

INFRASTRUCTURE

Networking

BY SIMSON L. GARFINKEL

Last March, two would-be information highway road warriors threw a gala celebration at Boston's Museum of Science. The companies, Continental Cablevision and Performance Systems International, were embarking on a first-of-its-kind partnership to deliver the Internet to homes in Cambridge using existing cable television wires. Eventually, they said, the service would be opened to subscribers throughout the Boston metropolitan area. It was a glimpse into our networked future.

Today, PSI's Cable-Internet connection remains a dream for most Cambridge residents: The promised system is more than nine months late. Continental says that these sorts of delays are typical when pioneers try to integrate different kinds of technologies for the first time. The problems, says Will Richmond, Continental's director of business development, lie with "a number of different technologies. I'll decline to be more specific."

Of all the networks that enter our homes, the cable television system bears much more similarity to the gas and electrical networks than to the one with which it hopes to compete: the telephone network. Most homes in New England get their telephone service through a pair of copper wires that are twisted together and travel in more or less a straight line back to the telephone company's central office. With cable television, on the other hand, a single piece of coaxial cable serves all of the subscribers on the same block. This cuts costs, but it also means that any one person can mess up the system for all.



and the natural gas transportation system

THE SINGLE MOST IMPORTANT NETWORK dominating life in the region is probably the New England Power Pool, a network of power companies that moves electricity throughout New England. The network is built mostly from 345,000-volt transmission lines.

Companies such as Boston Edison and Commonwealth Electric belong to the power pool. Each company, in turn, has its own sophisticated network of transmission lines, feeder cables, substations, transformers and both underground and overhead cables for delivering electricity to customers. For the most part, each company's system is redundant: "If one cable should all of a sudden fail, another one kicks in automatically, and the customer's service continues as if nothing ever happened," says Mike Monahan, a spokesman for Boston Edison. (Of course, sometimes there are problems, as when that nor'easter blew in late last month.)

Our power pool is in turn networked with neighboring power systems to form the Northeast Power Coordinating Council. The council, likewise, interconnects with other councils, all the way out to the Rockies. The councils help out each other in time of need: Last January, the New England Power Pool sold excess electricity to the power-hungry Pennsylvania-New Jersey-Maryland Power Pool, using transmission lines belonging to the New York Power Pool. It was one big happy network.

Boston Edison is even using its power lines to carry data. The system, called Power Line Carrier, is currently being used for simple applications, such as reading certain kinds of meters and controlling underground switching equipment, says Dick Hahan, the company's vice president for technology, research and development. Eventually, Hahan says, power utilities might use Power Line Carrier to communicate directly with the customer's big appliances. For example, the utility could broadcast the current price of electricity, and customers could set their washing machine to switch on automatically when the price dropped below a certain level.

The other half of the tie, belongs to Boston Gas,

the Cambridge Gas Company. The biggest part of the project was adjusting manually 700,000 appliances throughout the area — because natural gas burned hotter than manufactured gas. "We had to go around and adjust every stove, every heater, every gas appliance," Frank A. Arricale, the company's director of public information, says.

Since 1989, Boston Gas has been creating a second network of its own: a data network for automatically reading customers' meters. One of the key ingredients in the new system, Arricale says, is a radio-equipped truck that communicates with the meters in people's homes. As the truck drives down the street, it automatically picks up the account number and meter reading of each house. Before the system was installed, Arricale says, a meter reader could "do 200-250 homes in a normal day. We do 25,000 meters a day with one truck."

(Two other important networks are water and sewer; but as they are broken up by municipalities, they don't quite qualify for our categories. Boston had one of the country's earliest municipal water systems: The water came from Jamaica Pond and was distributed through the city in wooden pipes. The River Charles itself provided additional drinking water through the end of the 19th century. Over in Cambridge, things were a bit slower: The Cambridge Aqueduct Company wasn't founded until 1837; the city's sewer system wasn't built for another 20 years.)

80 TO 90 HOURS

Third place

The Internet

AFTER ELECTRICITY AND GAS, MY THIRD MOST important network is the Internet, a so-called "network of networks" that connects my desktop computer with millions of other computers throughout the world.

My connection to the Internet is a tiny Boston company called Terranet. Every day, a telephone in my basement calls Terranet and opens up a connection between my computers and theirs. Moments later, I am cruising around the information superhighway. Typically, I find myself using the Internet between 8 and 12 hours a day; that is,

the Internet to: chat with my wife, exchange mail with editors across the country; submit two articles to Wired magazine and this one to The Boston Globe; download free software from the INFO-MAC archives at the University of Hawaii; read an online magazine; access America Online; find information about building a mixer for my stereo; and sell a pair of (slightly used) Nike sneakers for \$40. I also run my own Worldwide Web server. Some of the things that I use it to "publish" are information about my latest books, my resume and photos of my cats.

Like gas company customers in the 1890s, I pay a set fee: Terranet charges me a flat rate for my Internet connection. The whole connection costs approximately \$100 per month, no matter whether I am sending e-mail to Boston or Japan. There's a movement afoot, though, to charge users for their actual use of the Internet. Users say that could put a damper on things real fast.

10-20 HOURS

Fourth place

The telephone network

BESIDES THE TELEPHONE THAT TIES ME TO the Internet, there are three other telephone lines into my house: personal phones for me and my wife and a line for my computer's fax modem.

Like the electrical system, the nation's telephone system is a network of networks. Nevertheless, the phone system is very different: Instead of moving power from plant to consumer, the telephone network is a mesh designed to interconnect any subscriber with any other. We are all producers and consumers of conversation.

The telephone companies make their living by metering my usage of their networks, but in practical terms, it's difficult to figure out how much of the phone system we actually use. For example, we are not charged for telephone calls that aren't answered, even though they consume network resources. (The US Postal Service, by contrast, charges for letters that aren't delivered.) Sometimes calls within Massachusetts are "free," which means that the cost is included in your monthly

bill. I use my phone for about 10-15 minutes a day, or a little less than 5 hours a week. Obviously, my Internet connection is saving me money in long-distance bills.

The four pairs of twisted copper wires make their way from my house to a New England Telephone central office on Ware Street in Cambridge. There, says Bill Howes, director of Nynex's Centrex/ISDN Major Customer System Group, the sounds of my voice are digitized by an Analog I Unit, then sent into a massive computer called: 5ESS (a fifth-generation electronic switching system). To the 5ESS, the sound of my voice is data no different, in principle, from a file on a floppy disk. The data are transmitted over fiber-optic cables to other 5ESS switches in Cambridge or Boston, depending on where the telephone call bound. Once the data reach their destination, the whole process is reversed.

0 HOURS

Last place

Cable television

MOST CABLE TELEVISION SYSTEMS LOOK remarkably like the natural gas distribution system. Programming material is beamed by satellite to the cable company's headquarters. The television signals are then carried by fiber-optics to each community, where they are then distributed to homes over coaxial cable.

Last winter, I had Continental Cablevision come to my house and install a cable connection. I didn't want to watch MTV: I wanted my high-speed Internet connection. After months of waiting and paying for cable service that I wasn't using, I returned the cable converter box and canceled my service.

Don't get me wrong: I'm not a stick-in-the-mud. I simply prefer renting videos to trying to decode the cable stations. Lately, though, neither my wife nor I has had much time for video entertainment anyway: We're too busy reading e-mail.

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a single piece of copper cable for all the subscribers on the same block. This cuts costs, but it also means that any one person can mess up the system for all.

For example, a few weeks ago one of Continental's subscribers in Cambridge wrapped his Christmas lights around his television. The lights probably didn't affect reception very much, but it was data death for PSI's Internet service. "It just whacked out the cable," says Jeffrey Shapard, PSI's cable-product manager.

These sorts of growing pains are causing some people to wonder if all the hype surrounding the Internet isn't overblown. But the fact is that there's nothing fundamentally new about the Internet. It is, after all, simply another form of network, and we've been surrounded by networks for more than a century. Modern society depends on them.

Webster's Dictionary says that a network is "any set of interlinking lines resembling a net." Nowadays, though, we think of networks as transmission systems that have some form of central control and management. Columbus didn't need a network of boats to reach the New World, but the early railroads quickly developed a network of rail lines in order to prevent collisions. Two lasting legacies of that network are standardized time and time zones.

Last month, I made a list of every network that I use on a regular basis, and the number of hours weekly that I depend on them. The results were surprising.

168 HOURS

First-place tie

New England Power Pool and the natural gas transportation system

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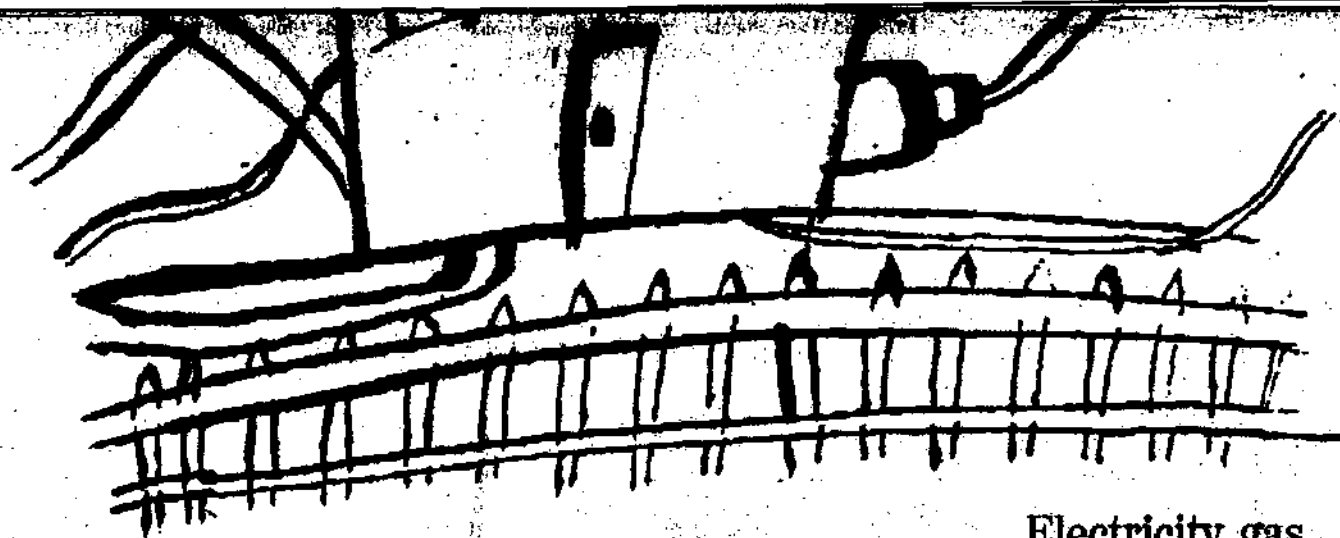
Companies such as Boston Edison and Commonwealth Electric belong to the power pool. Each company, in turn, has its own sophisticated network of transmission lines, feeder cables, substations, transformers and both

the oldest network in New England and the nation's second-oldest gas company.

Founded in 1822 as the City Gas Company, Boston Gas originally manufactured its gas using coal from across the Atlantic in Newcastle, England. Gas wasn't metered; charges were based on the number of burners installed on the premises or the size of the supply pipe. Metering didn't become widespread until after the Boston Meter Works was established in 1849; early meters were the subject of many alleged inaccuracies and abuses.

Probably the biggest change to sweep Boston Gas was the switch from manufactured gas to natural gas between 1953 and 1960. Manufactured gas was a mixture of hydrogen and carbon monoxide, a deadly poison. In order to bring their new product to New England, Boston Gas (known then as Eastern Gas and Fuel Associates) teamed up with other regional providers to create the Algonquin Gas Transmission Company. The biggest part of the project was adjusting manually 700,000 appliances throughout the area - because natural gas burned hotter than manufactured gas. "We had to go around and adjust every stove, every heater, every gas appliance," Frank A. Arricale, the company's director of public information, says.

Since 1989, Boston Gas has been creating a second network of its own: a data network for automatically reading customers' meters. One of the key ingredients in the new system, Arricale says, is a radio-equipped truck that communicates with the meters in people's homes. As the truck drives down the street, it automatically picks up the ac-



whenever I'm not sleeping, eating or otherwise occupied.

Because my computer is constantly connected to the Internet, I can click into my electronic mail program, dash off a message and then return to what I was doing without missing a beat. I know the message will be sent automatically from my computer to Terranet, and from Terranet to its destination without any further attention on my part. It's rather like being able to fax letters to machines that are never busy, and then have the letters delivered automatically to the recipient's desk. Likewise, a little red mailbox flashes in the corner of my screen when mail is waiting for me. Other tools on my computer let me search the Internet for information and download what I find.

My connection to the Internet is one of my most important tools in helping me to lead the life of a free-lance writer. For example, last week I used the Internet to: chat with my wife; exchange mail with editors across the country; submit two articles to Wired magazine and this one to The Boston Globe; download free software from the INFO-MAC archives at the University of Hawaii; read an online magazine; access America Online; find information about building a mixer for my stereo; and sell a pair of (slightly used) Nike sneakers for \$40. I also run my own Worldwide Web server. Some of the things that I use it to "publish" are information about my latest books, my resume and photos of my cats.

Like gas company customers in the 1880s, I pay a set fee: Terranet charges me a flat rate for my Internet connection. The whole connection costs

Electricity, gas,
telephone:
The Internet isn't
the only way
for someone
to be connected

bill, or footed by other subscribers if you are particularly chatty; sometimes calls are metered in message units and sometimes they are individually itemized on the bill.

According to Sprint, the long-distance service, I spent 1,267 minutes on the telephone between Nov. 17 and Dec. 16. This equals roughly minutes a day, or a little less than 5 hours a week. Obviously, my Internet connection is saving me money in long-distance bills.

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