in federal law allow these companies to give schools substantial discounts, so they are worth checking out.

Cable companies have begun testing cable TV as a way of connecting schools to the Internet.

Applications

- Client/Server Model
- E-Mail
- FTP
- Telnet
- Netnews
- Gopher
- World Wide Web



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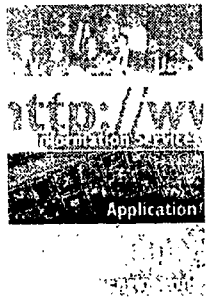

Now that we have an idea of how to connect computers to the Internet, let's turn our attention to what to do with this connection. When we talk about getting information or "surfing the net," we are talking about applications.

First we'll talk about how all Internet applications inter-relate. Then we'll talk about some of the most popular and useful Internet applications.

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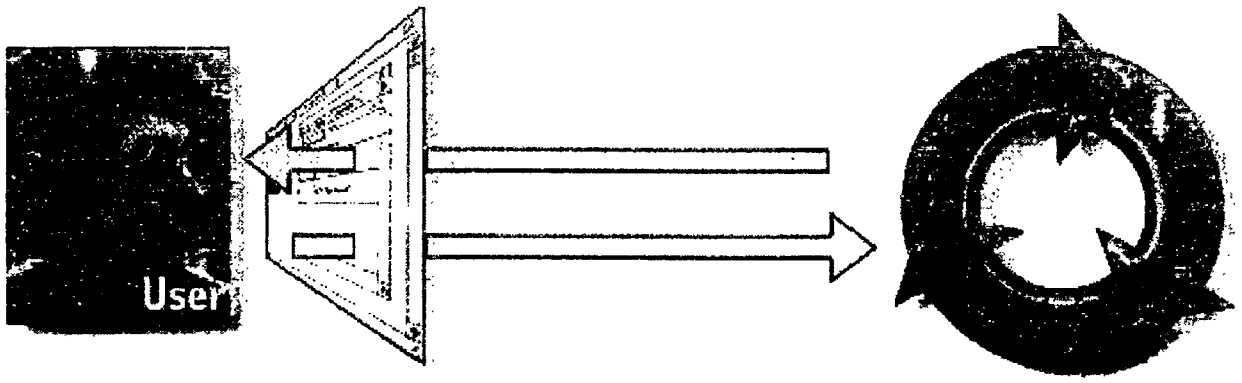
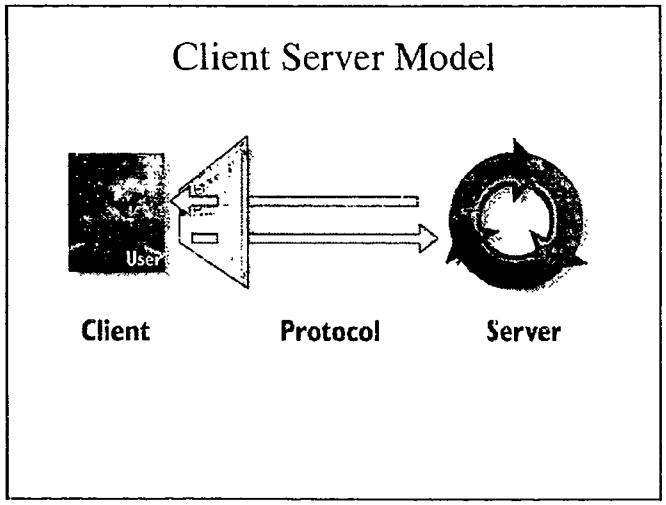
Client Server Model



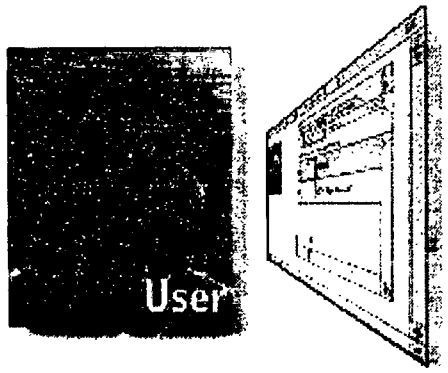
Client **Protocol** **Server**



Most Internet applications use the client/server paradigm. We can use this model to help you understand how applications interrelate.

The Client

- Handles user input
  - Old: Dumb Terminal (Telnet)
  - New: Multimedia PC (WWW)
- Utilizes local computing resources
  - Mouse
  - CD-ROM
  - Graphics
  - Applications



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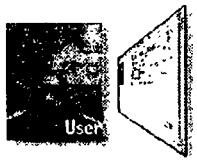


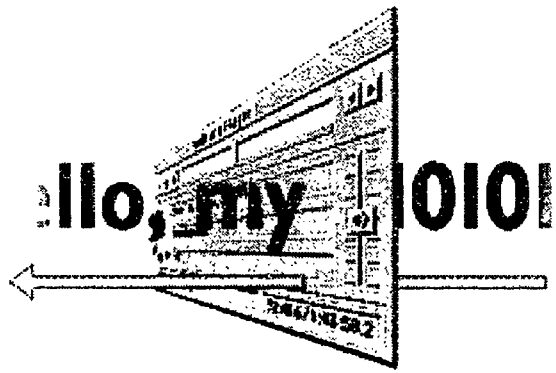
In the beginning of computing, powerful computers called mainframes stored almost all of the computing power, interface, and resources. Mainframes used terminals to take all the actions and requests from users. Terminals were little more than screens and keyboards—the mainframe did all the actual computer processing.

Modern personal computers are capable of much more than just taking in keyboard data and sending it off to a mainframe. Personal computers do most of the computer processing themselves and use the network only when they cannot accomplish a task alone.

Clients are platform specific. That is, they are written for and represent the look and feel of a given operating system (it looks like a Mac, or it works like a Windows application). The user has control over the look of the information—color for the background, the size of windows, etc.

The Protocol

- Creates a common thread between client and server
- Highly structured and standardized
  - Z39.50
  - Gopher
  - HTTP



The Protocol

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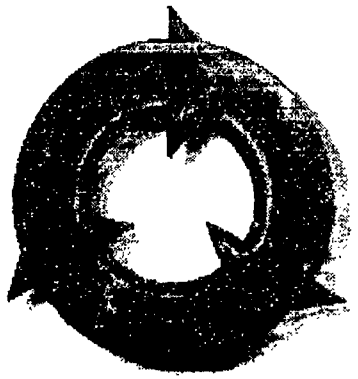
- Highly structured and standardized
  - Z39.50
  - Gopher
  - HTTP

The protocol acts as an intermediary between the client and the server. The protocol is an agreed upon, platform independent, standard language used for transferring information from the client to the server. It is normally a highly structured line of text that works in conjuction with TCP/IP (the most basic set of Internet protocols).

For example, when a gopher client 'talks' to a gopher server, it uses a very simple protocol that consists of text divided by tabs (really, that's it). The first set of text is a number that indicates the type of document being transferred or requested (0 is a directory, 1 is a text file, and so on), the tab character, and then the name of the item being requested and so on.

The Server

- Contains information
- Platform dependent to take advantage of local resources
  - Database
- Waits for requests



The Server

- Contains information
- Platform dependent to take advantage of local resources
  - Database
- Waits for requests

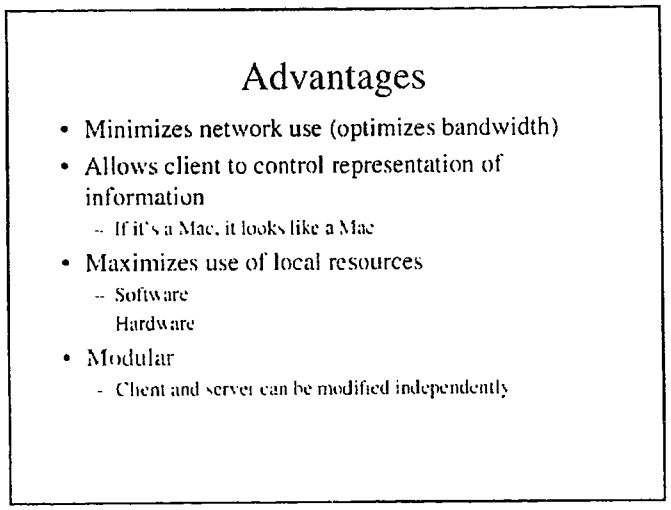
In the days of the mainframe, the role of the server was much greater than it is in present day server applications such as gopher and World Wide Web. In the mainframe model, all user functions were handled by the server. In the new client/server model, the server's role is limited only to basic information storage and retrieval functions. The server constantly waits for requests from clients. Once a request is received, the server will do only what it must do to fulfill the request. Normally, this means finding a requested file, translating it into a common language, and then sending it off to the client via the Engineering level of the Internet. See how everything builds? Sometimes, the server does more sophisticated functions such as handling database queries, or running a predetermined program.

As with the client, the server is platform specific. Server programs are written to take advantage of the computer they are running on.

If one school wants to provide the information it has to other schools via the Internet (e.g., via FTP, gopher or World Wide Web), it must set up at least one server at the school that other schools can contact. To share information in this way, you cannot use the same software you use to surf the net or gain information (such as *Netscape Navigator* or Microsoft's *Internet Explorer*). You will need server software (such as a web server, a gopher server, or an FTP server).

Advantages

- Minimizes network use (optimizes bandwidth)
- Allows client to control representation of information
  - If it's a Mac, it looks like a Mac
- Maximizes use of local resources
  - Software
  - Hardware
- Modular
  - Client and server can be modified independently



Client/Server interactions make the most of the available bandwidth by using the network connection only when information is exchanged.

The client computer controls how the information is represented. Since the client is platform dependent, the information will reflect that client's operating system (if it's a Mac it looks like a Mac) and other capabilities.

Clients and servers operate independently. You can change the hardware and software of the server without the client ever knowing.

Disadvantages

- Makes "stated connections" difficult
  - Database searching
- Complex organization
- Requires more user hardware
- Authors lack control of presentation of information

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- Makes "stated connections" difficult
  - Database searching
- Complex organization
- Requires more user hardware
- Authors lack control of presentation of information

Because it is difficult to retain a stated connection on the world wide web, sophisticated database searching may often be limited. Since the client must often interact with several different servers to get the right information, managing software and finding information can be complex.

Top of the line computers with large amounts of memory are necessary in order to run sophisticated client software. Since storage and representation of information is done separately, the information may look different when displayed on different computer platforms.

E-Mail

- Mechanism for sending memo-like messages point-to-point on the Internet asynchronously
- Advantages
  - Simple
  - Quick
  - Asynchronous
- Disadvantages
  - Not real-time
  - Information overload

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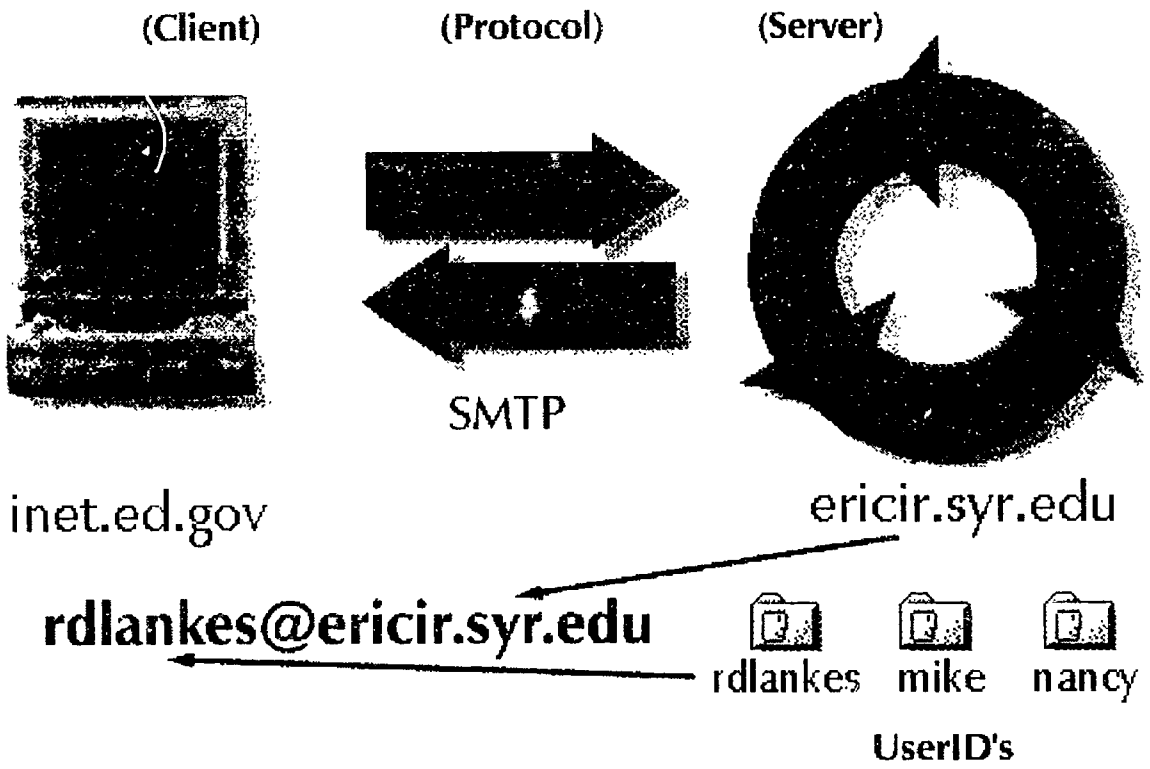
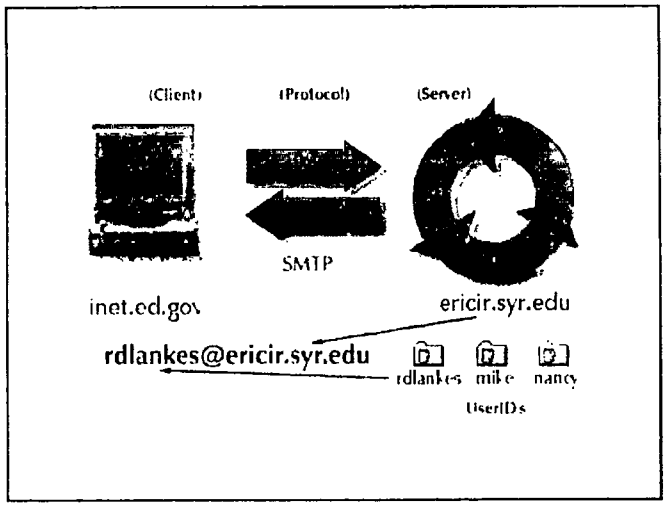
  - Information overload

Electronic mail, or e-mail is the Internet mechanism for sending memo-like messages from place to place. It is simple and quick. The computer receiving the mail doesn't have to be on, nor does the sending computer necessarily have to be on the Internet at the time of sending.

E-mail is considered "the lowest common denominator" of the net. However, with the recent inclusion of advanced e-mail clients with web browsers, e-mail is gaining new popularity.

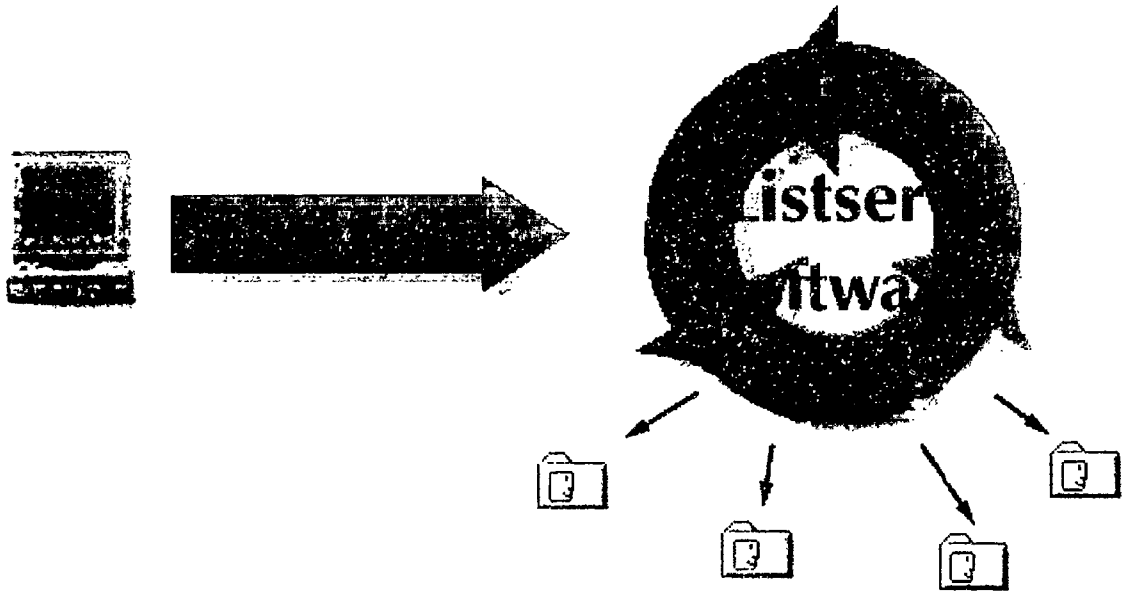
Possibly the largest drawback to e-mail is information overload. E-mail is delivered to your mailbox whether or not you are online. It is possible to find yourself receiving hundreds of e-mail messages each day.


(Client)
(Protocol)
(Server)
SMTP
inet.ed.gov
ericir.syr.edu
rdlankes@ericir.syr.edu
rdlankes
mike
nancy
UserID's



When you send electronic mail, your computer (the client) sends your message to a server computer. Because that server handles e-mail for more than one user, it needs to find a way to keep each user's messages private. It does this by creating user accounts, or userIDs.

To determine someone's e-mail address, you must specify their userID (such as 'rdlankes') and the mail server's IP address (in this case "ericir.syr.edu"). E-mail addresses use an "@" sign between the username and the mailhost.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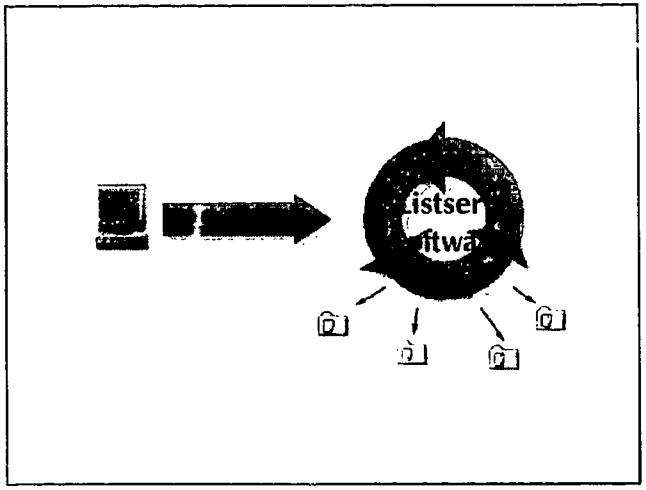
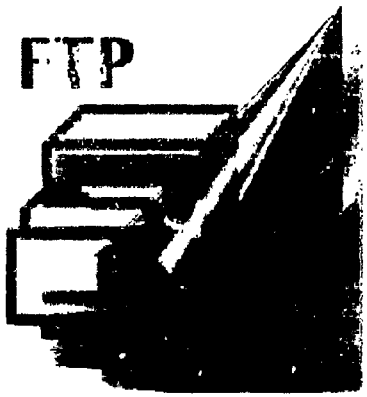


Listserv software, or more generally message list software, allows users to send e-mail to a single address and have that message distributed to other users. Users subscribe to a mailing list based on some common interest (a hobby, career, etc.). While some listservs have only a few subscribers, others have many thousands.

FTP

- Method of transferring files "catalog" style from one computer to another, ie. web pages
- Advantages
  - stated connection (you stay connected)
  - Number of "anonymous" FTP sites
- Disadvantages
  - Old and can be obscure
  - Need to know where you are going
  - Point-to-point
  - Need to have an account on remote computer



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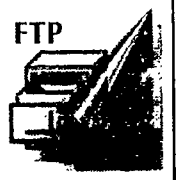


FTP's sole purpose is to move files from one computer to another When you use FTP, you can transfer files from the remote server computer to your client computer.

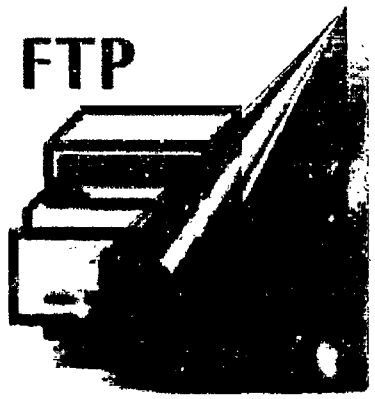
Because of the obscure protocols FTP uses to do its work, you need to learn certain commands in order to use FTP. However, unlike telnet, once you know these commands, they work on every computer that has an FTP server, no matter what type of computer/operating system the remote server is using. This rigid command structure means that your client computer can perform these commands for you, and as client computers have become much more sophisticated and user-friendly, they are able to hide the obscure nature of the underlying FTP protocol.

The primary advantage of FTP over the Web is its stated nature. Once you've connected to a site, you stay connected until you disconnect.

With FTP you need an account on the remote computer, and there is no site-to-site surfing.

What is Anonymous FTP?

- UserID "anonymous"
- Password is your e-mail address



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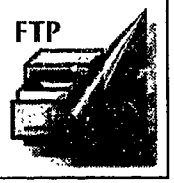

FTP servers and telnet servers require users to furnish user names and passwords. So how does this work without setting up separate accounts on the server for everyone using the Internet? The answer is, everyone uses the same username: "anonymous." Anonymous login is simply an agreement where anyone may access files by using the userID "anonymous." The user's e-mail address is used as the password.

Telnet

- Means of working remotely on another computer
- Advantages
  - Access more computing power than you have locally
  - Stated connection
- Disadvantages
  - Point-to-point
  - Vulnerable to network traffic
  - Need to know remote operating system

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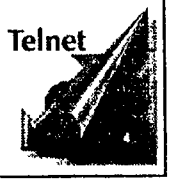
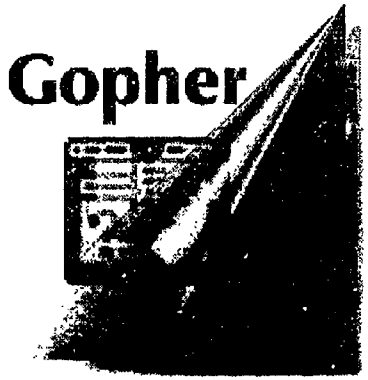


Telnet allows the user to open a "virtual terminal" or window on a remote computer. Even though the window is obviously sitting on the computer screen in front of you, the text and things you type are created and processed on the remote cor You type a letter. It is sent to the remote computer where it is processed, and then the results are se. nd displayed on the screen in front o ou. As far as the remote computer is concerned, you are sitti in front of a screen directly attached to the remote computer (wherever it may be).

This is a good thing and a bad thing. The good thing is you get to work on the remote computer in its native environment. If the remote computer has a program that accesses a database you want, you can telnet to that computer and have access to that database. If you want access to some of the most powerful software and hardware in the world, you can get to it if you have telnet access. The bad thing about telnet is you get to work on the remote computer in its native environment. That means, if it is running an archaic and obscure operating system like UNIX, you have to learn that operating system to do anything. The good news is that most "public services" tend to create simple interfaces. AskERIC, an information service for educators for example, gives the user a menu driven interface to access its services.

Gopher

- System for traversing the Internet in a menu-like fashion
- Advantages
  - Client/Server
  - Hierarchical menus very organized
  - Navigation based on menus not addresses
- Disadvantages
  - Linkage at title level only
  - Does not easily lend itself to multimedia
  - Primarily text based



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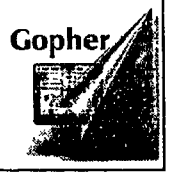
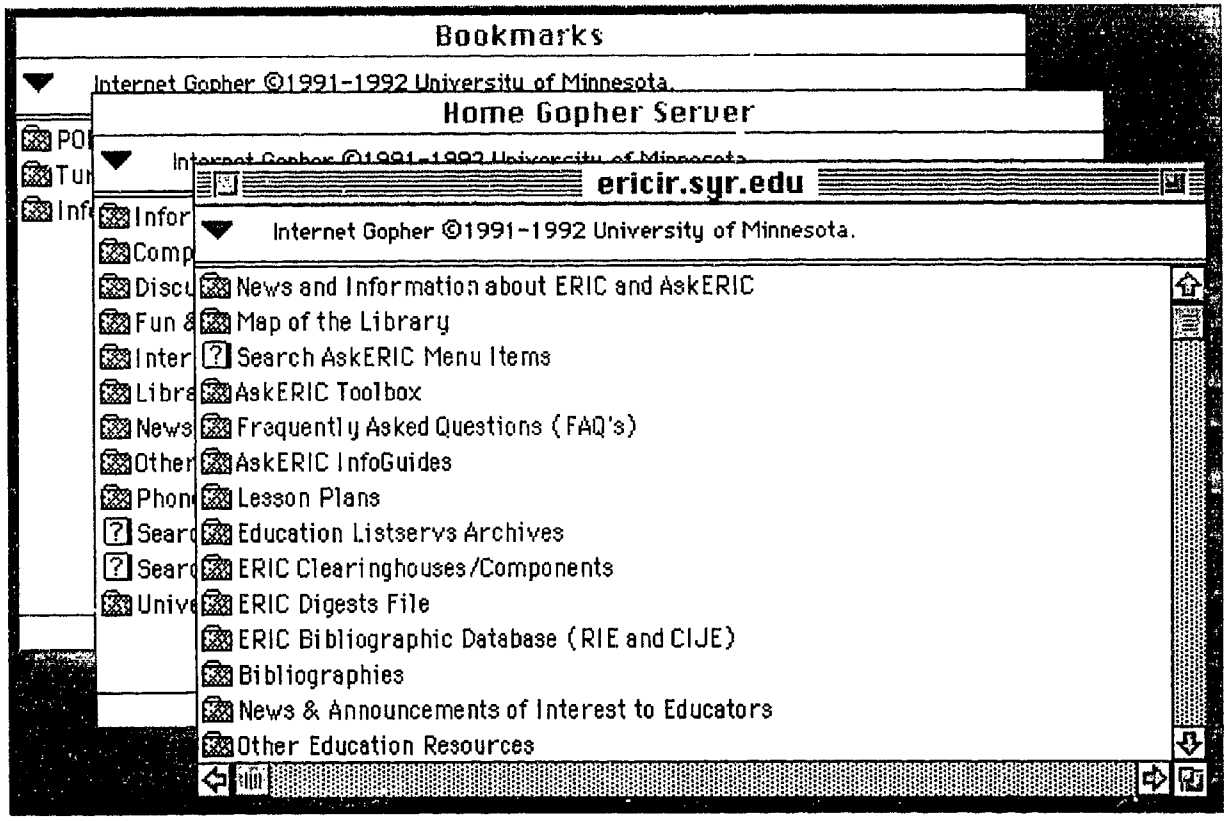
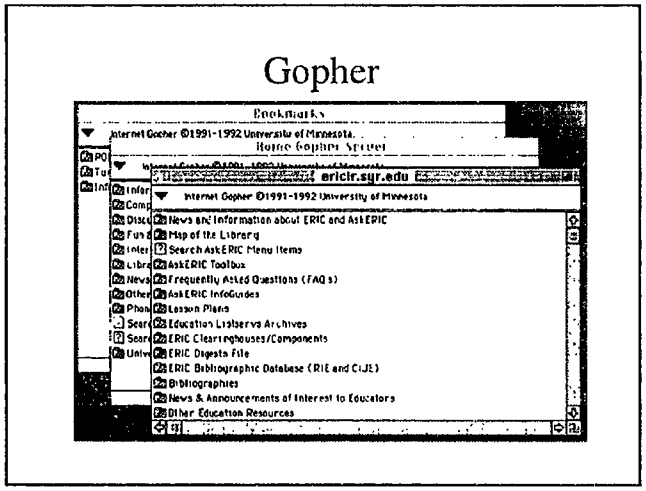


Gopher brought the Internet to the masses. It allows the user to navigate through a series of menus across servers to find information. With gopher you can link to information all over the world and you can search by topic.

Gopher is primarily text based. While it does have multimedia extensions, the basic documents in gopher are text documents.

Gopher


Bookmarks
Internet Gopher ©1991-1992 University of Minnesota.
Home Gopher Server
ericir.syr.edu
Internet Gopher ©1991-1992 University of Minnesota.
News and Information about ERIC and AskERIC
Map of the Library
Search AskERIC Menu Items
AskERIC Toolbox
Frequently Asked Questions (FAQ's)
AskERIC InfoGuides
Lesson Plans
Education Listservs Archives
ERIC Clearinghouses/Components
ERIC Digests File
ERIC Bibliographic Database (RIE and CIJE)
Bibliographies
News & Announcements of Interest to Educators
Other Education Resources



Here is how people see gopher on the Macintosh through a program called *TurboGopher* from the University of Minnesota. The University of Minnesota was the original creator of gopher.

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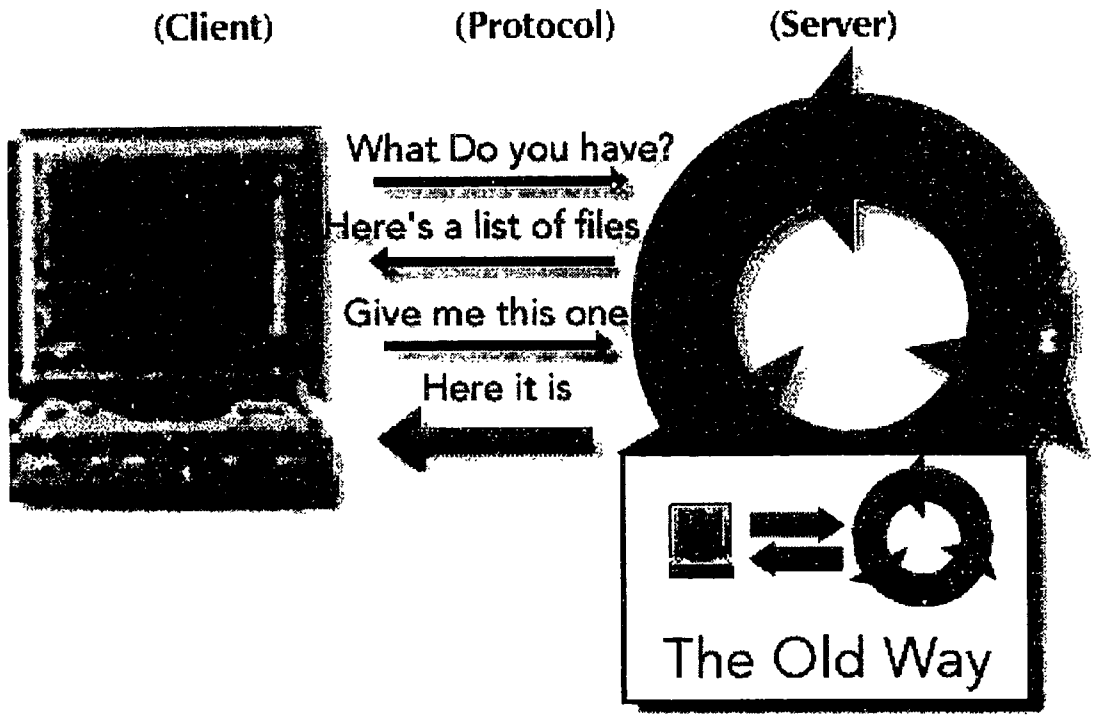
Gopher



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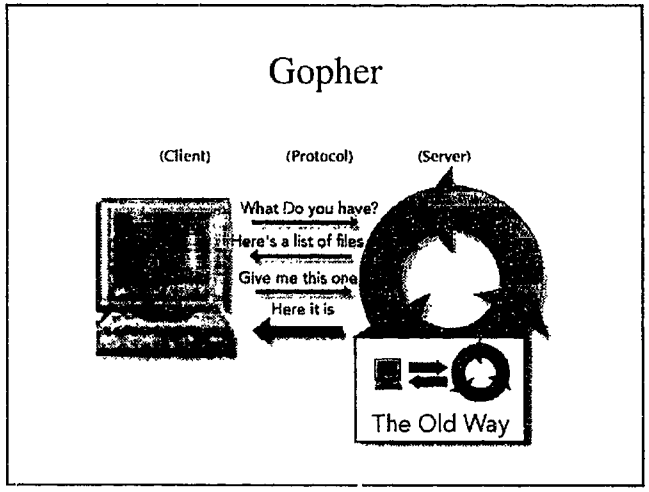

The main difference between gopher and software/protocols like telnet and FTP is the way the connection is made. In telnet and FTP, the client (the software you use) makes a connection (via the protocol) to a server (that houses the information). This connection, once established, stays established until you are done (you logoff or disconnect). This is like making a phone call. If you telephone your local Department of Motor vehicles to get some information, you wait until you get the information you need (or are too frustrated to wait any longer). That means even if you're on hold, you are still connected. This is a very big waste of bandwidth (think of bandwidth as the total number of calls that can be received by the DMV). It means that if you called the wrong office at the DMV for information, you have to hang up the phone, and make another connection. In essence, the state of the connection is always active, or stated.

Gopher does things very differently. It makes a connection only when it needs to. Imagine that call to the DMV again, but this time, you tell the person on the other end of the line what information you need, your phone number, and then hang up). The DMV (the server with the information) finds the information, and calls you back, tells you the information and then hangs up. If they don't have the information, they call you back and give you another number to call (a pointer). You can then keep this calling/disconnecting process up until you get the information that you need. Since a permanent connection is never made, it is called a stateless connection.

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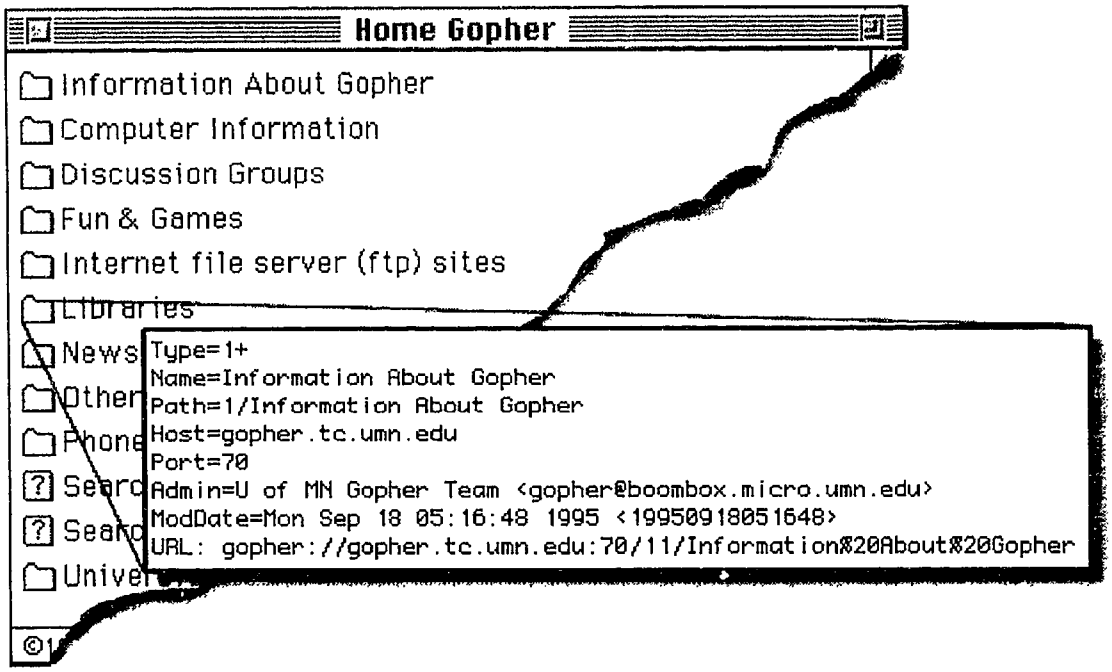
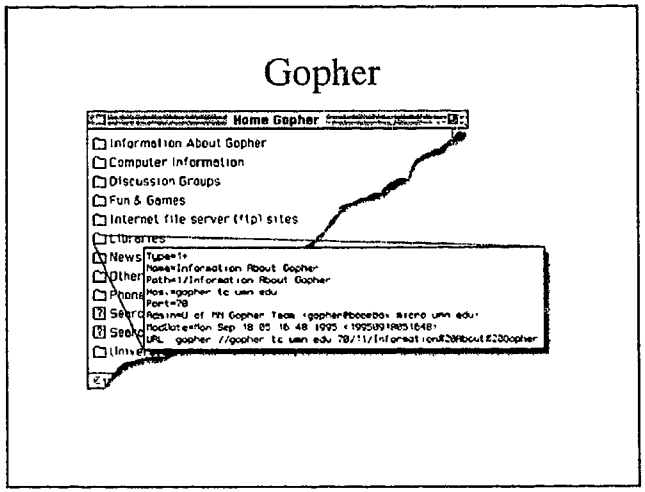
Gopher


Home Gopher
Information About Gopher
Computer Information
Discussion Groups
Fun & Games
Internet file server (ftp) sites
Libraries
News
Other
Phone
Search
Search
Univer...
Type=1+
Name=Information About Gopher
Path=1/Information About Gopher
Host=gopher.tc.umn.edu
Port=70
Admin=U of MN Gopher Team <gopher@boombox.micro.umn.edu>
ModDate=Mon Sep 18 05:16:48 1995 <19950918051648>
URL: gopher://gopher.tc.umn.edu:70/11/Information%20About%20Gopher



So how can you link to information contained in several servers? While your client computer may display things as simple icons, it stores information on each item. This information tells the client computer not only what pictures to use, but what server to use to gather the information. This use of pointers, or links, allows information from a wide range of sources to be displayed as a single menu. While it may look like everything on a menu is from one server, some information may be stored on other servers.

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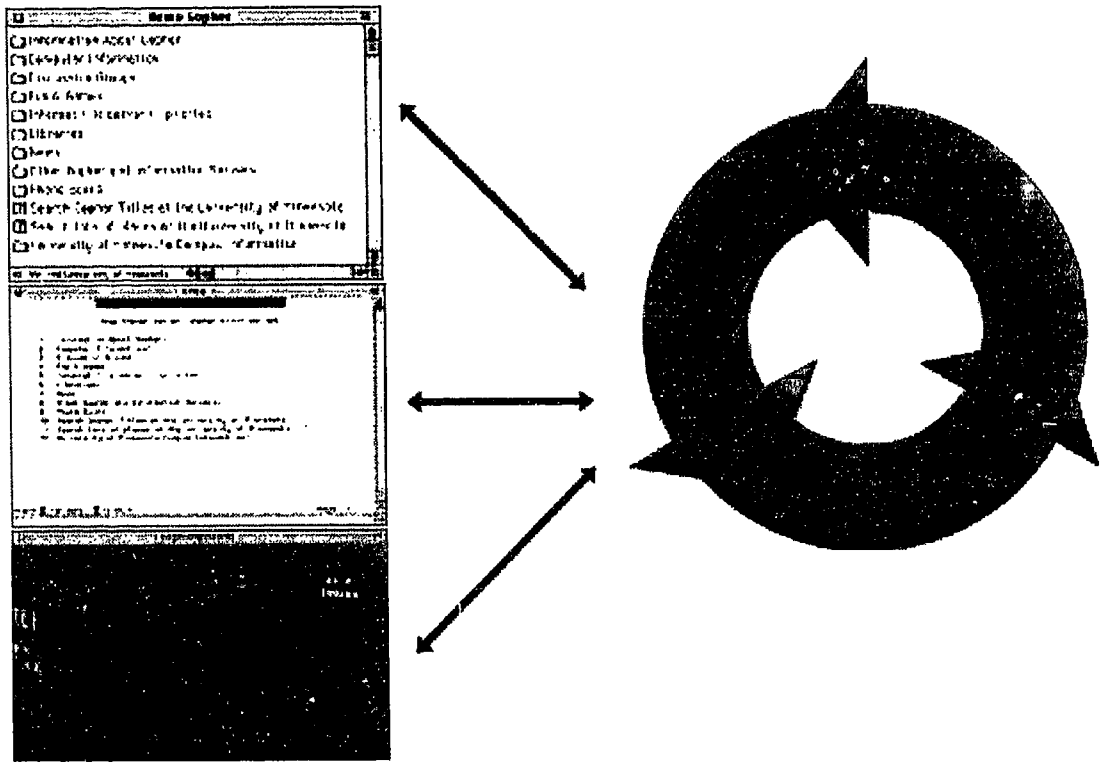
Gopher



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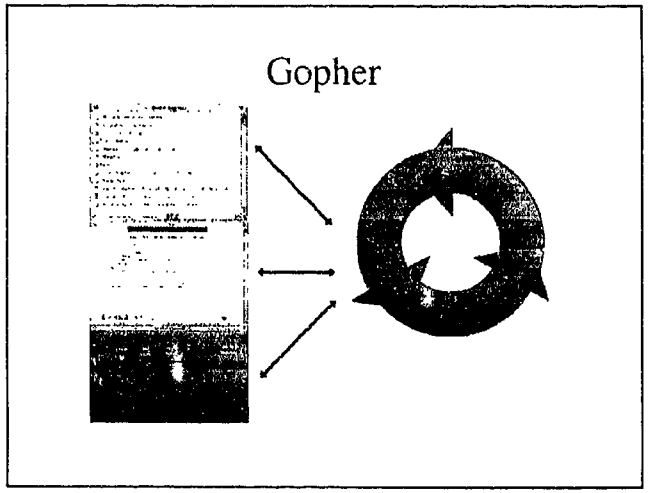

In gopher (and the Web), the gopher server does not handle anything but information storage and retrieval of data. The gopher client does much more of the work. In telnet, if you move your cursor around the screen, the the server has to compute every change in position and make all the changes the user commands. In gopher, if you move the mouse or cursor around the screen, it is your computer that does the work of redrawing the screen. Here's where it gets real interesting....the client also dictates how the information is presented. So if you are using a Macintosh, the information can be presented as a Mac, with folders and windows. If you are using DOS, it looks like DOS. In fact, even though most people think of gopher as a presentation of hierarchical menus, the information can be displayed any way you want. The Minnesota folks released *TurboGopherVR*, software which presents gopher items as 3D objects that you can fly around.

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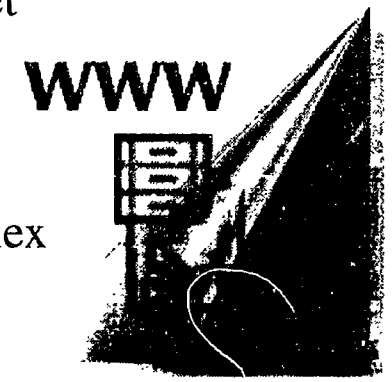
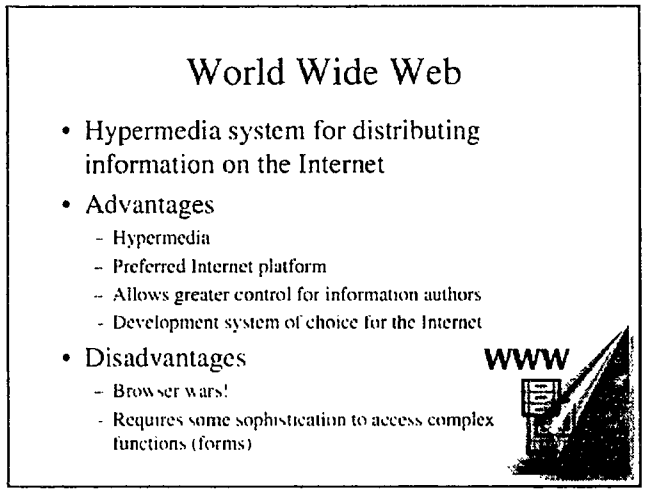
World Wide Web

- Hypermedia system for distributing information on the Internet
- Advantages
  - Hypermedia
  - Preferred Internet platform
  - Allows greater control for information authors
  - Development system of choice for the Internet
- Disadvantages
  - Browser wars!
  - Requires some sophistication to access complex functions (forms)

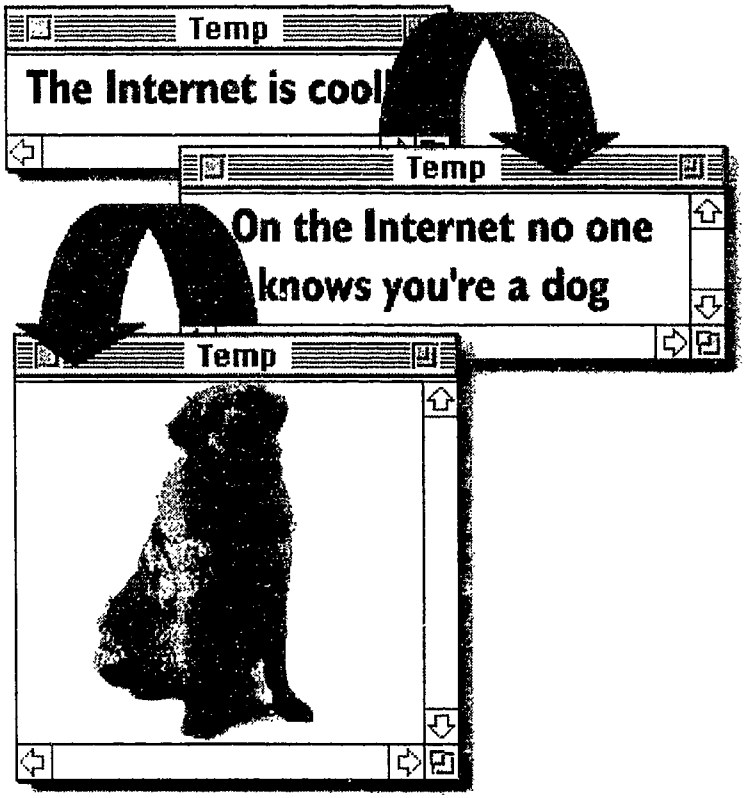




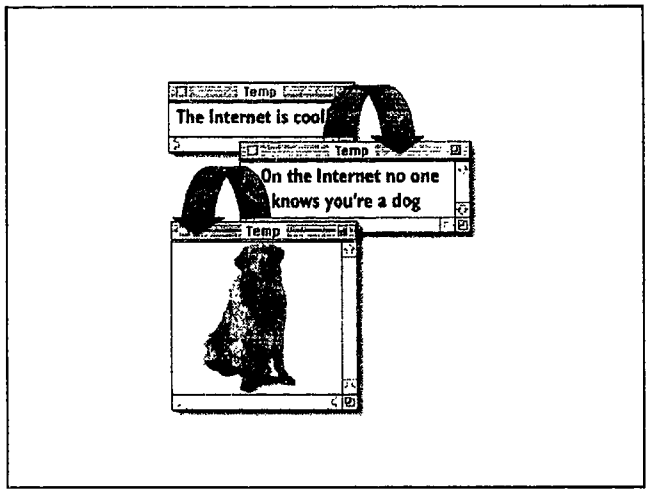
The World Wide Web allows people to link different media together. It has become the center of the Internet.

An author can use the web to format information. The author can use HTML (HyperText Markup Languae—the formatting code for web documents) to add styles, images, and rich formatting to the document. With gopher, all the author had to work with was plain text. This HTML formatting ability has some disadvantages. As more web browsers are written, companies enhance the basics of HTML. These additions can lead to the same information being displayed differently.

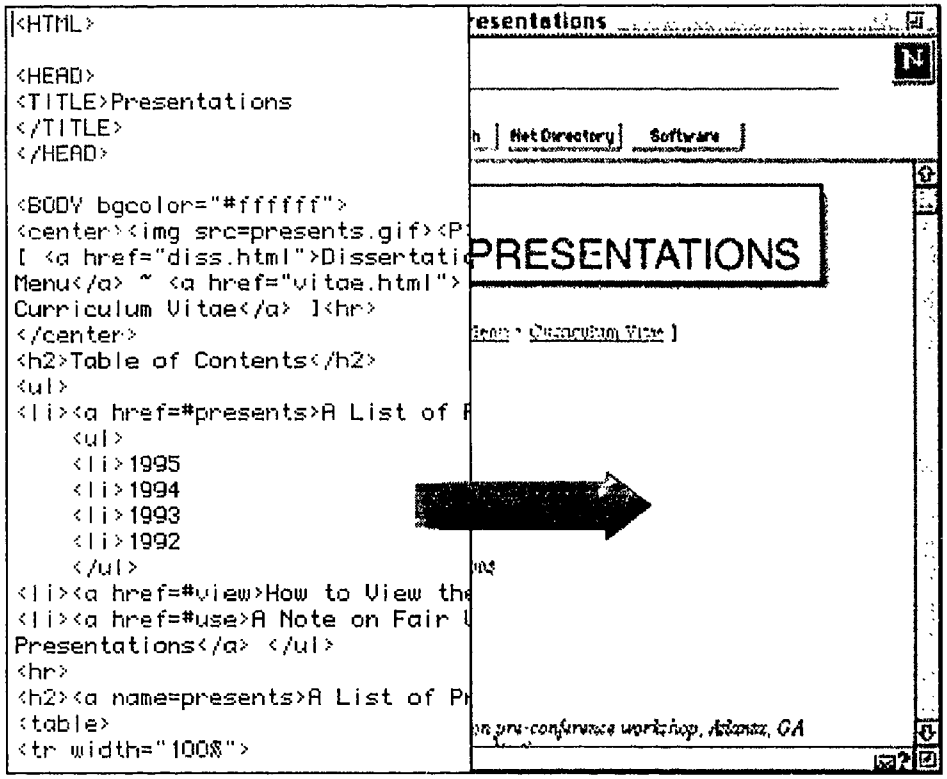
Another disadvantage is the increased bandwidth and computing requirements one needs to access all the functions of the web. Without a dedicated connection and a PowerPC or Pentium chip, one may not able to receive all the information available on the Internet.


Temp
The Internet is cool
Temp
On the Internet no one knows you're a dog
Temp

318



The World Wide Web allows the inclusion of Hypermedia links within a document. The web allows an author of a document to include links from one point (a piece of text or an image) to another piece of information within the same document or to another document. This information can reside anywhere on the Internet and can be in any form (text, graphic, movie).

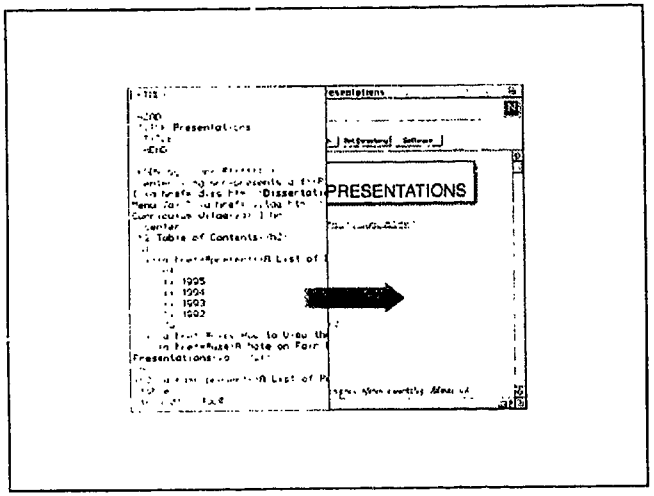

<HTML>
<HEAD>
<TITLE>Presentations
</TITLE>
</HEAD>
<BODY bgcolor="#ffffff">
<img src=presents.gif><P
[Dissertati
Menu ~
Curriculum Vitae]<hr>

<h2>Table of Contents</h2>

A List of

1995
1994
1993
1992

How to View th
A Note on Fair
Presentations
<hr>
<h2><a name=presents>A List of P
<table>
<tr width="100%">
resentations
Net Directory
Software
PRESENTATIONS



HyperText Markup Language or HTML is a series of codes within a document that dictates how the client computer will display information. This was a pretty revolutionary idea on the Internet. For one of the first times in the history of the Internet, information being distributed on the net needed to be put into a special format. Before this time, most of the information was in ASCII format; boring old text with no formatting information at all. HTML code tells the client computer where to put pictures, what size text to display, and where to put space for user input.

HTML is a page description language based on SGML (Standard Generalized Markup Language). It tells the software what type of text to display, but not specifically how to display it. That means the client computer determines what on screen representation is used.

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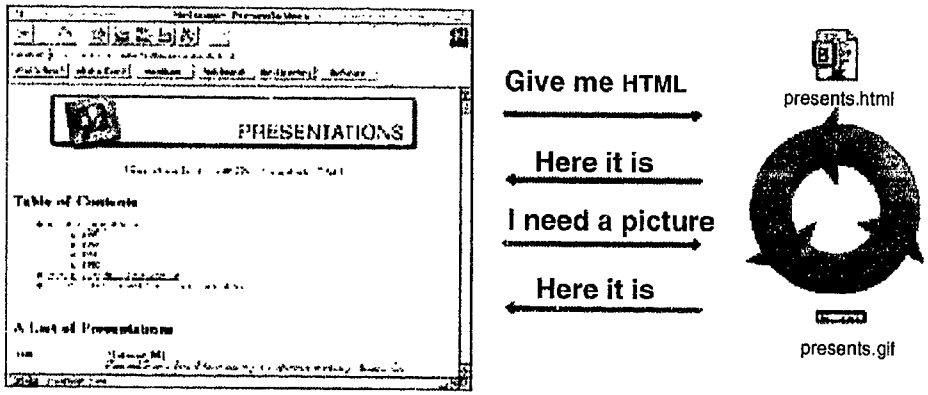
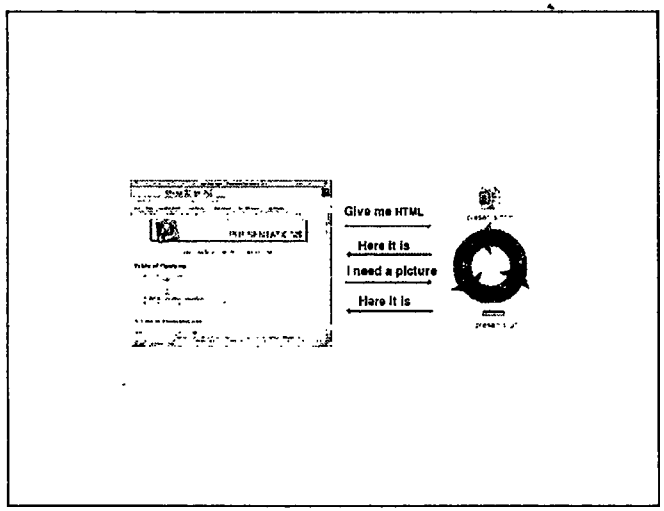

PRESENTATIONS
Table of Contents
A List of Presentations
Give me HTML
Here it is
I need a picture
Here it is
presents.html
presents.gif



A sample interaction. The client, or browser (*Netscape* here) makes a request (via the HyperText Transfer Protocol) to the server. The server replies. If the client needs more information, it needs to make another, separate request. If the user clicks on underlined text, the request is made again (not necessarily with the same server).

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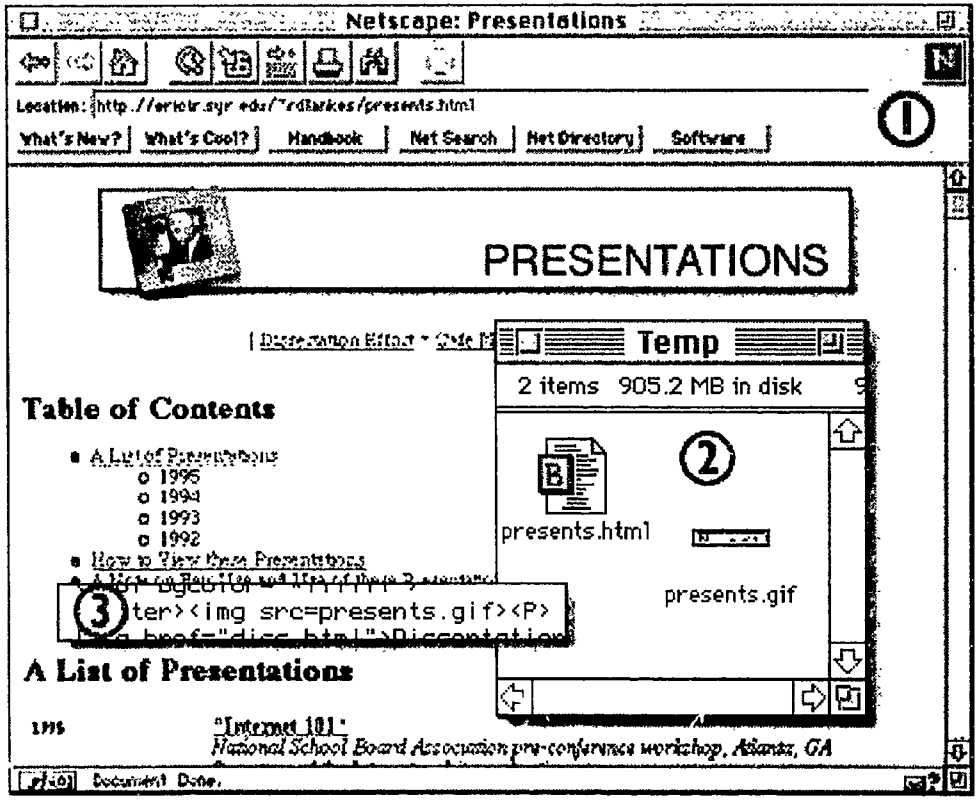

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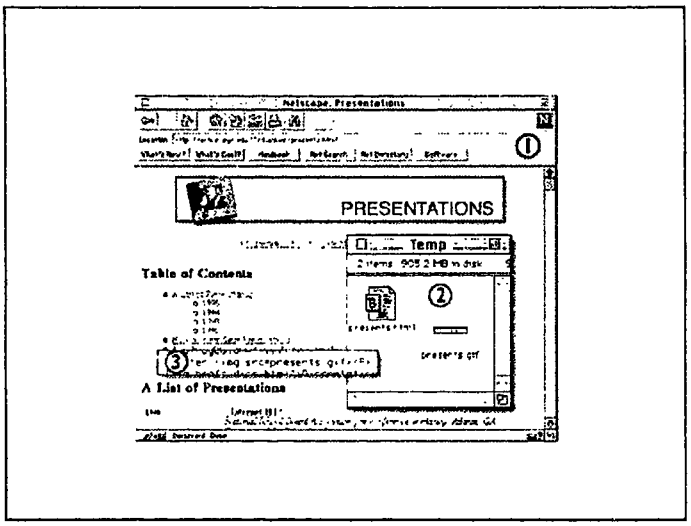

In order for *Netscape* (1) to display this web page, it needs two files (2), the HTML code and a ■rate image file. This is because of an image tag (3) in the HTML code (the file presents.html) that ■ts to the file "presents.gif." Note the URL in the Location box at the top...this tells *Netscape* where to the file presents.html.

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The Bread & Butter of the Internet

Presentation by: R. David Lankes

A Product of the ERIC Clearinghouse on Information & Technology

For updates, more information and other publications contact:

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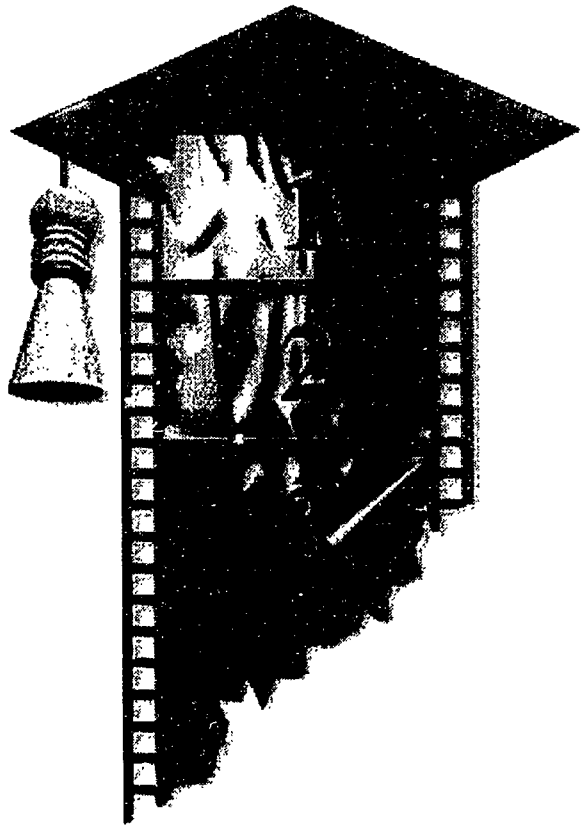
Center for Science and Technology
Syracuse, NY 13244-4100
Phone: 1-800-464-9107
Fax: 1-315-443-5448
E-Mail: eric@ericir.syr.edu
http://ericir.syr.edu/ithome/



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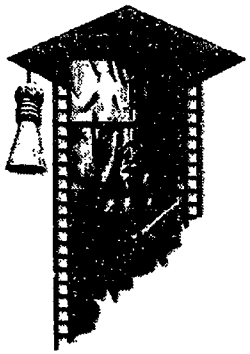
E-Mail: eric@ericir.syr.edu
http://ericir.syr.edu/ithome/



It is an exciting time to be on the Internet. It also can be a confusing time. New software appears daily. However, the new object architectures promise to simplify life. Complex and bizarre things will happen, but we can let our computers sort the complexity out for us. We don't have to comb the Internet for the right application. The software will arrive automatically. We won't have to wait for new versions and updates. They'll come on the fly.

What is ERIC?
Educational Resources Information Center

ERIC, the Educational Resources Information Center, is a national education information system sponsored by the Office of Educational Research and Improvement in the U.S. Department of Education. The main product of ERIC is a bibliographic database containing citations and abstracts for over 950,000 documents and journal articles published since 1966. Most of the document literature cited in ERIC can be read in full text at any of the 900+ libraries or institutions worldwide holding the ERIC microfiche collection. In addition, users can purchase copies of ERIC documents from the ERIC Document Reproduction Service. Journal articles cited in ERIC can be obtained at a subscribing library, through interlibrary loan, or from an article reprint service.

How do I find information in ERIC?

The ERIC Database can be searched manually through its two print indexes, *Resources in Education* (RIE) and *Current Index to Journals in Education* (CIJE). Over 3,000 libraries and information centers subscribe to one or both of these monthly indexes. The database can also be searched online: (a) through a computer based information retrieval service; (b) by CD-ROM; or (c) on a locally mounted system, which may be accessible through the Internet. Online searching is an expedient way to access many years' data, to locate items on specific topics, or to find items meeting several criteria at once. The number of libraries offering online and CD-ROM search services is rapidly increasing.

What is ERIC/IT?

The ERIC Clearinghouse on Information & Technology, or ERIC/IT, is one of 16 clearinghouses in the ERIC system. It specializes in library and information science and educational technology.

ERIC Database

ERIC/IT acquires, selects, catalogs, indexes, and abstracts documents and journal articles in these subject areas for input into the ERIC database.

Among the topics covered in library and information science are:

- management, operation, and use of libraries and information centers
- library technology and automation
- library education
- information policy
- information literacy
- information storage, processing and retrieval
- networking

Topics covered in educational technology include:

- design, development, and evaluation of instruction
- computer-assisted instruction
- hypermedia, interactive video, and interactive multimedia
- telecommunications
- film, radio, television, and other audio-visual media
- distance education
- simulation and gaming

What else is available from ERIC/IT?

Each year, ERIC/IT publishes Monographs, Digests, and Minibibliographies in the fields of educational technology and library and information science. Our semiannual newsletter, *ERIC/IT Update*, announces new clearinghouse products and developments, and ERIC/IT Networkers provide helpful information for using ERIC-related resources on the Internet.

Publications

- Digests—provide brief overviews of topics of current interest and references for further reading
- Monographs—feature trends and issues analyses, synthesis papers and annotated ERIC bibliographies
- *ERIC/IT Update*—a semi-annual newsletter

User Services

- Responds to inquiries about ERIC and matters within the ERIC/IT scope area
- Workshops and presentations about ERIC and database searching
- Assistance in searching the ERIC database

AskERIC

- Internet-based question answering service for educators
- AskERIC Virtual Library, an Internet site of education-related information resources including lesson plans, InfoGuides, listservs and much more.

  E-mail: askeric@ericir.syr.edu Internet: http://ericir.syr.edu
  Gopher: gopher ericir.syr.edu

Would you like to submit your work to ERIC?

Have you written materials related to educational technology or library and information science that you would like to share with others? ERIC/IT would be interested in reviewing your work for possible inclusion in the ERIC database. We actively solicit documents from researchers, practitioners, associations, and agencies at national, state, and local levels. ERIC documents include the following and more:

- Research Reports
- Program Descriptions
- Instructional Materials
- Conference Papers
- Teaching Guides
- Opinion Papers

How do I find out more?

For additional information about ERIC or about submitting documents, or for a current publications list, contact:

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Syracuse University
4-194 Center for Science and Technology
Syracuse, New York 13244-4100
Michael B. Eisenberg, Director
Telephone: (315) 443-3640 Fax: (315) 443-5448
(800) 464-9107
Internet: eric@ericir.syr.edu
http://ericir.syr.edu/ithome

Questions about the ERIC system can also be directed to:

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Glossary

Anonymous FTP site—See FTP.

Archives—Stored records, files, documents, etc.

Baud—The number of signals sent per second.

Baud rate—The speed at which telecommunications data are transmitted from one computer to another. The rate is measured in bits per second. The most common baud rates are 300, 1200, 2400.

Domain—The site of a host computer.

Domain name—A unique address name given to a computer by which it receives e-mail.

Download—The process of moving a file from a host to a personal computer.

Electronic mail—Messages sent from one individual or group to another through a computer network. Most electronic mail systems simulate the way that mail is usually handled, with capabilities such as sending mail, reading mail, forwarding mail, copying mail, saving mail, and writing or editing mail. Sending and receiving mail electronically usually requires an identification number and a password to enable access to be made to the mail system.

E-mail—The abbreviation for electronic mail.

File(s)—A set of associated data with a unique identifying name.

File functions—The access, retrieval, and transfer of files between computers.

File transfer—Using communications software, one computer can be linked to another in order to exchange data files (e.g., word-processed documents) and programs that are in the public domain (e g., games). When a file is received from an external source, it is downloaded.

File transfer protocol—See FTP.

> **Remote file transfer**—The transfer of a file from a remote host at another site to the user's computer.

Freeware—Software that is available to the public, for free. Often accessible through FTP access to many host sites on the Internet. See also Shareware.

FTP—File Transfer Protocol. It is the Internet standard, high-level protocol that allows files and software to be transferred and/or retrieved from another computer attached to a network (such a computer is also called a host, a node, the system, or the network).

> **Anonymous FTPsite**—An Internet host computer that makes certain of its files available to those who log-in as "anonymous," and give their e-mail addresses as a password. The files usually found at anonymous FTP sites are software packages for various systems, utilities, information, mailing list or usenet group discussion archives. At most FTP sites, the resources are organized hierarchically in directories and sub-directories.

Gopher—Also known as The Internet Gopher system, allows users to search and retrieve information residing on many Internet servers in a seamless fashion. Created by teams of programmers at the University of Minnesota, it links to other gopher servers to create an Internet-wide global

gopher web (Gopherspace). The information appears to the user as a series of nested menus, resembling the organization of a directory with many sub-directories and files. The sub-directories and the files may be located either on the local server site or on remote sites served by other gopher servers. From the user's point of view, all information items presented on the menus appear to come from the same place.

Veronica—Provides keyword indexing and access for menu offerings to different information systems on the Internet. Once appropriate information systems are identified, users may telnet to those systems to query databases and services of interest.

Jughead—Provides a way to search Gopher menus for the local site only.

Hardware—The computer itself as well as the technology used to acquire, store, and communicate data.

Host(s)—The computer on a network, usually a minicomputer or a mainframe computer, that stores information an/or facilities for telecommunications. It is also called a node, a server, the system, or the network. Members access the host (which serves many users) by personal computer, modem, or telephone line.

Host server(s)—See Server.

Multiple hosts—Several mainframe computers or several nodes.

Interface—The boundary between the information system and everything outside the system; the link between the resources and the components of a system. Interfaces can be customized by the user, have graphic representations, be adjusted by the hardware, and use hypermedia functions.

User interface—The boundary between the user and the computer, where a human meets a computer at the screen level.

Internet—(The Internet) A world-wide network of networks that serves as an information conduit for the transfer of messages and files.

LAN—Local Area Network. A LAN links computers with other computer in close proximity. By connecting computers in a LAN, the users can share devices such as printers and storage disks and the hardware that connects them to networks.

Leased line—A telephone line leased from a common carrier for the exclusive use of the lessee.

Listservs—Also known as Listserv Discussion Groups, distribute e-mail (messages) to members on a specific address list. The identifying names and addresses of people with common interests are grouped on a list, then stored on a computer with listserv software. A single mail message sent to this list (by a member of the list) is distributed automatically to everyone whose address is on the list. (Listserv is actually a trademarked name for a particular software application used for the purpose just described. The term has also come to be used for the format, as well.)

Local Area Network—See LAN

Log-in—Same as Log-on, which see.

Log-on /log-off—The process of entering and leaving an electronic communications system.

Lynx—A character-based browser that provides a full-screen interface for UNIX and VMS platforms and is very easy to use.

Mail agents—The technology and protocols that simplify mail functions such as reading, sending and filing.

Mailing list(s)—A discussion group, possibly moderated, distributed by electronic mail from a central computer maintaining the list of people involved in the discussion . See also—listserv discussion groups.

Modem—An acronym for modulator/demodulator. This is the hardware that allows a computer to transmit and/or receive data over telephone lines. A modem converts computer signals to telephone signals and reverse. The modem can be inside or outside the computer.

Mosaic—An internet resource locator and navigator developed in 1993 by the University of Illinois National Center for Supercomputing. This software supports easy and transparent access to documents, graphics and other diverse protocols and data formats which are found on the network. It capitalizes on the World Wide Web (WWW) product which enables the using of hypertext links to jump to different information on the Internet.

Naming convention—Same as Addressing convention, which see.

Network—A communications system designed to convey information from a point of origin to a point of destination within the network.

Node—The beginning, intersection, or end of a communications link; or the device located at any of these points from which data can be sent, received, and/or processed. Also called a host, a server, the system, or the network.

NSFNET—The National Science Foundation Network. It consists of a backbone and several regional networks. It is a group of interconnected , high speed, heirarchical networks. NSFNET midlevel (regional) networks provide connections for regions in the United States. These regional networks also connect to Internet.

Online—Refers to using a computer while it is connected to another computer.

PPP—Point-to-Point Protocol. A protocol used to allow users to dial into the Internet (i.e. TCP/IP based network) with high speed modem over a standard telephone line. PPP is a new standard replacing SLIP(serial line interface protocol) although PPP is less common but increasing in popularity. See also SLIP.

Packet—A block of data containing both a message (or part of a long message) and addressing information.

Password—A personal code used to identify the legitimate users of multiuser system. It is normally used in conjunction with an individual identification number.

Protocol(s)—The rules established by a computer system to transmit data. The protocol must be the same for both the sending and the receiving computers to be able to exchange messages.

Real time—Communication between two or more people that occurs while they are online simultaneously.

Remote file transfer—See File.

Remote long-in—See Log-on.

Route—The path that traffic takes on a network, from its source to its destination.

Router—A dedicated computer (or other device) that sends packets (units of data) from one place to another, paying attention to the current state of the network.

Server—A workstation that performs a service to other workstations on a network, such as a computer that shares its printer with other computers on the network. Also called a Host, a node, the system, and the network.

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Shareware—Software available to the public at a nominal fee. This type of software is frequently available on bulletin boards and Internet FTP hosts for downloading. The person downloading the shareware application is then free to try it out, and is encouraged to send in payment if kept and used thereafter.

SLIP—Serial Line Interface Protocol. A protocol that allows computer users at home to dial into a local Internet node with full Internet capabilities (e.g. telnet, FTP, e-mail). SLIP is being superseded by PPP but is still very common. See also Point-to-Point Protocol.

Software—A program or a set of instructions that tells a computer how to accept and manipulate data in order to turn it into information; also called computer program or an application.

Standards—Constraints imposed by current technology. Rules governing the types of computers and software that can be used.

TELNET—The Internet standard protocol that allows connection to a remote terminal (an operation referred to as "remote log-in"). In action, it means to connect across Internet from one computer on a network to another computer on another network. (This term is also used as a verb, as in "to telnet" to another host computer.)

Terminal—A combination of a display screen and a keyboard for putting data into a computer and viewing the results of processing it.

Terminal server—See Server.

Upload—To transmit information created or stored on one computer to another computer (i.e., from a personal computer to a network host computer).

User(s)—The person that is served by the information system.

User interface—See Interface.

WAN—Wide Area Network. A network that connects parts of an organization that are spread across a wide geographical area, such as a company with offices throughout the United States, a multi-campus university system, or state-wide K-12 computer network.

Wide area network—See WAN.

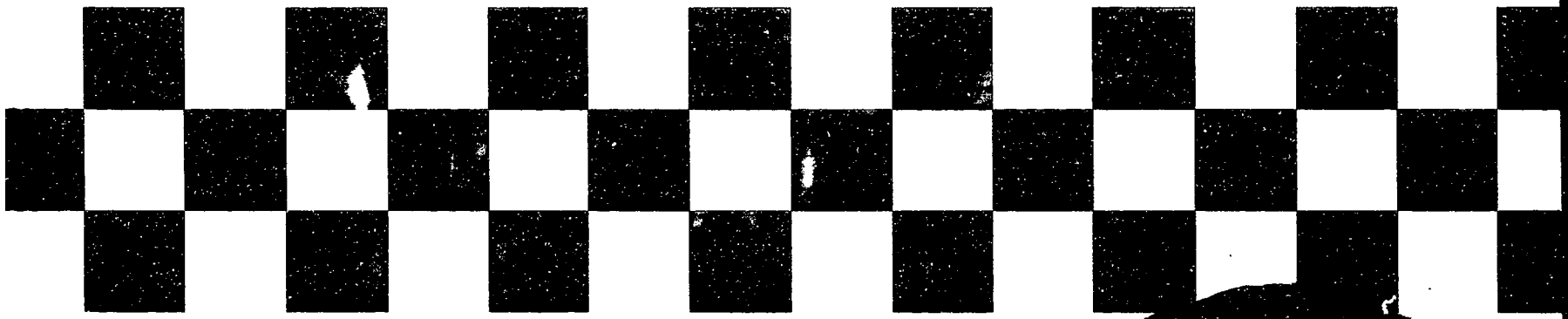
Workstation— A network personal computing device (sometimes called a microcomputer) with more power than a standard computer. Typically, a workstation has an operating system that is capable of doing several tasks at the same time.

WWW—A system developed in 1992 by European Laboratory for Particle Physics, CERN, in Geneva Switzerland as a network tool which would link full text documents marked up with Hypertext Markup Language. WWW documents can contain links to other text, images, sounds and movies.

K-12

Classroom teachers, School library media specialists, School technology coordinators, Parents

Education/Internet



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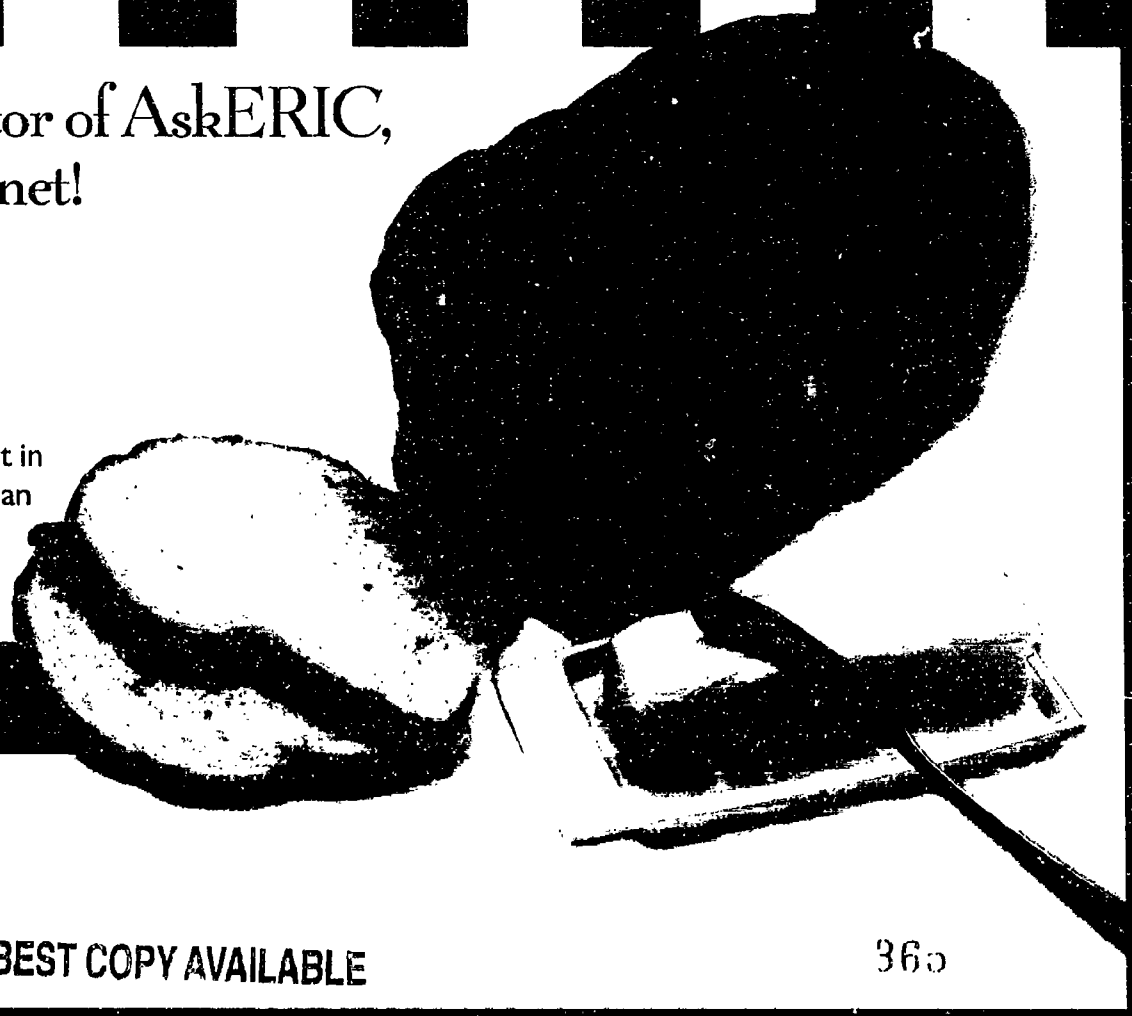

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