

VANITY FAIR

AN ORAL HISTORY OF THE INTERNET

How the Web Was Won

Fifty years ago, in response to the surprise Soviet launch of Sputnik, the U.S. military set up the Advanced Research Projects Agency. It would become the cradle of connectivity, spawning the era of Google and YouTube, of Amazon and Facebook, of the Drudge Report and the Obama campaign. Each breakthrough—network protocols, hypertext, the World Wide Web, the browser—inspired another as narrow-tied engineers, long-haired hackers, and other visionaries built the foundations for a world-changing technology. Keenan Mayo and Peter Newcomb let the people who made it happen tell the story.

by **KEENAN MAYO** and **PETER NEWCOMB** July 2008

This year marks the 50th anniversary of an extraordinary moment. In 1958 the United States government set up a special unit, the Advanced Research Projects Agency (ARPA), to help jump-start new efforts in science and technology. This was the agency that would nurture the Internet.

This year also marks the 15th anniversary of the launch of Mosaic, the first widely used browser, which brought the Internet into the hands of ordinary people.

Millions of words—multiplied and sent forth by the technology itself—have been written on the world-changing significance of the Internet, for good or ill, and the point hardly needs belaboring. Surprisingly, few books have been written that cover the full history of the Internet, from progenitors such as Vannevar Bush and J. C. R. Licklider up through the entrepreneurial age of our own times. Not many people recall that the first impetus for what became the technology of the Internet had its origins in Cold War theorizing about nuclear warfare.

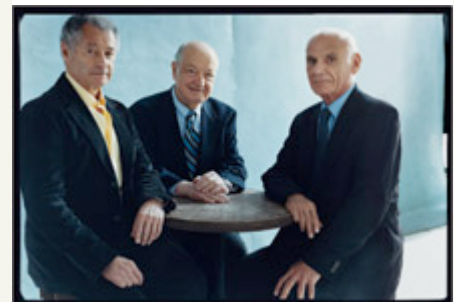
To observe this year's twin anniversaries, *Vanity Fair* set out to do something that has never been done: to compile an oral history, speaking with scores of people involved in every stage of the Internet's development, from the 1950s onward. From more than 100 hours of interviews we have distilled and edited their words into a concise narrative of the past half-century—a history of the Internet in the words of the people who made it.

Chapters:

- I: The Conception**
- II: The Creation**
- III: The Web**
- IV: The Browser Wars**
- V: Going Public**
- VI: Boom and Bust**
- VII: Modern Times**
- VIII: The Last Word**

I: The Conception

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Paul Baran, an electrical engineer, conceived one of the Internet's building blocks—packet switching—while working at the Rand Corporation around 1960. Packet switching breaks data into chunks, or “packets,” and lets each one take its own path to a destination, where they are re-assembled (rather than sending everything along the same path, as a traditional telephone circuit does). A similar idea was proposed independently in Britain by Donald Davies. Later in his career, Baran would pioneer the airport metal detector.

Paul Baran: It was necessary to have a strategic system that could withstand a first attack and then be able to return the favor in kind. The problem was that we didn't have a survivable communications system, and so Soviet missiles aimed at U.S. missiles would take out the entire telephone-communication system. At that time the Strategic Air Command had just two forms of communication. One was the U.S. telephone system, or an overlay of that, and the other was high-frequency or shortwave radio.

So that left us with the interesting situation of saying, Well, why do the communications fail when the bombs were aimed, not at the cities, but just at the strategic forces? And the answer was that the collateral damage was sufficient to knock out a telephone system that was highly centralized. Well, then, let's not make it centralized. Let's spread it out so that we can have other paths to get around the damage.

I get credit for a lot of things I didn't do. I just did a little piece on packet switching and I get blamed for the whole goddamned Internet, you know? Technology reaches a certain ripeness and the pieces are available and the need is there and the economics look good—it's going to get invented by somebody.



Listen: **Paul Baran on the importance of communications during wartime**

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Leonard Kleinrock, a professor of computer science at U.C.L.A., was instrumental in creating the earliest computer networks, in the 1960s. J. C. R. Licklider, one of the fathers of computer science and information technology, was the first director of ARPA's computer-science division.

Leonard Kleinrock: Licklider was a strong, driving visionary, and he set the stage. He foresaw two aspects of what we now have. His early work—he was a psychologist by training—was in what he called man-computer symbiosis. When you put a computer in the hands of a human, the interaction between them becomes much greater than the individual parts. And he also foresaw a great change in the way activity would take place: education, creativity, commerce, just general information access. He foresaw a connected world of information.

The culture was one of: You find a good scientist. Fund him. Leave him alone. Don't over-manage. Don't tell him how to do something. You may tell him what you're interested in: I want artificial intelligence. I want a network. I want time-sharing. Don't tell him how to do it.

Robert Taylor left NASA and became the third director of ARPA's computer-science division. Taylor's chief scientist was Larry Roberts, who oversaw development of the Arpanet. ARPA's director was Charles Herzfeld.

Bob Taylor: Sputnik in 1957 surprised a lot of people, and Eisenhower asked the Defense Department to set up a special

agency, so that we would not get caught with our pants down again.

ARPA was a go-for-broke kind of culture. First of all, it had a lot of carte blanche. If ARPA asked some cooperation from the air force or the navy or the army, they got it instantly and automatically. There was no interagency bickering. It had a lot of clout and little or no red tape. To get something going was very easy.

Leonard Kleinrock: Bob Taylor, who was funding many research computer scientists around the country, recognized that accessing each of the computers was a pain in the neck.

Bob Taylor: There were individual instances of interactive computing through time-sharing, sponsored by ARPA, scattered around the country. In my office in the Pentagon I had one terminal that connected to a time-sharing system at M.I.T. I had another one that connected to a time-sharing system at U.C. Berkeley. I had one that connected to a time-sharing system at the System Development Corporation, in Santa Monica. There was another terminal that connected to the Rand Corporation.

And for me to use any of these systems, I would have to move from one terminal to the other. So the obvious idea came to me: Wait a minute. Why not just have one terminal, and it connects to anything you want it to be connected to? And, hence, the Arpanet was born.

When I had this idea about building a network—this was in 1966—it was kind of an “Aha” idea, a “Eureka!” idea. I went over to Charlie Herzfeld’s office and told him about it. And he pretty much instantly made a budget change within his agency and took a million dollars away from one of his other offices and gave it to me to get started. It took about 20 minutes.

Paul Baran:The one hurdle packet switching faced was AT&T. They fought it tooth and nail at the beginning. They tried all sorts of things to stop it. They pretty much had a monopoly in all communications. And somebody from outside saying that there’s a better way to do it of course doesn’t make sense. They automatically assumed that we didn’t know what we were doing.

HOW THE WEB WAS WON

Chapters:

[I: The Conception](#)

[II: The Creation](#)

[III: The Web](#)

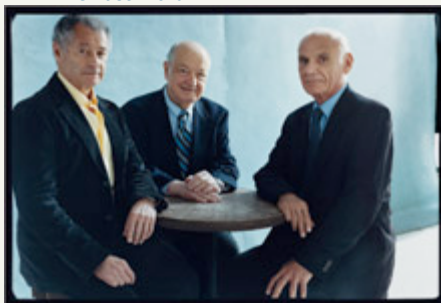
[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



Plus: [See our slide show of Internet pioneers.](#) Photograph by Christian Witkin.

Bob Taylor: Working with AT&T would be like working with Cro-Magnon man. I asked them if they wanted to be early members so they could learn technology as we went along. They said no. I said, Well, why not? And they said, Because packet switching won’t work. They were adamant. As a result, AT&T missed out on the whole early networking experience.

Robert Kahn worked on the technical staff at Bell Laboratories before joining the electrical-engineering faculty at M.I.T. In 1966 he left to become a networking theorist at Bolt, Beranek & Newman, in Cambridge, Massachusetts—where he worked until 1972, when he was named head of ARPA’s computer branch. He teamed with Vint Cerf to devise the TCP and IP networking protocols in the 1970s.

Bob Kahn: Let me put it into perspective. So here we are when there are very few time-sharing systems anywhere in the world. AT&T probably said, Look, maybe we would have 50 or a hundred organizations, maybe a few hundred organizations, that could possibly partake of this in any reasonable time frame. Remember, the personal computer hadn’t been invented yet. So, you had to have these big expensive mainframes in order to do anything. They said, There’s no business there, and why should we waste our time until we can see that there’s a business opportunity? That’s why a place like ARPA is so important.

Best known for founding, editing, and publishing the Whole Earth Catalog, Stewart Brand is a techie anthropologist and a co-founder of the Global Business Network and the Long Now Foundation.

Stewart Brand: This was a time which was pretty much ARPA-derived, in the sense that the money for computers and for networking computers was coming from the government, and from pretty enlightened leadership there. The idea of Arpanet was that it was going to basically join up computational resources. It was not set up primarily to do e-mail—but the computational-resource connection turned out to be not so important, and the e-mail turned out to be the killer app. These were people who were just trying those two experiments, one to try to make the computational resources blend, and the other to stay in touch with each other conveniently. You were inventing in all directions, with no particular certainty what was going to play out.

Anyway, we were all engineers of both ilks, the narrow-tie, nine-to-five serious engineers and the stay-up-all-night long-haired hackers who had earned their way into the respect of the engineers. And pretty much everybody was male.

Next: **II: The Creation**

II: The Creation

In 1969, ARPA gave the job of building “interface message processors” (I.M.P.’s), otherwise known as “nodes” or “packet switches”—the crucial hardware for sending and receiving bursts of data—to Bolt, Beranek & Newman. In a congratulatory telegram to the company, Senator Edward M. Kennedy referred to I.M.P.’s as “interfaith” message processors.

Bob Kahn: They said, We want a network. This would be like a bid for a rocket to the moon—you know, handle a thousand pounds of payload, launch from a vertical liftoff in Florida, bring back something safely.

Larry Roberts: There were two competing bids that were particularly close, BBN and Raytheon. And I chose between them based on the team structure and the people. I just felt that the BBN team was less structured. There wouldn't be as many middle managers and so on.

Bob Kahn: Larry Roberts was an engineer. In fact, Larry probably could have built the Arpanet himself, would be my guess, except there would have been nobody at ARPA to run the program who was capable. When Larry contracted with us at BBN to do it, you know, in some sense he kept his fingers in the pie right through that whole period.

On an eight-month deadline, the BBN team delivered their prototype I.M.P. to U.C.L.A. on August 30, 1969.

Leonard Kleinrock: September 2, 1969, is when the first I.M.P. was connected to the first host, and that happened at U.C.L.A. We didn't even have a camera or a tape recorder or a written record of that event. I mean, who noticed? Nobody did. Nineteen sixty-nine was quite a year. Man on the moon. Woodstock. Mets won the World Series. Charles Manson starts killing these people here in Los Angeles. And the Internet was born. Well, the first four everybody knew about. Nobody knew about the Internet.

So the switch arrives. Nobody notices. However, a month later, Stanford Research Institute gets their I.M.P., and they connect their host to their switch. Think of a square box, our computer, connected to a circle, which is the I.M.P., 5, 10 feet away. There's another I.M.P. 400 miles north of us in Menlo Park, basically at Stanford Research Institute. And there's a high-speed line connecting those two. We are now prepared to connect two hosts together over this fledgling network.

So on October 29, 1969, at 10:30 in the evening, you will find in a log, a notebook log that I have in my office at U.C.L.A., an entry which says, “Talked to SRI host to host.” If you want to be, shall I say, poetic about it, the September event was when the infant Internet took its first breath.



Listen: Len Kleinrock on building the first computer networks

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Bob Kahn: More than a year and a half later there were really no fully operational sites. And the reason was that, in order to get on, you had to implement interfaces, you had to build protocols, you had to connect it to your operating systems, you had to connect it to your applications. It was a job for wizards. My conclusion was that we needed to do something to stimulate people. So I talked to ARPA about doing a demonstration, and they made arrangements with the organizers of the very first International Conference on Computer Communication. It was very exciting. People would come in to see what was going on. If you had to pick an analogy, I'd almost liken it to Kitty Hawk.

Vint Cerf, who worked with Leonard Kleinrock at U.C.L.A., is the co-designer (with Bob Kahn) of the TCP and IP protocols that provide the basic linking structure of the Internet. He is now an executive at Google, where his title is "chief Internet evangelist."

Vint Cerf: One of the features of this Arpanet is that the machines that were connected to it were time-shared. The idea of leaving files for each other was pretty common in the time-sharing world. A guy named Ray Tomlinson, at Bolt, Beranek & Newman, figured out a way to cause a file to be transferred from one machine through the Net to another machine and left in a particular location for someone to pick up. He said, I need some symbol that separates the name of the recipient from the machine that the guy's files are on. And so he looked around for what symbols on the keyboard were not already in use, and found the "@" sign. It was a tremendous invention.

Robert Metcalfe, who worked on the Arpanet at M.I.T., went on to invent Ethernet and to found 3Com. He is also the progenitor of Metcalfe's Law: as the number of users on a network grows, the value of that network increases exponentially. Metcalfe was given the job of demonstrating the Arpanet system at its coming-out party, at the I.C.C.C. meeting at the Washington Hilton, in 1972.

Bob Metcalfe: Imagine a bearded grad student being handed a dozen AT&T executives, all in pin-striped suits and quite a bit older and cooler. And I'm giving them a tour. And when I say a tour, they're standing behind me while I'm typing on one of these terminals. I'm traveling around the Arpanet showing them: Ooh, look. You can do this. And I'm in U.C.L.A. in Los Angeles now. And now I'm in San Francisco. And now I'm in Chicago. And now I'm in Cambridge, Massachusetts—isn't this cool? And as I'm giving my demo, the damned thing crashed.

And I turned around to look at these 10, 12 AT&T suits, and they were all laughing. And it was in that moment that AT&T became my *bête noire*, because I realized in that moment that these sons of bitches were rooting against me.

To this day, I still cringe at the mention of AT&T. That's why my cell phone is a T-Mobile. The rest of my family uses AT&T, but I refuse.

As networking grew, so did the number of distinct networks. Across the Atlantic, French computer scientist Louis Pouzin was building his own Arpanet, called Cyclades. A packet-switched satellite network (Satnet) was developed. Foreseeing the chaos of multiple networks that could not communicate, Bob Kahn and Vint Cerf designed the Transmission Control Protocol (TCP), in 1973. The term "Internet" has its roots in TCP, which is a way of interconnecting networks.

Larry Roberts: After we built the Arpanet, lots of people built networks. Everybody was competing. Everyone had their own thing that they wanted to do. So it became very important that the world have one protocol, so they could all talk to each other. And Bob Kahn really pushed that process. And Vint. And it wasn't licensed. They proved to the world that making something free as a driver would make a huge difference in making it a standard.

Vint Cerf: The Arpanet demonstrated the effectiveness of packet switching. And it demonstrated that it was possible to get heterogeneous computers to talk to each other through a single common packet-switched net. What Bob Kahn and I did was to demonstrate that with a different set of protocols you could get an infinite number of—well, infinite is not true, but an arbitrarily large number of—different heterogeneous packet-switched nets to interconnect with each other as if it was all one big giant network. TCP is the thing that makes the Internet the Internet.

We absolutely knew what could happen if our work was successful. We knew about the mobile possibilities. We knew about satellite. We had some idea of how powerful this was. What we didn't know was the economics of it.

In the decade after TCP was introduced, the Internet was embraced by university researchers and other early adopters. The roots of Web culture can be traced to the USENET and bulletin boards that evolved in this era. In 1977, Apple Computer, Inc., founded by engineers and hobbyists Steve Jobs and Steve Wozniak, introduced the Apple II, one of the first personal computers (priced at \$1,200). In 1981, IBM launched a rival model, IBM PC.

Bob Metcalfe: In the early days there were these big computers. They cost millions of dollars and they occupied entire rooms. And there was usually one or two per city. Then personal computers came along, Apple in the late 70s. But mostly, the big event was IBM in August of 1981. That was a huge event. Because those P.C.'s became business tools. It went from the university into business. And it wasn't a consumer phenomenon for a long time after that.

In 1985, a company called Control Video hired Steve Case, a product manager at Pizza Hut, to help market its fledgling electronic-gaming service. In a few years Case became its chief executive and pushed the company further into interactivity and communications. The company was ultimately re-christened America Online, and the catchphrase "You've got mail" became a salutation for a generation of computer users.

Steve Case: We always believed that people talking to each other was the killer app. And so whether it was instant messaging or chat rooms, which we launched in 1985, or message boards, it was always the community that was front and center. Everything else—commerce and entertainment and financial services—was secondary. We thought community trumped content.

The biggest breakthrough that drove the success of the medium was getting P.C. manufacturers to bundle modems into their P.C.'s. We tried for several years with all of them, but finally convinced IBM to do that in 1989. Up until then modems were viewed as a peripheral.

The arrival of e-mail was followed quickly by the arrival of "junk" e-mail, or spam. Gary Thuerk, a marketer for Digital Equipment Corporation, sent the first spam into the Arpanet in 1978—it was an open invitation to two product demonstrations in California. (The Ferris Research technology group estimates that the global cost of combating unwanted e-mails will reach \$140 billion in 2008.) As late as 1988, e-mail was still far from widely used—nearly all traffic was either academic or military-oriented. In that year Ronald Reagan's former national-security adviser John Poindexter was indicted for his role in the Iran-contra scandal, and his trial was one of the first to bring e-mail into the courtroom. Dan Webb was the prosecuting attorney in U.S. v. Poindexter.

Dan Webb: I didn't really know what e-mail was, to be honest with you. All of a sudden these top-ranking government

officials were communicating back and forth with each other with amazing candor just as if they were in a conversation. And it opened my eyes to what, in effect, was a stunning change in the way evidence gets presented. What we're always doing is we have witnesses, and we're trying to reconstruct past historical events through the imperfection of recollection. All of a sudden you have these things called e-mails, where there's a verbatim record of what was actually communicated at a point in time.

Steve Case: I remember when our growth suddenly accelerated. There were so many people who were trying to get into AOL that we weren't able to handle the demand. And for one particular period, I think for 23 hours, the whole system was down. In just a short few years we went from a business nobody knew anything about or cared about to suddenly being such a part of everyday life that the system was down for a day and it was a major national story. It was like the water system was down or the electricity system was down.

When the Internet started to become a truly globalized system, the potential threats to it became more insidious—interconnectivity is both a strength and a weakness. The first significant attack came on November 2, 1988, in the form of the so-called Morris Worm, created by a Cornell graduate student named Robert Tappan Morris. Keith Bostic, a computer programmer then at Berkeley, was one of those who tracked Morris down.

HOW THE WEB WAS WON

Chapters:

I: The Conception

II: The Creation

III: The Web

IV: The Browser Wars

V: Going Public

VI: Boom and Bust

VII: Modern Times

VIII: The Last Word



Plus: See our slide show of Internet pioneers. Photograph by Christian Witkin.

Keith Bostic: Basically, Robert Morris finds a couple of security problems in Unix systems and figures he can write a worm. He's a student. He's not being malicious here. Fires that sucker off. And unfortunately he makes a pretty boneheaded programming error. Instead of doing what he intended, which was kind of, you know, to wander around the Net and have a good time, it just pretty much shut down all the network systems.

Morris became the first person indicted under the Computer Fraud and Abuse Act. He was eventually fined more than \$10,000 and sentenced to three years' probation and 400 hours of community service. Mark Rasch, then the top computer-crime lawyer at the Justice Department, was the prosecuting attorney in U.S. v. Morris.

Mark Rasch: From a law-enforcement perspective our concern is to figure out (a) is this deliberate activity?, (b) is it criminal?, and if so, who's responsible? I wish I could say that it was heavy detective work and things like that. By the time he told us, we already knew. If you recall, his father was the chief scientist for the National Computer Security Center, at the National Security Agency. And he told

his father, and his father, through a back channel, told other government officials. I don't take a cynical view of it. He told his father because he was a scared 20-year-old kid. His father told other people because it was the right thing to do, so that the government wouldn't over-react and think this was, you know, the Soviets.

It didn't destroy any information. It didn't even corrupt any information. All it did was make copies of itself. On the other hand, while it was running it basically made 10 percent of the computers on the Internet unusable for a period of anywhere between a few hours to a few days. Military installations took themselves off the grid.

It was a watershed event. If somebody who wasn't even trying to do something bad could do this, imagine what someone evil can do.

Morris himself is now a professor of computer science at M.I.T.

Robert Morris: I'd rather not talk about it—sorry.

Next: [III: The Web](#)

Previously: [I: The Conception](#)

III: The Web

In 1991, CERN, one of the world's largest physics laboratories, based in Geneva, introduced the World Wide Web, a vast document-linking structure developed by the British scientist Tim Berners-Lee and his Belgian colleague Robert Cailliau. This robust new global-information resource made possible the emergence of "browsers"—software used to navigate the Web and maneuver through text and images on-screen. The first browser to take off was Mosaic, created by Marc Andreessen, a student at the University of Illinois. Entrepreneur and Silicon Graphics founder Jim Clark soon took notice and partnered with Andreessen to create Netscape Communications.

Robert Cailliau: The Web is actually a coming together of three technologies, if you like: the hypertext, the personal computer, and the network. So, the network we had, and the personal computers were there, but people didn't use them, because they didn't know what to use them for, except maybe for a few games. What is hypertext? It is a method of giving a text more depth, structuring it, and letting the computer help you explore it. Links, like we know today—you see some blue underlined word and you click on it and it takes you somewhere else. That's the simplest definition of hypertext.

Lawrence H. Landweber is a professor emeritus of computer science at the University of Wisconsin. In 1979 he founded CSNet, which connected universities without access to the Arpanet.

Lawrence Landweber: What do people use networks for? They use e-mail. They send files around. But until '93 there's no killer application that would draw in real people. I mean, people who are not academics or not in the technical industries. The World Wide Web turns the Internet into a repository, the largest repository of information and knowledge that's ever existed. Suddenly, people who want to check on the weather or keep track of the stock market—suddenly, there's a wealth of stuff you can do.

Robert Cailliau: We looked for a name for several weeks and couldn't come up with anything good, and I didn't want yet another one of these stupid things that doesn't tell you anything. In the end Tim said, Why don't we temporarily call it the World Wide Web? It just says what it is.

At one point CERN was toying with patenting the World Wide Web. I was talking about that with Tim one day, and he looked at me, and I could see that he wasn't enthusiastic. He said, Robert, do you want to be rich? I thought, Well, it helps, no? He apparently didn't care about that. What he cared about was to make sure that the thing would work, that it would just be there for everybody. He convinced me of that, and then I worked for about six months, very hard with the legal service, to make sure that CERN put the whole thing in the public domain.

Marc Andreessen: Mosaic was built at the University of Illinois. I was an undergrad student, but I was also a staff member at the National Center for Supercomputing Applications, which is basically a federally funded research institute. When Al Gore says that he created the Internet, he means that he funded these four national supercomputing centers. Federal funding was critical. I tease my libertarian friends—they all think the Internet is the greatest thing. And I'm like, Yeah, thanks to government funding.

Mosaic was a side project that one of my colleagues and I started in our spare time, for several reasons: One, we didn't think the real project we were working on at the time was going to go anywhere. And, two, all this interesting stuff was happening on the Internet. And so we basically said to ourselves, you know, if a lot of people are going to connect to the Internet, if only

because of e-mail, and if all the P.C.'s are going to be going graphical, then you've got this whole new world where you're going to have a lot of graphical P.C.'s on the Internet. Somebody should build a program that lets you access any of these Internet services from a single graphical program.

It sounds obvious in retrospect, but at the time, that was an original idea. When we were working on Mosaic during Christmas break between 1992 and 1993, I went out at like four in the morning to a 7-Eleven to get something to eat, and there was the first issue of *Wired* on the shelf. I bought it. In it there's all this science-fiction stuff. The Internet's not mentioned. Even in *Wired*.



Listen: Marc Andreessen on developing the first web browser

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Sky Dayton founded EarthLink, an Internet-service provider, in 1994.

Sky Dayton: I owned a couple of coffeehouses in L.A., and I had a computer-graphics company that I co-owned. And I heard about this thing called the Internet. I thought, That sounds kind of interesting. The first thing I did is I actually picked up the phone and dialed 411, and I said, I'd like the number for the Internet, please. And the operator is like, What? I said, Just search any company with the word Internet in the name. Blank. Nothing. I thought, Wow, this is interesting. What is this thing anyway?

Jim Clark: I worked for a long time at Silicon Graphics, trying to build a competitive computer company, but eventually got frustrated. So in early '94, I resigned and left the board and walked away from \$10 million worth of stock options. Just left it on the table. The day I resigned, I met Marc Andreessen.

One of the things that struck me at that early embryonic state was that the Internet was going to mutate the newspaper industry, was going to change the classified-ad business, and change the music business. And so I went around and met with *Rolling Stone* magazine. I met with the Times Mirror Company, Time Warner. We demonstrated how you could play music over this thing, how you could shop for records, shop for CDs. We demonstrated a bunch of shopping applications. We wanted to show the newspapers what they were going to undergo.

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[II: The Creation](#)

[III: The Web](#)

[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



Jann Wenner is the founder and editor of Rolling Stone.

Jann Wenner: Jim and Marc set up a demonstration. I'd never seen a hyperlink before. I don't think anybody had. And it was kind of drop-dead amazing. That you could click on this blue, highlighted, underlined word and then, *bam*, go to a whole new level of information was dazzling. So I said, Look, this is fantastic, I get it, but I don't want to go through the cost of building a Web site. We didn't have the staff or the technology, let alone the money, to do such a thing. But I would invest in two seconds. And I actually sent them a check, but they sent the check back. They said, If you don't build a Web site, we're not taking your money.

Lou Montulli, the creator of the early Internet browser Lynx, was one of the



Plus: See our slide show of Internet pioneers. Photograph by Christian Witkin.

founding engineers at Netscape and, later, Epinions.com (now Shopping.com). He co-founded Memory Matrix.

Lou Montulli: Jim had the Jedi mind trick, the ability to convince you of pretty much anything. And he really filled our heads up with the idea that we can go and we can change the world—and we’re going to make a buttload of money doing it.

Initially, of course, there was no entry from Microsoft, so Netscape very, very quickly took over the entire browser market. We went from zero to more than 80 percent in a year. The thing that really drove it home for me as to how much impact we were having on the world is the first time I saw the “http” on a prime-time television show. Here’s this thing that probably a year earlier nobody in the world has ever heard of, and now they’ve got a U.R.L. on a prime-time commercial: Hey, come to our Web site and check this out.

Jim Clark: Sometimes, you know, you just happen to be at the right place at the right time. Once we went public, everyone—everyone—had a new idea. We basically created the late-90s boom in technology stocks, and it became out of control, as you know.

Vint Cerf: Suddenly, the genie is out of the bottle.

Next: **IV: The Browser Wars**

Previously: **II: The Creation**

IV: The Browser Wars

By 1995 the Netscape Navigator browser dominated the market. On December 7, 1995, Microsoft C.E.O. Bill Gates gave a speech to his employees outlining Microsoft’s aggressive new approach to the Internet. He named Netscape as a target and rallied a team of top-notch programmers to build Internet Explorer. The event is known in the industry as Pearl Harbor Day.

Lou Montulli: From a scientific point of view none of us really respected Microsoft. There was definitely a sense of: They’ve put out of business three or four major companies, and they did it simply by copying what they did and outpricing or outmaneuvering them in the market. This is a general feeling of computer scientists everywhere, that Microsoft doesn’t tend to innovate as much and really just enters the market late, takes it over, and then stays at the top.

Thomas Reardon was 21 years old when Bill Gates offered him a senior position at Microsoft, in 1991. Reardon became a program manager for Internet Explorer.

Thomas Reardon: I was the first at Microsoft to know about Netscape. I remember calling down there and saying, Hey, I’m with Microsoft, and I’m looking around at all these people who started Web browsers because I think we’re going to do one inside of Windows and we want to know if we might look at your technology as a source for this, do a license deal, or we buy your technology. And they told me basically to go fuck off.

In June 1995, Microsoft dispatched representatives, including Reardon, to Netscape’s corporate offices in Silicon Valley to discuss browser technology.

Thomas Reardon: I know it sounds like I was big bad Microsoft. You have to remember I was 24 years old here, so I wasn’t exactly a captain of industry. The big meeting that people have talked about that was really at the heart of the government’s anti-trust trial is a meeting we had in June. We tried to have a relationship with Netscape.

Gary Reback, with the firm Carr & Ferrell, in Palo Alto, was Netscape’s lawyer and would be instrumental in persuading the

Justice Department to prosecute Microsoft.

Gary Reback: A group of Microsoft executives came down to Netscape and had a meeting, and the Microsoft people in effect said that if you're going to make a browser that can serve as a platform for new applications it's going to be all-out war with us. But if you want to do something smaller, that just hooks in with our stuff, we'll give you the non-Microsoft part of the market to work with. And we'll sort of draw a line, and you'll have part of the market and we'll have part of the market.

HOW THE WEB WAS WON

Chapters:

[I: The Conception](#)

[II: The Creation](#)

[III: The Web](#)

[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



Plus: See our slide show of Internet pioneers. Photograph by Christian Witkin.

Thomas Reardon: The government's argument that we went down there Mafia-style, telling Netscape that they have to do a deal with us or they were going to find a dead-horse head in their bed in the morning—it was kind of absurd. It turns out Marc was sitting in the meeting, taking notes on his laptop. They had contacted this famous anti-trust lawyer, Gary Reback. They had been working with him. They kept asking us these really loaded and weird questions. We thought we were down there for a business meeting, technology meeting, engineering meeting. And then they ended up taking all the minutes of that meeting, you know, and sending it out to this anti-trust attorney, who then turned it over to the D.O.J. that night. It was just a bunch of bullshit.

Hadi Partovi was the group program manager for Internet Explorer at Microsoft. He later co-founded Tellme Networks and is president of iLike. Jim Barksdale was Netscape's president.

Hadi Partovi: Both Marc Andreessen and Jim Barksdale were trash-talking basically. I mean, there was a competition between the companies, but it got to the point where they felt they were far enough ahead that they might as well

trash-talk to build up the perception that these guys are going to win. On the one hand, you know, they were the David and we were the Goliath. On the other hand, Internet Explorer only had 5 percent market share in the Web-browser world, and nobody had even heard of it when we started out. And it definitely got people's competitive juices up. Marc Andreessen had said something along the lines of "Windows will be reduced down to being a poorly debugged bag of device drivers." And what that means is basically the relative value of Windows will be pretty much meaningless.

Thomas Reardon: Andreessen said that Windows was just a piece of shit. Well, that became a call to arms for us. We had this famous meeting called the Pearl Harbor Day meeting that year. Bill was going from talking about the Internet to: O.K., now we need a battle plan. The Internet Explorer team went from 5 people to 300.

Hadi Partovi: I personally printed out the strongest quotes from the Netscape people, with their faces, so if you walked down the hallway of the Internet Explorer team, you'd see the faces of one of these Netscape executives and what they said.

Jim Clark: Microsoft was making it very clear that they were going to kill us. We were trying to negotiate deals where Compaq and Gateway and all these P.C. manufacturers would bundle our Web browser. And Microsoft threatened them. Microsoft threatened them that if they did they would revoke their license to Windows. So, needless to say, everyone backed off.



*Listen: **Jim Clark on the fight between Netscape and Microsoft***

[PLAY](#) | [PAUSE](#) | [STOP](#)

Thomas Reardon: We had an intensely competitive battle. We were releasing browsers every six months. The amount of software that got written in relation to the Web in that period of time was just insane.

For two and a half years Internet Explorer ate away at Netscape's lead. The Browser Wars reached a pivotal moment when Microsoft offered Internet Explorer as a free feature in Windows.

In 2000, U.S. District Court judge Thomas Penfield Jackson ruled that Microsoft had illegally held a monopoly on Windows and used it as a platform to crush competitors such as Netscape. He ordered that Microsoft be broken into two companies. In 2001 a federal appeals court upheld his ruling, but reversed the order to split up the company. Later that year Microsoft reached a settlement with the U.S. Department of Justice, which permitted the bundling of Internet Explorer into Windows on the condition that users could choose other browsers as well.

Next: **V: Going Public**

Previously: **III: The Web**

V: Going Public

Thomas Reardon: As Netscape and Microsoft were having this grand battle, the entire world was saying, Holy shit, this Web thing is really a big deal! And we can build businesses around it! The Web itself is growing just as maniacally as our own efforts!

Of all the "old media" tycoons, few were as quick to grasp the power of the Internet as Barry Diller. Diller transformed QVC, his home-shopping television channel, into an interactive Web enterprise. Today, Diller presides over more than 60 Web businesses, including Ticketmaster, the personals site Match.com, and the online travel agency Expedia.

Barry Diller: I started using a P.C. earlier than most, and it led to me discovering something that I referred to as interactivity, a word that I obviously made up. I started getting involved in the primitive convergence of technology three years before the World Wide Web. When the Web actually came along, I was already in the directly predecessor world.

It was one dumb step in front of the other. I wasn't interested in travel. What happened is, I said, Oh, my God. What a great idea to colonize travel by the Internet. What a great idea. And so we did it, and it turned out rather well. There were no road maps or signposts. You were making it up every day.

Jeffrey P. Bezos, a former analyst for the New York hedge fund D. E. Shaw, created the online bookstore Amazon.com in 1995. Based in Seattle, it is currently the world's largest online retailer.

Jeff Bezos: The Web was growing at about 2,300 percent a year. I made a list of 20 different products that you might sell online. I picked books because books are very unusual in one respect. And that is that there are more items in the book category than there are items in any other category, by far. There are millions of different books active and in print. I was also looking for something that you could only do on the Web. And having a bookstore with universal selection is only possible on the Web. You could never do it with a paper catalogue. The paper catalogue would be the size of dozens of New York City phone books, and it would be out of date the second you printed it. And you could never do it in a physical store. You know, the largest book superstores carry about 150,000 titles, and there aren't very many that big.

When we launched, we launched with over a million titles. There were countless snags. One of my friends figured out that you could order a negative quantity of books. And we would credit your credit card and then, I guess, wait for you to deliver the books to us. We fixed that one very quickly.



Listen: **Jeff Bezos on raising money and the venture capital scene**

[PLAY](#) | [PAUSE](#) | [STOP](#)

The Internet auction site eBay was created in 1995 by Pierre Omidyar, a French-born Iranian computer programmer, and it now has some 276 million registered users in 39 countries. (Not everything can be bought on eBay; restrictions cover many items, including lottery tickets, locksmithing tools, and human body parts.)

Pierre Omidyar: By '94, '95, the first technology to make Web pages interactive had come out. I was really interested in the theory of markets, this idealistic theory that says if you have an efficient marketplace, then goods are traded at their fair value. So finally I came on this notion that with the Web, with the interactivity of it, we could actually create a place, a single market, where people from all over the world could come together and actually trade with full information on a level playing field and do business with one another regardless of who they were. And so that's when I sat down, frankly, over Labor Day weekend in September of '95, and wrote the original code for what I called Auction Web—very rudimentary.

I founded it on the notion that people were basically good, and if you give someone the benefit of the doubt, you'll rarely be disappointed. I think what eBay has shown is that, in fact, you can trust a complete stranger.

Jeff Bezos: When we started out, we were packing on our hands and knees on these cement floors. One of the software engineers that I was packing next to was saying, You know, this is really killing my knees and my back. And I said to this person, I just had a great idea. We should get kneepads. And he looked at me like I was from Mars. And he said, Jeff, we should get packing tables.

We got packing tables the next day, and it doubled our productivity.

In 1994, Stanford classmates Jerry Yang and David Filo launched Yahoo, an early Web portal and search engine. It remains one of the most visited sites on the Internet.

Jerry Yang: The challenge was always trying to keep up with what users were expecting and what they wanted. We remember counting the number of different countries that used Yahoo in the early days, and it didn't take too long before 90-plus countries around the world were using Yahoo without even our telling people about it. So it was just total word of mouth.

David Filo: When we first started, we had no revenue and we didn't really have any definitive plans for how we would make money. It was probably six months after we started the company that we got our first check from advertising. In those early days there was obviously a big question whether we could really continue to support its development.

Craigslist, a network of online communities featuring mostly free classifieds, was set up in San Francisco in 1995 by Craig Newmark, a former software engineer. Craigslist today has some 40 million monthly users worldwide.

Craig Newmark: I really did grow up as a nerd. In high school I really did have thick black glasses taped together. I really did wear a plastic pocket protector. This is not an exaggeration. And I felt left out all the time. Nowadays, I remember that feeling, and I want everyone to be included, and that's something we work on every day on the site.

In 1994, I was at Charles Schwab. I was looking around the Net, and I could see a lot of people helping each other out, and I

thought I should do some of that. So I started a simple c.c. list, 10 or 12 people, told people about arts and technology events.

Then people started suggesting maybe putting out an occasional job or something to sell. And I said, Hey, how about apartments? And, boy, that worked out well until May of '95, at which point the c.c.-list mechanism broke at about 240 addresses. I had to give it a new name. I was going to call it SF Events, but people around me said they already called it Craigslist, that I had inadvertently built a brand, and that I should stick with it.

I'd say our style is basically just, well, flea market. People have stuff to do, they've got to do it, no business-speak, just getting the job done. The site is about as mundane as you can make it. It deals with everyday life, but sometimes there are people who just really need to reach out to people, and sometimes our site works out for that. The best example might be the way people re-purposed our New Orleans site during Katrina, because immediately survivors started notifying their friends and family using our site to tell people where they wound up. At the same time, friends and family were looking for survivors by asking on the site, Hey, has anyone seen so-and-so?

One of the earliest ventures in online journalism was Slate magazine, created under the aegis of Microsoft by Michael Kinsley, a prominent columnist, a former editor of The New Republic, and a former co-host of the television program Crossfire.

Michael Kinsley: I read in *Newsweek* that [Microsoft C.E.O.] Steve Ballmer was quoted saying he's looking to hire, quote, big-name journalists, unquote, to sort of shepherd their journalism on the Web. This was the summer of 1995. I knew him slightly, so I e-mailed him and said, Am I by any chance a big-name journalist? And next thing I knew I was out at Microsoft.

People thought I was being very daring. David Gergen—I remember telling him, and his famous google eyes popped open. He couldn't believe it, that anyone would essentially give up television as well as print to go out into the Internet.

The only thing we were up against was *Salon*. They were our only competition. Oh, but dealing with Microsoft was—Microsoft was great in the sense that they did the key thing, which is pay for it. But getting them acquainted with a writer's contract! They originally wanted us to make every writer sign three different documents which warranted the accuracy of everything they said and indemnified Microsoft. They even wanted us to get anyone interviewed to sign a release indemnifying Microsoft.

So there were 18 different ways that they just didn't get it. On the other hand, on the committee that interviewed me was my future wife, so Microsoft is forgiven everything.

Vinod Khosla created Sun Microsystems with Stanford classmates Scott McNealy and Andy Bechtolsheim, and Bill Joy. He later joined the venture-capital firm Kleiner Perkins Caufield & Byers, one of Silicon Valley's premier investment shops.

Vinod Khosla: The media people essentially did not think the Internet would be important or disruptive. In 1996, I got together the C.E.O.'s of 9 of the 10 major newspaper companies in America in a single room to propose something called the New Century Network. It was the C.E.O.'s of *The Washington Post* and *The New York Times* and Gannett and Times Mirror and Tribune and I forget who else. They couldn't convince themselves that a Google, a Yahoo, or an eBay would be important, or that eBay could ever replace classified advertising.

Pierre Omidyar: I remember clearly in the early days when there was a community of Barbie-doll collectors. They found eBay sort of all at once. And I'll never forget, we had an early focus group in late '96, and one of the guys who came to our focus group was a truckdriver—he actually did long-haul truckdriving across the country—and when people were introducing themselves, going around the room, he says, I'm a truckdriver and I collect Barbies.

And then later there were Beanie Babies. Around the time that we went public we disclosed in our filing that Beanie Babies

accounted for 8 percent of the inventory on the site.

The Internet made possible new forms of self-promotion. A former model on The Price Is Right and a “fembot” in the Mike Myers film Austin Powers: International Man of Mystery, Cindy Margolis shot to fame in the 1990s as the world’s “most downloaded woman” (according to the Guinness Book of World Records).

Cindy Margolis: A lot of my success had to do with timing. In 1996, it was all about the Internet. I recognized it, embraced it, and went for it with everything I had. I wasn’t just a small part of Internet history. Hell, I started it all. Who do you think coined the phrase “cyberbuddies”? Before MySpace, YouTube, and Facebook—even before Yahoo and Google—became household names, *Extra*, the television show, took photographs from several of my recent swimsuit shoots and posted them on America Online. An idea started forming in this crazy little head of mine. If people were that excited about seeing my pictures, then why couldn’t I just post them myself? As it turned out, I could.

The Smoking Gun, a Web site that posts primary documents such as legal filings, arrest records, and mug shots, was created in 1997 by William Bastone, the former Mafia reporter for The Village Voice; his wife, Barbara Glauber, a graphic designer; and Daniel Green, a writer and editor.

Bill Bastone: When you obtain police records or F.B.I. memos or affidavits, oftentimes, for a print journalist, you end up using small portions of documents and the remainder still ends up being unbelievably fascinating. The narrative can be, you know, funny and profane and, maybe, not suitable for a family newspaper.

My idea was always that there can be a life for this material online. If I personally get a kick out of these documents, there could very well be other people out there who would find it interesting or bizarre, or whatever—they’re looking at things that the normal person wouldn’t be able to obtain.

We launched the site on April 17, 1997. I didn’t have an e-mail address. I remember actually faxing out like 40 press releases on paper. Boy, what a retard: I’m sending you a fax to let you know about this Web site that we just started.

The role of the Internet as the bottom of the food chain for news and gossip was illustrated and reinforced by the events that led up to the impeachment of President Bill Clinton. The allegation that Clinton had pursued a sexual relationship with a White House intern, Monica Lewinsky, was first circulated by the online Drudge Report after Newsweek declined to publish a story on the same subject by Michael Isikoff. Mike McCurry was the White House press secretary when the Lewinsky story broke.

HOW THE WEB WAS WON

Chapters:

[I: The Conception](#)

[II: The Creation](#)

[III: The Web](#)

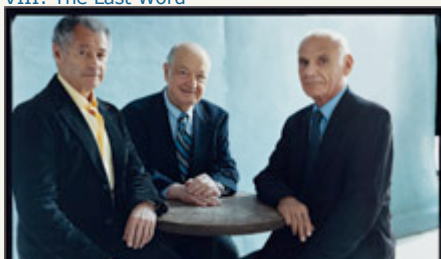
[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



Mike McCurry: My memory is that whatever was on Drudge appeared over a weekend. The first I heard about it would have been on Monday morning at what is called “the gaggle,” which is a much less formal gathering of the White House press corps in the office of the press secretary. And my recollection is that Ann Compton asked, Do you know anything about, you know, some stories we’re picking up that may implicate the president, and, you know, it’s kind of a troubling matter. Something innocuous like that. And I remember shooting her a look and saying, “Is ABC asking me that question based on ABC’s report?” “Oh, no, no, no, no, no, not that. I just, you know, it was just, some things going around.”

It would have been bad form for any White House correspondent to cite Drudge as a source for anything—there was a lot of tsk-tsking at the time about how



Plus: See our slide show of Internet pioneers. Photograph by Christian Witkin.

awful, how dreadful, that we have this Matt Drudge out there who just has no editorial standards.

Remember, we're talking January 1998, and the Internet had not blossomed into the robust information source that it is now. I mean, we had barely started a White House Web site, and there was nothing friggin' on it.

As the day developed, the day the story broke, I was told that this is about Clinton and Monica Lewinsky, and I said, You mean Monica—you mean the large intern? And someone said yeah, and I remember just breaking out laughing. It was like, This is so wildly improbable that maybe finally we're going to be able to put the rumor-mongering to bed once and for all.

Even just telling this story makes it sound like ancient times, doesn't it?

The impeachment controversy led to a great deal of online political organizing and fund-raising, on both right and left. One of the most significant new ventures was the liberal group MoveOn.org, started by computer entrepreneurs Joan Blades and Wes Boyd, co-founders of Berkeley Systems.

Joan Blades: Wes and I were in a Chinese restaurant hearing yet another table talking about the insanity of having our government obsessed with the scandal when there were other, important things the government might be doing. And we wrote a one-sentence petition: Congress must immediately censure the president and move on to pressing issues facing the nation.

We sent that out to under a hundred of our friends and family, in essence to sign it and pass it along. And within a week we had a hundred thousand people sign that petition. This was in '98. I don't think anything like that had ever happened before on the Internet. And very shortly we had half a million people. So we had the proverbial tiger by the tail.

Wes Boyd: I think the biggest shock for us, and it was from the very beginning, was not: Oh, boy, these big people are paying attention to us. It was that there are no big people; it's up to all of us. And that's a very scary thing, you know, when you realize what a vacuum there is in many ways in politics.

Next: **VI: Boom and Bust**

Previously: **IV: The Browser Wars**

VI: Boom and Bust

The dot-com boom of the 1990s was epitomized by the initial public offering of Netscape Communications, in August 1995; on the opening day of trading, Netscape's stock price almost doubled in value. Before long, Silicon Valley was the scene of the most frenzied investing in modern times. Some companies, such as Amazon.com and eBay, had realistic business models; many other start-ups did not. Record losses soon followed. Between March 10, 2000, and October 10, 2002, the NASDAQ Composite Index, which lists most technology and Internet companies, lost 78 percent of its value.

Hadi Partovi: There were so many start-ups where they'd have a fund-raising party. The company basically would have a business plan and a PowerPoint, no technology. They'd raise \$10 million and then there'd be like \$250,000 or \$500,000 blown away just on the party.

Jeff Bezos: Many of those companies didn't spend the money in a thrifty way. They would raise \$25 million with a single phone call and then spend half of it on Super Bowl ads.

Hadi Partovi: Most investors didn't understand the Internet. They just knew that these things that have "dot-com" next to them were worth a lot and were going to be really big someday, and they missed the last one. I remember DrKoop.com. And I

remember they were losing money, I think \$10 million a month or some crazy amount, and they still had an I.P.O. of almost a billion dollars, something really ridiculous.

Rich Karlgaard's Upside magazine was the first to cover the Silicon Valley start-up scene.

Rich Karlgaard: The hottest job title during the frothy days was—you'd see 25-year-olds who had the title of "vice president, business development." It was like sales without the quota. I remember asking one of these V.P., biz-dev guys how his company was doing, and he says, "Oh, it's great, we're into our third round of financing." And I said, Well, how about the revenue side? Are you profitable? He says, "We're a pre-revenue company."

Vinod Khosla: You know, the dot-com crash was mostly a crash about stock-market perceptions, not about actual growth. If you look at data traffic on the Internet between 2000 and 2001, 2002, 2003—all the way to 2008, there hasn't been a down year. People think of the dot-com crash, but it wasn't a crash in the usage of the Internet.

Gary Reback: Silicon Valley had been through boom times for sure, but nothing like that Internet boom. Companies were going public—you couldn't get a corporate lawyer in Silicon Valley. Big law firms were bringing in lawyers from Cleveland, literally. You couldn't get an underwriter.

The Valley was in such a boom that it was crushing our infrastructure. You couldn't go out for lunch, because there'd be no parking spaces. The streets would be clogged to get there. You couldn't get a reservation. People stopped scheduling meetings during the day because it was like Los Angeles. It was a system out of control.

Pets.com, which sold pet supplies and accessories, is now mainly remembered for its 1999–2000 national sock-puppet advertising campaign. The company shut its doors in late 2000. Julie Wainwright was the C.E.O.

Julie Wainwright: When we went public we raised just under \$80 million. We always had a plan for profitability and the company was exceeding its goals. In the first full year of operation we were going to hit about \$50 to \$55 million in revenue. But it became clear that we wouldn't be able to close the gap, so I shut it down in November 2000 and actually returned money to shareholders. I didn't run into bankruptcy.

People think we spent tons of money in advertising. And we didn't, because I only ran ads in key markets. But people fell in love with the sock puppet. It captured people's imaginations. When you start thinking about what Pets.com did in that short time period—we actually exceeded PetSmart and Petco and became the No. 1 brand online.



Listen: **Julie Wainwright discusses the rise and fall of Pets.com**

[PLAY](#) | [PAUSE](#) | [STOP](#)

Jeff Bezos: I think the only thing I ended up with out of that investment is a sock puppet. An expensive sock puppet.

Rich Karlgaard: And after it all, there was a bumper sticker you'd see in Palo Alto: "Dear God, one more bubble before I die."

With more and more businesses coming online, the Internet underwent an enormous build-out of its underlying infrastructure. Companies such as Global Crossing and Qwest Communications laid down thousands of miles of fiber-optic

cables to accommodate the high-bandwidth services that define today's Web.

Although the United States has never experienced a full-scale attack on communications such as the one anticipated by Paul Baran, the destruction of the World Trade Center on September 11, 2001, had the effect of putting a portion of the Internet under stress. The network adapted easily. Craig Partridge is a chief scientist at BBN Technologies (formerly Bolt, Beranek & Newman).

HOW THE WEB WAS WON

Chapters:

[I: The Conception](#)

[II: The Creation](#)

[III: The Web](#)

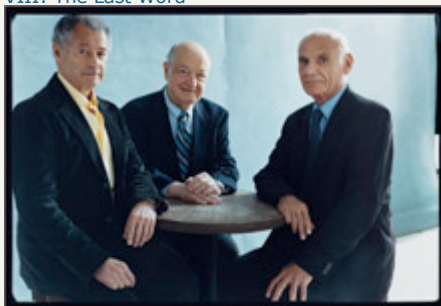
[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



Plus: [See our slide show of Internet pioneers.](#) Photograph by Christian Witkin.

Craig Partridge: When the towers came down, they took out the communications infrastructure that ran underneath them. Power went off in southern Manhattan. A large number of data hotels that support Wall Street suddenly found themselves without power and had to deal with outages. Data hotels are basically large air-conditioned spaces with a lot of power in them where you can rent racks of computing space.

In terms of the Internet, what we saw was the towers come down, and suddenly data connectivity within chunks of Wall Street, *bam*, forget it, good-bye, shot. Data connectivity in weird parts of the world came apart because it was dependent, knowingly or unknowingly, on the communication lines running under the towers. The most notable instance of that is you couldn't get traffic across South Africa. In some parts of the Third World it's cheaper to get a line that goes under the ocean than to get a terrestrial line within certain poor areas, and so you end up connecting countries that are adjacent by running lines—it used to be to New York; I'm told now France is a popular place.

But if you look within about two hours of the worst outages, the Internet was running almost entirely back to normal. Backup routing systems found backup links. The data hotels found power, got themselves back on. The brokerages—many of them had backup locations in the Midwest or the West Coast, and many of the houses were back online within minutes of the disaster.

People used the Internet heavily on 9/11. You couldn't call your friends in D.C. or Boston or New York within about an hour or so, because the cellular system was overloaded, so people started reaching out via the network. The Internet became extremely important. It was suddenly the key source of news: What do I do? What do I need to be worrying about?

Next: [VII: Modern Times](#)

Previously: [V: Going Public](#)

VII: Modern Times

In 1998, two Stanford students, Sergey Brin and Larry Page, unveiled their prototype of an Internet search engine that they believed outperformed anything else available at the time. They gave it the quirky name Google (from the mathematical term "googol," or 10 to the 100th power). Today, Google dominates the search-engine business.

Larry Page: One of the first things we did was just understand the relative importance of things. It used to be in the early days when you did a search for, say, a university, if you did that on an early search engine like Alta Vista, you would get pages that just said university like three times in the title. It was based on looking at the text of the documents—that was the traditional way of doing it.

We said, Well, given you have all these documents on the Web, why don't we try to figure out in general which ones are more

important than others, and then return those? Even in the very early days when we were at Stanford, you could type “university” into Google, and you actually got the top 10 universities. I think that basic notion really helped us a lot.

In a sense, it’s humans who do the ranking. It’s just that we capture everybody’s ranking. We looked at things like: How many people link to this Web page? How do they describe it? What’s the text they use in the link itself? You can capture the collective intelligence of all the people who are writing Web pages and use that to help the people who are searching. We use an automated mechanism for capturing all that. It’s a sort of group intelligence. That’s a powerful idea.

Steve Jobs returned to Apple in 1997 to help revive its sagging fortunes. Among his early initiatives: the iMac, a one-piece, candy-colored computer that made easy Internet use the cornerstone of its design. Four years later, Apple introduced the iPod and the online music store iTunes. For the music business, already reeling from widespread piracy, it was an embarrassing blow. The persona and outlook of Steve Jobs were parodied in the popular blog the Secret Diary of Steve Jobs; its author was eventually revealed to be a Forbes writer named Daniel Lyons.

Fake Steve Jobs: All these music companies saw this coming years ago—they saw digital distribution coming. The genie was out of the bottle when they started doing CDs and distributing digital music that could be copied anyway, right?

They saw digital downloads coming; they saw Napster; they knew that they had to create a legal and workable alternative. And if you could do one that was easy to use and simple, you know, the bet was that people would pay for it, if you made it, you know, convenient. But the record guys were all either stupid or lazy or frightened, and just sat there with their thumbs up their ass and, like, couldn’t get out of their own way to figure out how to do it. Or each one wanted to do their own store, or whatever.

But I really think that Apple came along and took all the risk. Apple said, O.K., we’ll invest in making this hardware device and in making a store, and running that store, and making all these deals, and working with all you scumbags and assholes in the music business. We’ll put on our asbestos suit and deal with you people, right, to be able to, like, sit in the same room and breathe the same air that you criminals in the music industry, you retarded criminals, do, right?

The online encyclopedia Wikipedia, which is written and edited by voluntary contributors, was launched in 2001 by former options trader Jimmy Wales. From the outset the encyclopedia had to confront the problem of maintaining accuracy—with thousands of volunteers—and of combating bias and even outright malice.

Jimmy Wales: How do you innovate a social community—social rules and norms that allow for good-quality work to take place? What you have to balance there are, on the one hand, if a Web site is essentially a brutal police state where every action could easily result in random blocking or banning from the site and nobody can trust anything—that doesn’t work. Complete and total anarchy, where anyone can do anything, also doesn’t work. It’s actually the same problem we face off-line. It’s the problem of living together. It’s the problem of a good city government.

Long before Matt Drudge and Arianna Huffington became household names, journalist Dave Winer wrote what is widely credited to be one of the first Web logs, or blogs. His motivation? The independent software developer wanted to get his voice out—unexpurgated. His journal, called Scripting News, has been publishing since 1997.

Dave Winer: The press is very susceptible to conventional wisdom. The press buys into certain things being true that really aren’t true. The conventional wisdom was that Apple was dead and there was no new software for Macintosh. Yet I was a software developer making new software for the Macintosh. So I went to bat for Apple.

That was the reason why I got so heavy into blogging—I didn’t want the verdict of the press to be the last word. And I’d argue that the same thing is happening now in politics. Today it’s: Is Reverend Wright really a disaster for the Obama campaign?

Well, the press seems to think so, but if we want to get a different story out there we're going to have to do it ourselves.

Today, there are more than 113 million blogs on the Web. Elizabeth Spiers was the founding editor of Gawker, a Manhattan-centric media-and-gossip blog. She was also the founder of the Web site Dealbreaker and the editor of Mediabistro.

Elizabeth Spiers: Nick Denton and I started Gawker as a 10-hour-a-week hobby. It really wasn't supposed to be a full-time business. Initially, we were publishing seven days a week.

The voice on Gawker was a conscious imitation of things I liked. Among recent contemporary media, I liked *Spy* magazine and Suck.com in particular. *Private Eye* in the U.K. And I liked straight satire. In that vein, Mark Twain's "A Humane Word from Satan" is sort of the ideal. To a lesser extent, the voice on Gawker was similar to my own. I have a dry wit and tend to be naturally skeptical, but I like mischief-making, and it was easy to have a good time with the things Gawker was supposed to be covering. Did I personally care about the Condé Nast cafeteria? No. Did I think it would be fun to act as if it were The Most Important Institution of Our Time, infiltrate it, and then write about it, explaining the supposed mystique in light of that assumption? Yes.

South Africa-born Elon Musk took to computing early, writing the code to a game called Blaster at the age of 12. In 1999, he launched X.com, an online financial-services site that had an electronic payment service that eventually merged with Confinity, which had a similar service called PayPal. Today Musk is, among other things, in the forefront of the private-sector rocket industry.

Elon Musk: It came to me that the Internet was going to be something that changed the very nature of humanity. It was like humanity getting a nervous system. It's as if each of the cells in the human organism had access to all the information, the cumulative information, of humanity. And it's very difficult to hide information. If it was possible to do a conspiracy in the past, it's very hard to do a conspiracy now.

Given that money is low-bandwidth, it's digital, it seemed like there should be something innovative that was possible in that arena. When you think about it, the vast majority of the financial system is just entries in a database. And transferring money is pretty simple—all we do is change one entry in the database and update another entry. All you need is a unique identifier like an e-mail address. By the end of the first year we had a million customers.

Former Vermont governor Howard Dean, currently the chair of the Democratic National Committee, was a Democratic presidential candidate in 2004 and the first contender to make sustained use of the Internet as an organizing tool, in particular through Meetup.com, a Web site that brings social groups together online.

Howard Dean: My initial reaction was H, blank, blank, blank, S, blank, blank, blank. I can remember the exact moment. My chief aide for many years was a woman named Kate O'Connor. And she kept talking to me about Meetup, and she said, You know, you're No. 5 on Meetup, and I said, What the hell is Meetup? And she explained to me what Meetup was, and then she said I was No. 4, and then two weeks later I'd be No. 2.

We actually went to a Meetup, and then I realized that there were six or eight hundred groups around the country like the one I first went to, on Essex Street in New York, Lower East Side. The thing is, I was introduced to the Net in ways most politicians are not introduced to the Net. I was introduced to the Net as a community, which it is. Very few politicians have understood that it's not an A.T.M. machine. It's a community of people. It's the beginning of two-way campaigns.

The Internet is the most important democratizing invention since the printing press, 500 years ago. The Internet is remaking American politics, and the Republicans are in big trouble because of this. American politics is no longer a top-down

command-and-control business, which people in Washington can't get over. But it's true. If young people want to get something done, they go on the Net. They find out some information. They find an affinity group—or if they don't have one, they start an affinity group.

And so when we started all this stuff, we hired a bunch of really smart 25-year-olds who I think slept under their desks. The real key is trusting people in local areas to do the right thing and giving them the resources to do their job.

In 2002, former Netscape engineer Jonathan Abrams created a new movement in Internet activity with his “social networking” site Friendster. While Friendster emerged as a darling of Silicon Valley, it was eventually overtaken in the U.S. by the hipper MySpace, founded by Tom Anderson and Chris DeWolfe. Another rival emerged with the cleaner, college-student-friendly Facebook, founded in a Harvard dorm in 2004 by Mark Zuckerberg, Dustin Moskovitz, and Chris Hughes. Abrams is the founder and current C.E.O. of Socializr.

Jonathan Abrams: Before Friendster, people who had a profile online were either a geek or somebody on a dating site, and the sites did have a stigma. People would sign up for traditional dating services like Match.com and then hope all their friends never saw their profile. I wanted to flip that upside down and create a service where you would actually deliberately invite your friends to use it with you. One of the analogies was that it was like a cocktail party or a nightclub.

There's been a whole generation of sites and services that have been influenced by Friendster. The cost of that is that every day I get all these friends' requests from all these different sites. And it's not just LinkedIn, Facebook, and MySpace. I now get somebody who wants to follow me on Twitter and somebody who wants to be my friend on Pounce and they want to be my friend on Yelp. And they want to be one of my buddies or contacts on Flickr and they want to subscribe to my channel on YouTube.

Before Friendster this silly concept of saying, Is this person your friend, yes or no?, I don't remember it. That's the overwhelming and slightly annoying legacy of Friendster.

Chris DeWolfe: One of the big differentiators of MySpace, and one of the really cool things, is that we've enabled self-expression, and that a person's profile really becomes an online expression of who they are in the off-line world. They can customize their profile through colors and photos and the music they have playing in the background. That was one of the really big drivers. Young people craved this self-expression and craved the ability to be unique.

Mark Zuckerberg: It's really interesting to see what kind of things happen when people are able to stay connected and communicate efficiently. I don't know if you saw this story from Colombia, where we launched Facebook in Spanish for the first time. Colombia really started to take off in usage, and when they reached critical mass, the first thing that a lot of people started doing was they started using the decentralized communication medium to start organizing and protesting against the armies there.

Chad Hurley, a former graphic designer at PayPal, started YouTube in 2005 with his PayPal colleague the engineer Steve Chen. It was one of the first media sites entirely driven by user-generated content. According to The New York Times, in 2007 YouTube consumed as much bandwidth as the entire Internet did in 2000. (User-generated adult sites have quickly risen in popularity as well. YouPorn—unaffiliated with YouTube—gets more traffic than CNN.com. Overall, the online porn business generates some \$2.8 billion annually.)

Chad Hurley: We just saw an opportunity where we had digital cameras, we had cell phones that had video capabilities, we had these video files sitting on our desktops—but there weren't any services out there dealing with storing and serving these videos, making it easy for people to share them.

We started concentrating on short clips because we saw them building the largest audience for online video. It wasn't necessarily about a high-quality, full-length, full-screen experience. In the experience that people have online—between checking e-mails and visiting different Web sites and reading articles—we saw a quick opportunity to add a bit of video.

There were already other video sites out there defining what the audience would want, and not allowing them to interact or even upload their own videos. We allowed everyone to put their content online. Every minute on our site we receive over 10 hours of video.



Listen: **Chad Hurley on the creation of YouTube and user-generated content**

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Andy Samberg, now in his third season as a cast member of Saturday Night Live, is best known for his SNL Digital Shorts, created with writers Jorma Taccone and Akiva Schaffer. Samberg and S.N.L. castmate Chris Parnell were responsible for the first YouTube sensation, the rap video "Lazy Sunday," which aired on December 17, 2005. It was viewed five million times before NBC asked YouTube to remove it.

Andy Samberg: Pretty much my first memory of the Internet was going into chat rooms and pretending to be weirdos, right? It was, like, the safest prank, because it was before anyone could, like, track you or anything. If the Internet and video on the Internet existed when we were kids, we definitely would have been posting all our stupid stuff on YouTube. The more people are turning to it, the more viable it's becoming. If you make a video that gets circulated a ton and people think it's hilarious, you are in certain circles famous, you know what I mean?

It took several years for Silicon Valley to shake its hangover after the bubble burst, in late 1999. But with the rise of the social networks and new Web companies like YouTube, frothy evaluations are on the rise again, a trend some have dubbed "Web 2.0." A former Goldman Sachs investment banker, Gina Bianchini, is the C.E.O. and co-founder (with Marc Andreessen) of Ning, which allows people to create their own socially oriented Web sites without having to write code.

HOW THE WEB WAS WON

Chapters:

[I: The Conception](#)

[II: The Creation](#)

[III: The Web](#)

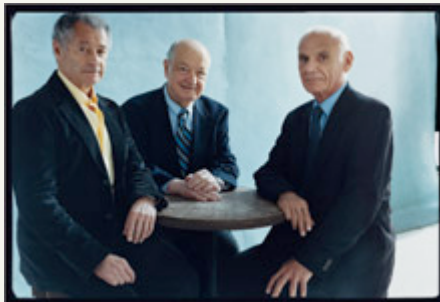
[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



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Gina Bianchini: When you look at the history of any new medium, it takes a decade or more for people to figure out what the native behavior of that medium is. For the first 15 years of television, they were actually filming radio shows. And it really took 10 to 20 years to start seeing native TV programming like the *Today* show, which nobody thought was going to be successful because people didn't watch television the first thing in the morning. What's becoming very, very clear—and really why we started Ning—was when you look at what the fundamental or native behavior of what the Internet is, it's social. It is two-way communication.

Unlike a MySpace, which really came out of this concentrated L.A. music-and-hot-chick scene, or Facebook, which came out of a dorm at Harvard, what's been interesting about Ning is that we basically have this service and this platform that we throw out there and say, Hey, anybody can create whatever social network they want and spread it virally through invitations and sharing and embeddable widgets and things like that.

pioneers. Photograph by Christian Witkin.

I wouldn't consider it crazy to say that there will be millions of social networks. They will be for every conceivable purpose in every conceivable country. Today, we have registered users in 220 countries. Forty-six percent of our traffic is outside the United States.

In 2007, CNN partnered with YouTube to create the "YouTube Debates," which allowed computer users to upload questions for the candidates—one indication of the Internet's increasing grip on American politics. Howard Dean won't publicly say which candidate is the most Internet-savvy, but the answer is Barack Obama. Chuck Todd is the political director of NBC News and the former editor of the political Web site the Hotline.

Chuck Todd: Obama basically is Dean 2.0, and like any successful 2.0, sometimes you actually have to rename the entire software. Microsoft got rid of the Windows, called it XP. Now we call it Obama rather than Dean. The Internet was Obama's only path—he had to be successful doing it this way, because the party, the old-school party infrastructure, was behind the brand name Clinton. He had to figure out how to expand the electorate. He had to figure out how to change the rules, and to change the rules he had to figure out how to create this technological marvel that is the Obama campaign.

The other thing the Obama people understand is that to make the Internet work you have to close your eyes and say, O.K., I'm going to let something like that go. You've got to be willing to not have centralized control.

Next: **VIII: The Last Word**

Previously: **VI: Boom and Bust**

VIII: The Last Word

The underpinnings of the Internet trace back in part to concerns about national security. In October of this year the nation's newest military endeavor, the United States Air Force Cyber Command, is set to commence operations. The command will employ a force of 8,000—mostly tech-savvy civilians such as physicists, computer scientists, and electrical engineers. Major General William Lord is the commander.

HOW THE WEB WAS WON

Chapters:

[I: The Conception](#)

[II: The Creation](#)

[III: The Web](#)

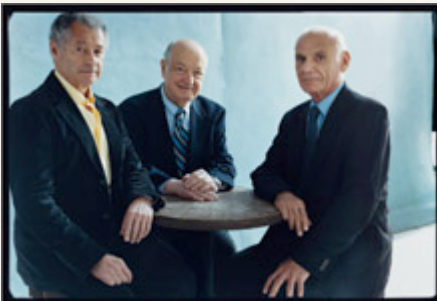
[IV: The Browser Wars](#)

[V: Going Public](#)

[VI: Boom and Bust](#)

[VII: Modern Times](#)

[VIII: The Last Word](#)



Plus: [See our slide show of Internet pioneers.](#) Photograph by Christian Witkin.

Major General William Lord: There are cyber-terrorists, there are cyber-criminals, and potentially there are even nation-states. I don't happen to view the nation-states as the 800-pound gorilla in the room. I think that the cyber-terrorists and the cyber-criminals are much more problematic. The fact that a 12-year-old in the Philippines can affect global markets with the release of one virus, all of a sudden it's kind of a wake-up call.

We don't want to be in the middle of monitoring the Internet. What we have been focusing on in the air force is really the defense of our networks, the defense of our ability to use the entire electromagnetic spectrum to conduct air-force operations. As you see in some of our ads, we show you a Predator flying over a combatant area that is being controlled from the United States—that's a long, long thin thread that we need to be able to protect. It's a worldwide operation that's in air and space and terrestrial networks. It connects 500,000 people together, and probably 3,000 aircraft, and an untold number of spacecraft.

Vinod Khosla: Communication always changes society, and society was always organized around communication channels. Two hundred years ago it was mostly rivers. It was sea-lanes and mountain passes. The Internet is another form of communication and commerce. And society organizes around the channels.

Paul Baran: At the beginning there was a different attitude than today. Now everyone is concerned about making money, or reputation. It was different then. We all wanted to help one another. There was no competition, really, on most things. It was a total open flow of information. There were no games. There are so many others who did equally good work, and their names are just forgotten. We were all a bunch of young whippersnappers.

Bob Metcalfe: It was nerd city.



Listen: **Bob Metcalfe on the Internet, past and present**

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