The Creators

Twenty-five years ago, they brought the Internet to life.

By Katie Hafner

In September, 19 middle-aged men gamely crammed themselves onto a bridge at the Christian Science Publishing Society's Mapparium in Boston to pose for a photograph. They were gathered to celebrate the 25th anniversary of the installation of the first node on the Arpanet, the precursor to the Internet. True to an engineer's proclivity to solve problems, even at the risk of seeming meddlesome, they couldn't help but offer some advice to the photographer, who was having a little trouble fitting them all in the shot: Try a different angle. Try a different configuration. Try a different lens. Try a different camera! The years haven't dimmed any of the invention and curiosity that drove these men to rig together the world's first real data network.

Bob Taylor, a psychoacoustician, was director of the computer research program at the Department of Defense's Advanced Research Projects Agency in 1966 when he hit upon the idea of lining computers together. By getting various research sites to share computing resources, Taylor figured he could save some money. Thus, albeit unwittingly, he ignited a revolution. Charlie Herzfeld, Taylor's boss at the time, was head of ARPA and keeper of the purse strings. He liked Taylor's idea and gave him US$1 million to build a small experimental network.

Larry Roberts, a pioneer in computer networking at MIT's Lincoln Laboratory, was considered the only scientist in the country who could put the network together. It took Taylor more than a year to convince Roberts to move to ARPA, but Roberts finally agreed. He designed the original four-node network, which was to be based on packet-switching, as opposed to circuit-switching.

Wes Clark, a gifted computer scientist, came up with the idea for building a separate computer to handle the communications, called an Interface Message Processor. At the same time, computer scientists in the UK, including Roger Scantlebury, were also working on a data network. The Brits coined the word "packet." In 1968, Roberts and fellow ARPA administrator Barry Wessler sent out a request for proposals. Dozens of companies responded. IBM, however, claiming such a network could never be built, declined to bid.

Bolt Beranek and Newman (BBN), a consulting company in Cambridge, Massachusetts, won the bid, and a small team, led by engineer Frank Heart, set out to build the first Interface Message Processor.

Other members of the group included Bob Kahn, a networking theorist; Dave Walden, a programmer; and Severo Ornstein, a hardware whiz who later founded Computer Professionals for Social Responsibility (CPSR). On Labor Day weekend 1969, the communications processor, built from a Honeywell minicomputer, was crated up and flown to the University of California at Los Angeles, which would ultimately become the network's first node. Ben Barker, another hardware designer, wrote "Do it to it, Truett" on the side of the crate. Barker's graffiti was intended for BBN engineer Truett Thach, who accompanied the processor by plane to California.

At UCLA, a group of graduate students - Vint Cerf, Jon Postel, Steve Crocker, and Bill Naylor - worked on connecting the first Interface Message Processor with the university's host computer. The faculty member overseeing the project was Len Kleinrock, who ran the Network Measurement Center, which measured and controlled the flow of packets.

Doug Engelbart, later known for his invention of the mouse, worked at the network's second node, SRI International in Menlo Park, California, and ran the Network Information Center. Roland Bryan brought up the third node at the University of California at Santa Barbara.

Postel would later write the first telnet program. Crocker chaired the Network Working Group, the first organized attempt to develop standards and protocols for the Arpanet and, later, the Internet. Cerf and Kahn went on to develop the Transmission Control Protocol/Internet Protocol (TCP/IP). They worked to get TCP/IP adopted as the undisputed standard among communications languages in the mid-1980s.

The rest, as they say, is history.

In that short history, Vint Cerf is an Old One, a major character whom many consider the true father of the Net. He has been the president of the Internet Society, an international organization devoted to the continued evolution and spread of the Internet, since 1991.

The Internet has been viewed by some as an inspiring example of a postmodern, noncommercial economic success story. So it struck many as ironic that Cerf recently accepted the position of senior vice president for data architecture at tele-giant MCI. Steve Cisler caught up with Cerf to find out what the president of the Internet Society is up to now that he's an MCI vice president.

Wired: Why did you go to MCI?

Cerf:

This was not an easy decision to make, but it was increasingly clear that MCI was really serious about building its share of the global information infrastructure. So in the end I agonized and agonized and decided, well, I've had seven years to fill up my research and development rain barrel, and it's time to go build something. R&D is a way to explore possible systems designs that can be used by real people. But you have to go into the business world to get enough resources to build production systems.

Would you say that MCI's vision of the future is different from, say, that of AT&T or Sprint or the Deutsche Bundespost?

I hope so. MCI certainly sees a very large vertical market - providing information services to particular business and consumer segments - in addition to the important horizontal infrastructure that has traditionally been, and still is, a dominant part of its service.

What are you doing with MCI on a day-to-day basis, and how is that different from what you were doing before?

I was doing research before - and experimentation. Now I am doing architecture for a world-class production information infrastructure. If I'm in town, and not traveling, I'm likely to be online for five or six hours, at least, just plowing through e-mail. I also rely on things like gopher, WAIS, and the World Wide Web.

Do you run into congestion when you're cruising the Internet?

Yes, all the time. I think what this tells us is that we have to learn how to find ways to distribute the load, especially for tens of millions more consumers.

How many users do you think there will be by the end of the decade?

300 million.

That's a lot of growth. Is MCI thinking about how the Internet impacts its core business of long distance?

The Internet is really like basic telephone dial tone, but for computers. It has, in addition, many value-added services that lie atop the basic communication-service infrastructure.

But how does MCI plan to make money on Internet services? Will MCI become an Internet service provider and compete with the likes of Netcom and The Little Garden?

It's possible. MCI is already helping companies build private internets using a variety of switched- and private-line services. MCI is also involved in the public Internet, supplying a variety of underlying services to many Internet service providers worldwide. Local service providers and regional service providers need long-distance parts of the Internet.

While MCI is not in the business of providing bandwidth for free, and millions of new users mean lots of demand for new bandwidth, do you agree with techno-pundit George Gilder that bandwidth eventually will become free?

I don't agree with Gilder. All Internet service providers ultimately have to recover the costs of providing service, including the long-distance parts. It really does cost something to install, maintain, and operate wide-area networks, and the costs must be borne somehow. They may be so widely spread, however, that they may seem free to users sharing the costs.

Too much popularity can kill a site. Do you see this as a problem?

Yes. That's why I think electronic publishers will survive as providers of capacity for online service and as editorial quality-control filters, as in the print medium. It wouldn't surprise me a bit to find people putting up servers for third-party information. That's no different than what CompuServe does.

But right now there's no easy way for me, at the bottom of the information food chain, to be reimbursed by somebody like a publisher at the top who might be making money off of my information. Is there a way to repair this?

Yes, several ways. New methods for capturing transaction data and providing compensation for information are under consideration in the Internet community on an experimental or pilot basis. Many publishers are starting to experiment with delivery of information on the Internet on a compensated basis.

Of course, CompuServe, America Online, and Prodigy, to name three, are examples of services that provide access to information for a price. Building free and compensated information services into the Internet is an important aspect of making the Internet an effective business and information tool.

What other Internet-based problems are you trying to solve?

More than 50 percent of registered networks are on the Internet and the rest are private. They have concerns about protecting, broadly speaking, all of the assets that their host companies had on their internal network. Recently I have been thinking about new architectural features for the

Internet that allow a kind of semipermeable membrane that lets the company put some of its assets in a private setting, so that they're only accessible to other parts of the company or some discretionarily selected group. We still have to find ways of distinguishing between access points.

Do you find this huge recent interest in the Internet surprising?

I have parents come to me and say, "Oh, I just got online, and I can talk to my kids! They are at school and on the Internet, and that's the only way I ever hear from them." They tell me their extended family has been knit together because they are all networked. The thing that I personally found surprising is that the Internet used to be a kind of neat, private thing within this little community, and now all of a sudden the public is here. All of a sudden we ain't special anymore.

How is the Internet now different from what you thought it would be in the beginning?

It was supposed to be a highly robust technology for supporting military command and control. It did that in the Persian Gulf War. But, along the way, it became a major research support infrastructure and now has become the best example of global information infrastructure that we have.

If you had to do the protocols over again, what design changes would you make?

I'd make a much larger address space!!

Katie Haffner (katieh@bga.com), coauthor of Cyberpunks, is a former staff writer at BusinessWeek. She is writing a book for Simon & Schuster on the history of the Internet. Steve Cisler (sac@well.com) *is a senior scientist in the library at Apple Computer Inc., in Cupertino.*