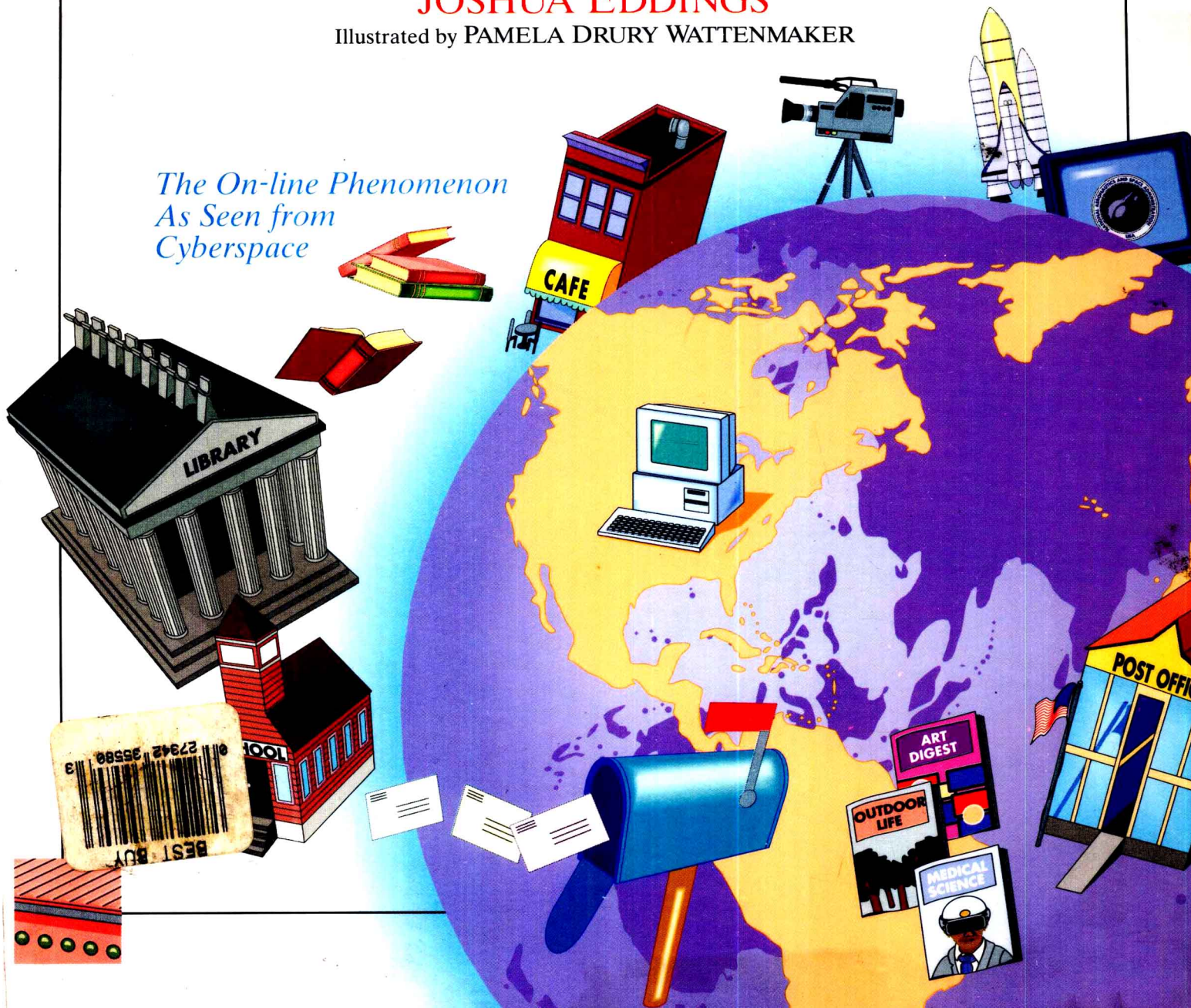
HOW THE INTERNET WORKS

JOSHUA EDDINGS
Illustrated by PAMELA DRURY WATTENMAKER

The On-line Phenomenon As Seen from Cyberspace



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Thanks to Valerie Haynes Perry, development editor at Ziff-Davis Press, for shepherding me through this project. And to Pamela Drury Wattenmaker, illustrator—it was fun to turn in montages of clip art and crayon drawings and to get back illustrations that captured what I was trying to say! And special thanks to the editorial and production team for this project: Kelly Green, copy editor; Kim Haglund and Cort Day, project coordinators; and M. D. Barrera and Bruce Lundquist, layout artists. As a former retail bookseller it was fun for me to watch the choreographed dance involved in getting a book out so quickly.

Thanks to Mike Sabeskis for his support over the years, for turning me on to the *How It Works* series, and for all those times we've bounced ideas back and forth.

Special thanks also to Kathy Henley for her support, for "beta testing" and reviewing my ideas for this book, and for training me in how to think of and explain computer-related topics clearly.

And thanks to the Internet community. I recently heard the statement "There is no encyclopedia on the Internet!" I've found the Internet itself to be an encyclopedic source of knowledge. It is a source of real, live experts, only an e-mail message or phone call away, who are always willing to help you out.

anarchy: 1a: absence of government 1b: a state of lawlessness or political disorder due to the absence of governmental authority 1c: a utopian society of individuals who enjoy complete freedom without government.

—Webster's Ninth New Collegiate Dictionary

The Internet's environment often seems chaotic to the computer tyro who stumbles onto the net for the first time. In fact, the Internet resembles an anarchy in the philosophical sense of the word.

The Internet is a cooperative society that forms a virtual community stretching from one end of the globe to the other. As such, the Internet is a gateway to cyberspace. *Cyberspace* is the electronic infrastructure of the late twentieth century. Cyberspace encompasses a virtual universe of ideas and information we enter whenever we read a book or use a computer, for example. The Internet allows you to travel through cyberspace from your computer using your Mac, Amiga, PC, or SPARCstation, as well as other types of computers. One moment a task on your computer may absorb your attention, the next you may decide to switch between library catalogs spread across several continents. You may then quickly change gears to have an electronic conversation with a friend on the other side of the world whom you'll never meet in person; this could lead to your participation in an electronic forum, along with thousands of others.

Acronyms and terms such as PPP, SLIP, TCP/IP, WAIS, WWW, FTP; and Telnet, e-mail, and gopher often seem to conspire against a simple understanding of the Internet. These acronyms and terms all compete for your attention at the same time. This book is a visual guide to understanding the Internet, its jargon, and how it all works. It will help you get a conceptual handle on the Internet, and will make you comfortable as you explore cyberspace and join the global electronic village.

If you are new to the Internet or to computers, you may elect to read this book linearly, from beginning to end. You can also browse the illustrations, only pausing to dip into the text when a particular topic piques your curiosity. If you are already familiar with the Internet, feel free to read this book in any manner that pleases you. I only hope that whether you are a computer novice or a seasoned net surfer, this book will enhance your understanding of the Internet.

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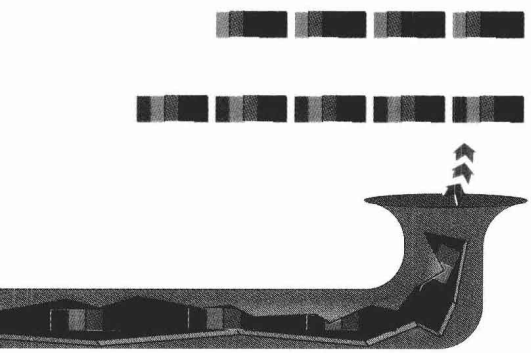

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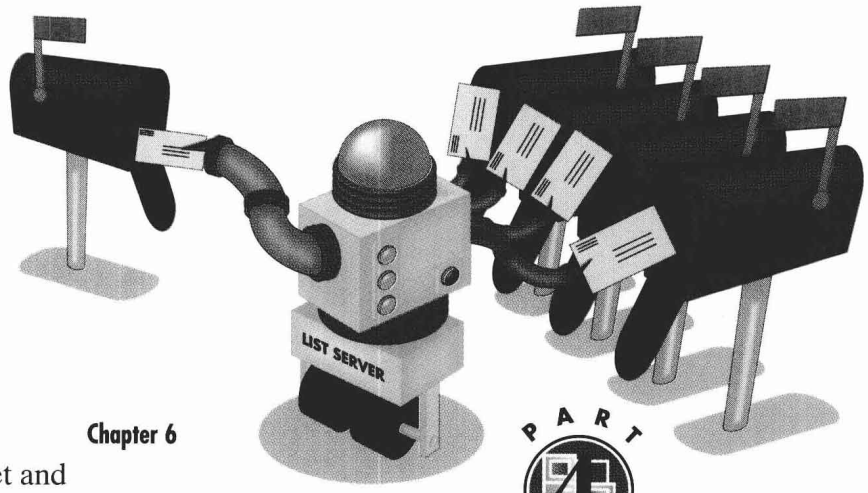

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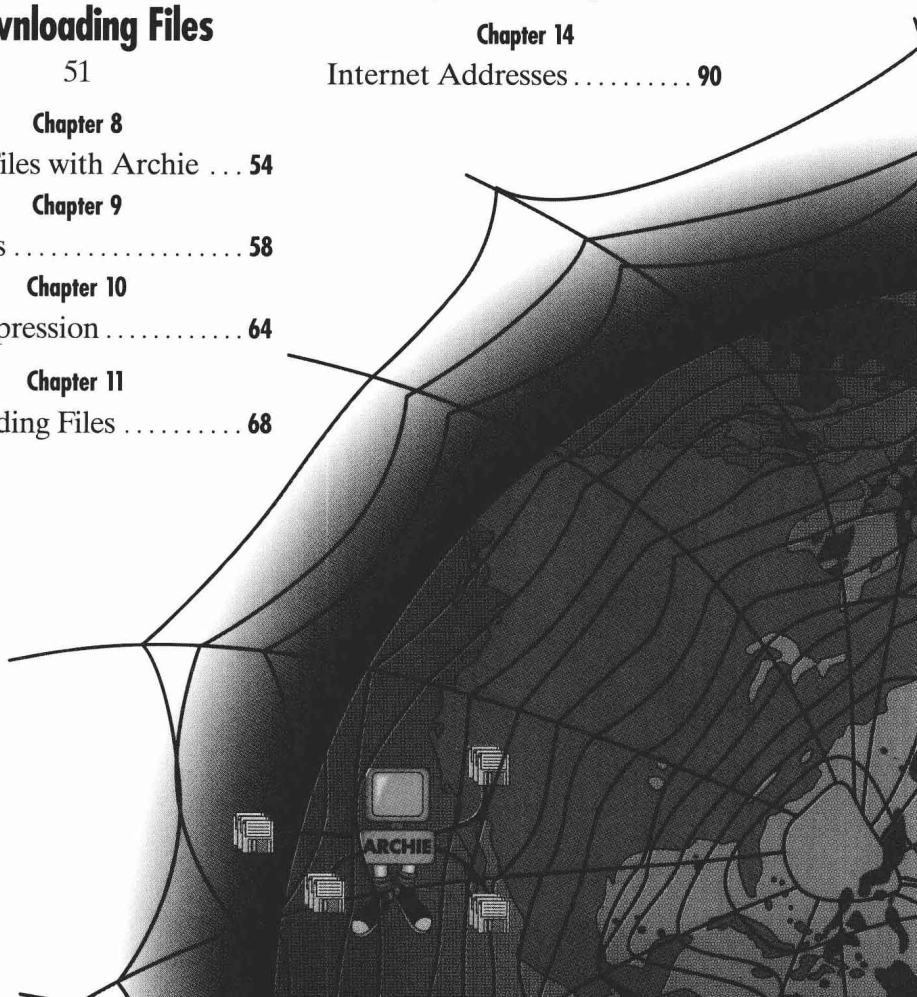

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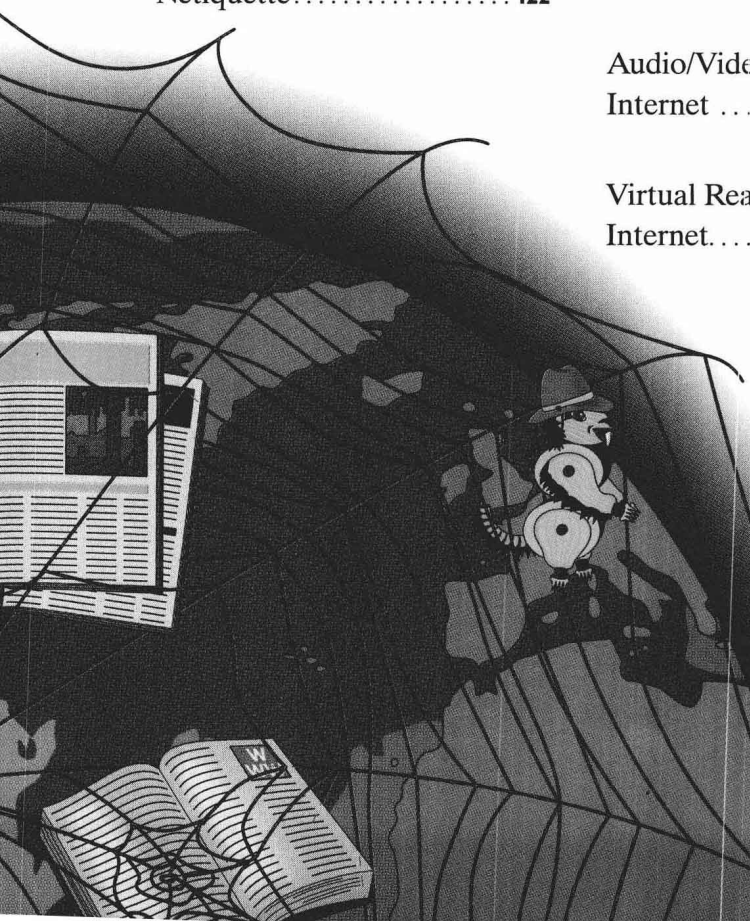

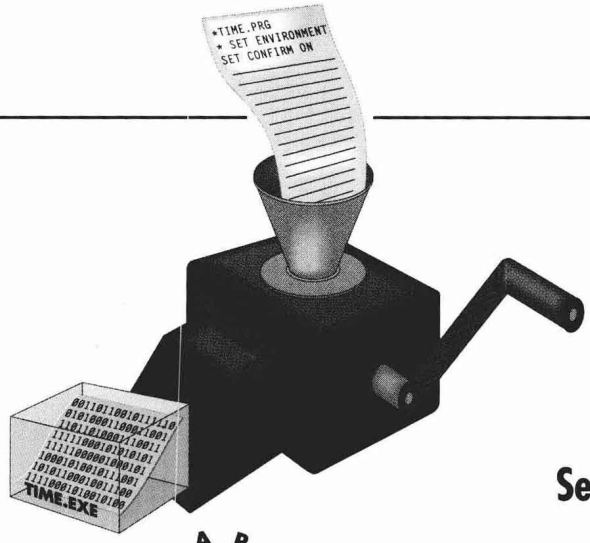

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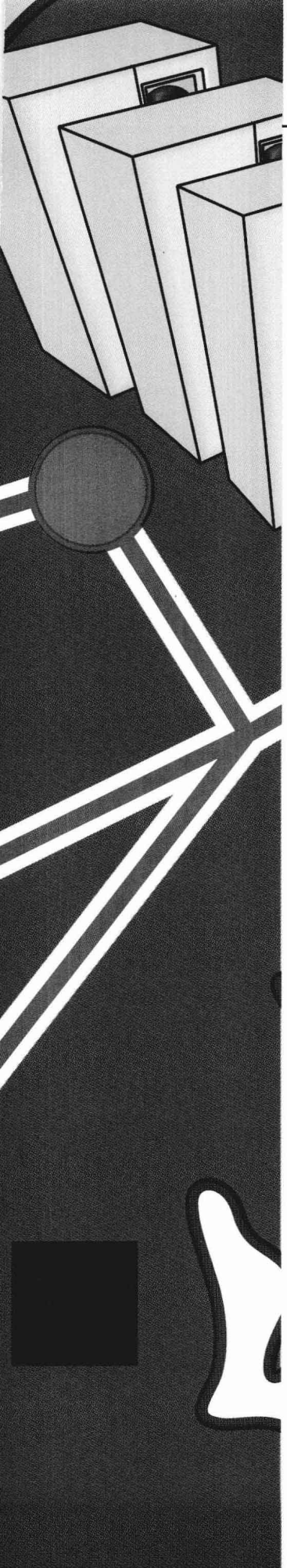

PART 1

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OVERVIEW

FROM YOUR FRONT room, your back office, or your child's grade school, you can turn on your computer, dial a local phone number, and connect with the biggest computer system in the world. It's completely legal. It may even be free. It's the Internet.

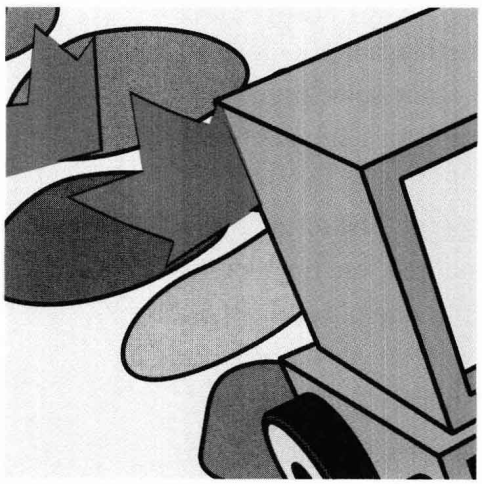
The Internet is a network of networks. You can use electronic mail to contact other Internet subscribers. From your computer, you can log in to another computer, called a *remote computer*. The remote computer may be thousands of miles away, and you can run programs on it as if it were in the same room. You can search libraries of software around the world, and transfer that software back to your own computer.

When you connect to the Internet, your computer becomes an extension of what seems like a single giant computer—a computer with branches all over the world. What's really happening is that your computer is talking with one of more than a million other computers. However, these computers don't all talk to each other at the same time. Tens of thousands of networks all over the planet connect them, sending information between computers as needed. Millions of people use this system every day.

This book will give you a taste of what's available on the Internet. The resources that the Internet interconnects and makes available to you, the end user, are tremendous. They also change daily, as new services and computers come on-line, and old computers and resources are taken off-line.

A good way to explore the Internet is to start at home. Whether we know it or not, most of us live near an "electronic town." Local governments and colleges set up and fund these towns, which offer a collection of computer resources to the locals. Chapter 1 will take a closer look at one such town.

Electronic towns pepper the world, and the Internet connects these towns. Many offer similar services, but with a local twist. Other electronic towns offer unique services through various local institutions. Once you've explored what's available locally, in Chapter 2 you can venture out onto the global Internet to explore electronic towns all over the world.



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The Electronic Town

SO WHAT CAN you do with the Internet? Let's start by looking at a Free-Net.

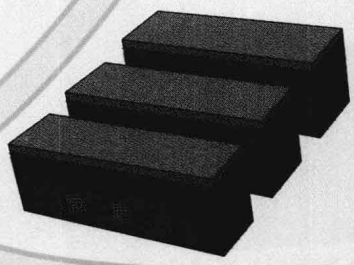
A Free-Net brings together the resources of a community or campus. Everyone and everything from regular citizens to public and private schools, government offices, elected representatives, and local businesses; farmer and agricultural experts; community organizations, museums, and other institutions can all be found on the net. This convergence of electronic resources has all the elements of a town—an electronic town. There's a post office, where members have electronic mailboxes from which they can send electronic mail throughout the world. There's a public square, with coffeehouses for one-on-one conversations and podiums and auditoriums for large gatherings. There's a teleport, which enables users to jump to other networks around the world via the Internet. There are weather stations, hospitals, newsrooms, recreation centers, libraries, and much more. In fact, Free-Nets are the libraries of the future.

The Cleveland Free-Net is the original Free-Net, started in the mid-1980s and run by Case Western Reserve University. Technically, it is a metropolitan area network, or "net," reached via the Internet or by a local phone call if you live in Cleveland, Ohio. Case Western Reserve University and the Cleveland Free-Net provide the infrastructure of the electronic town—the administration building, the post office, and the teleport. Other organizations on the net are organizations that exist in the real community. Often these organizations already have local area nets or other computer systems in place. By joining the Free-Net electronic town, these organizations offer their information to many more people, as well as access information from other organizations. The local library system provides the computer with an on-line catalog and library system. The local medical school and hospital do the same with medical information. Computer user groups find electronic homes on the Free-Net. The local, state, and Federal government provide access to more information.

All this is accessible by a simple phone call from your modem, or even from a direct connection to the Internet that your local area network or on-line service may already provide! As you start looking around your community you will probably find your own local electronic town. The Internet has expanded into almost all colleges and universities; even high schools and grade schools are joining. Free-Nets bring the Internet into our own backyards.

An Electronic Town

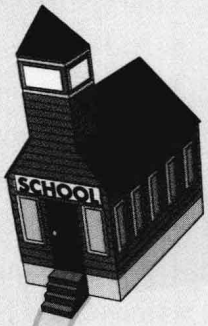
A Free-Net brings together the resources of a community or campus on your computer. This convergence of electronic resources has all the elements of a town—an electronic town.



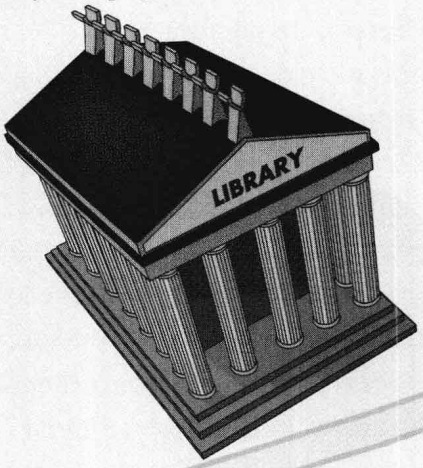
Business and Industrial Park As more businesses move into the electronic town you will find more databases and services here.

Home Here's where you start, with your own computer, in your own home.

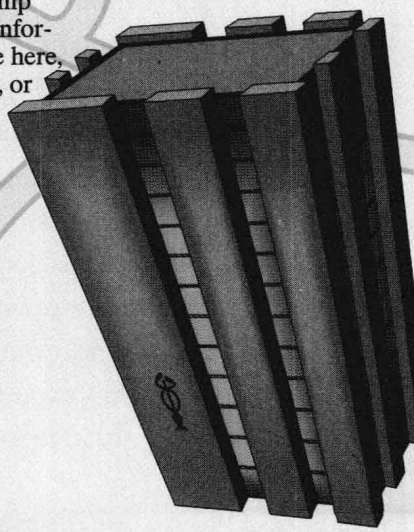
Schoolhouse This is the home of Academy One, a very low-cost educational resource for students, teachers, and administrators. Many Ohio K-12 schools, as well as schools throughout the country, participate in Academy One. It's open to all schools.



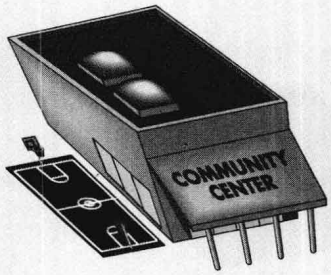
Library You'll find almost all the services of the local library here. Browse the card catalog. See how many overdue books you have. Reserve a book at your local branch—it will be waiting there for you next time you stop by the real library.

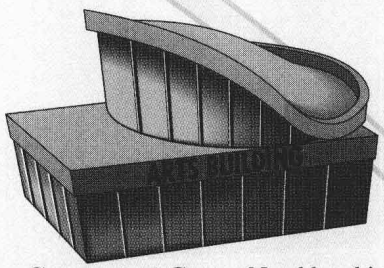


Medical Arts Building Leave a medical question at the front desk. A real doctor will send you a short answer, usually within 24 hours. Can't wait that long? Then jump into the database of medical information yourself! While you're here, why not visit the dental clinic, or the sports medicine clinic?



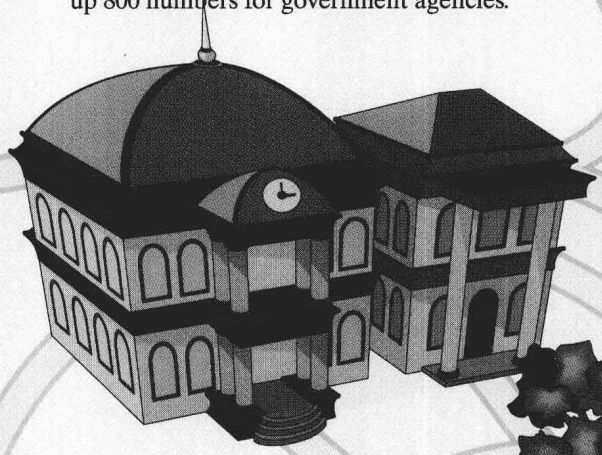
Community Center and Recreation Area Join in with your neighbors to relax a bit and shoot the breeze. Meet with stamp collectors. Discuss TV trivia. Maybe play an electronic game. Discuss yesterday's basketball game, or that upcoming football game.



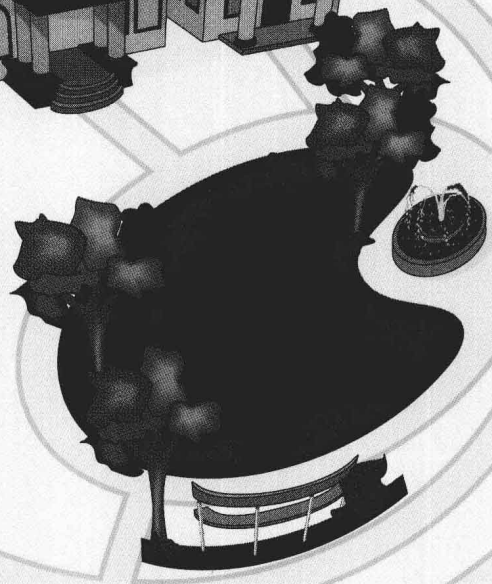


Arts Building Stop in and meet the local artists. You'll find authors, painters, poets, musicians, and much more.

Government Center Need legal information? Here's the courthouse, with a database of legal questions and answers. Research Supreme Court opinions. Examine the text of historical documents at Freedom Shrine. You can also contact your Representatives from here, or look up 800 numbers for government agencies.

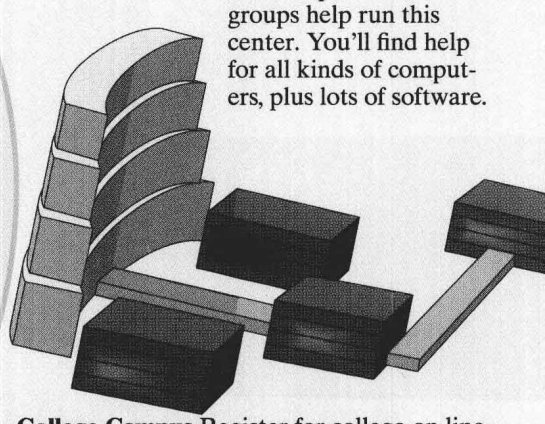


Administration Building Here's where you talk to the people who run the town. Stop in here for general information about helping build the town.



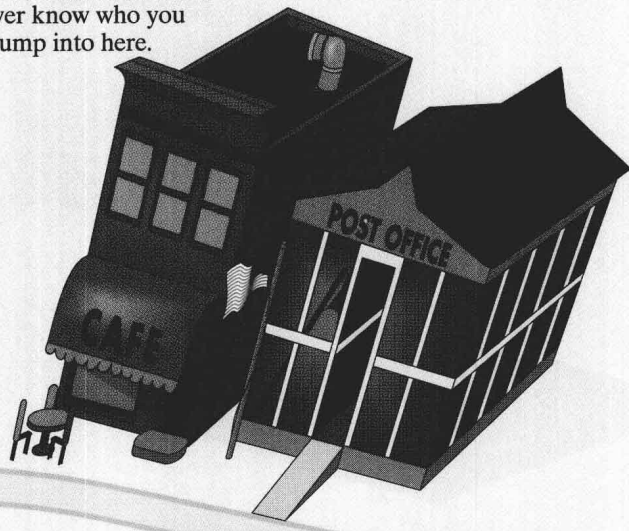
Public Square Gather with the crowd to hear the politicians speak. Give a speech yourself. The podium's open!

Science and Technology Center Local colleges and computer user groups help run this center. You'll find help for all kinds of computers, plus lots of software.



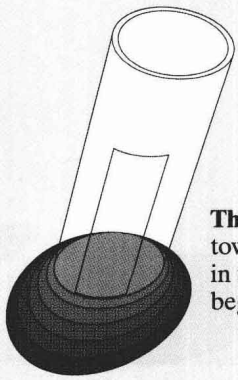
College Campus Register for college on line. Preview next term's class offerings. Leave a message for your favorite teacher. At some campuses you can turn in homework on line, and some classes even meet on-line!

Cafe Stop by the cafe to join in on a conversation. You never know who you might bump into here.

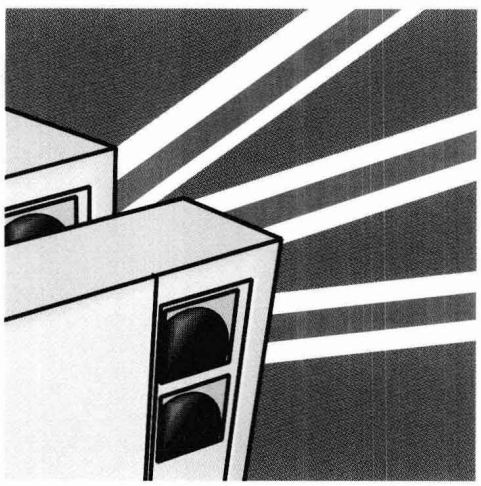


Post Office Check your electronic mailbox for messages, send e-mail to your friend down the street, or to a pen pal in New Zealand. In some towns you have to "buy" stamps to send mail outside of the town.

The Cleveland Free-Net The Cleveland Free-Net, the first Free-Net, was used as the basis for this electronic town. By the time you finish reading this book, some of the features above may have changed, and many more will have been added.



The Teleport When you're ready to leave town, you can "beam" yourself anywhere in the global Internet. Turn this page to begin your journey.



The Global Internet

YOU'VE JUST SEEN an electronic town. Many towns offer unique resources: maybe a library specializing in the Civil War, a database of medical journal articles, the world's most accurate clock, television plot summaries, or even a high-end, state-of-the-art supercomputer. Now imagine the planet covered with electronic towns, all linked by the Internet. With your computer you can travel to any of these towns, via the global Internet, without leaving home!

The Internet evolved in part from the connection of supercomputer sites across the United States. The National Science Foundation (NSF), a U.S. government agency that promotes science, wanted to get the most out of their supercomputers. Connecting the sites to each other made the supercomputers more efficient. Scientists, researchers, and engineers could then access the supercomputers from their own labs and offices.

The high-speed networks that connect the NSF supercomputers now form the backbone of the Internet. The *backbone* consists of high-capacity telephone links, microwaves, lasers, fiber optics, and satellites, connecting networks, computer sites, and people all over the world.

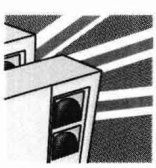
NASA SPACElink is an electronic town on the Internet. NASA educational specialists provide teachers with information on space science and the space program. Teachers or anyone interested can find lesson plans, information on the latest shuttle launch, computer images from Mars or the shuttle landing, and much more on SPACElink. If that's not enough, you can also try the European Space Information System, or the Hubble Space Telescope archived exposure catalog, both also available on the Internet!

Libraries are the most visible and numerous resources on the Internet. You can visit college libraries, public and private libraries, national libraries, corporate libraries, scientific libraries, and even virtual libraries with electronic books, all over the world. The U.S. Library of Congress has even developed a virtual library catalog, the L.C. Marvel that you can browse through like any other electronic card catalog. In fact, most libraries will let you browse through their card catalogs, and maybe even check their database of newspaper clippings or other special services. Some let you copy electronic books that are now in the public domain, which have been scanned into a computer. Other libraries, like the Multnomah County Library Association in Portland, Oregon,

even let you check out hard-copy books electronically—they send the book to you by U.S. Mail. Of course, they charge the postage for this service to your library card.

There are many other resources available through the Internet. You can visit CURIA, the Irish literature archive, keep track of the Vatican Exhibit, study architecture at the Instituto Universitario de Architettura in Venice, Italy, or buy books from an on-line bookstore. You can participate in politics, communicate directly with people in war-torn areas of the world, or share hobbies with others.

Today, the NSF supercomputer centers are further expanding the power and usefulness of the Internet. They have formed a *metacomputer*, a sort of one-stop shopping center for scientists and engineers. A metacomputer ties supercomputers and other, smaller computers from San Diego to New York together to form a seamless "virtual computer." A carefully arranged team of computers handles problems in areas such as climate change and the scientific visualization of massive amounts of information better than a single computer would. Software at the supercomputer centers determines the best combination of computers to handle such tasks, freeing up valuable computer time for other tasks.



The resources available on the Internet are almost unimaginable. If you were to systematically explore everything that is out there, you'd never finish.

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