

# Roads and Crossroads of the Internet History

By Gregory Gromov, 1995. Updated: 1998, 2005, 2012

## Internet History with a Human Face



Photo by Hakon Wium Lie

*A comprehensive and fascinating overview of the philosophy and history of the Internet.*

~ [Magellan Internet Guide, 1996](#)

### Table of Contents:

#### [Chapter 1. Internet Before World Wide Web](#)

Internet before Web - Atlantic cable, Sputnik, ARPANET, "Information Superhighway", ...

#### [Chapter 2. Web as a Side Effect of Physics Experiments](#)

World Wide Web was born in CERN ...

#### [Chapter 3. Next Crossroad of World Wide Web History](#)

Web as a NextStep of PC Revolution ... from Steven P. Jobs to Tim Berners-Lee

#### [Chapter 4. Birth of the World Wide Web - Browser Wars, ...](#)

Birth of the Web, Tim Berners-Lee, R. Cailliau, Marc Andreessen, Browser Wars, ...

#### [Chapter 5. Early History of Hypertext](#)

Vannevar Bush's hyperlink concept, Ted Nelson coins the word Hypertext, ...

#### [Chapter 6. "Living History" of Hypertext.](#)

Hypertext Saga of Theodor Holm Nelson: The Fate of Thinking Person in Silicon Valley ...

#### [Chapter 7. "Xanadu" Plan](#)

The Nelson's Xanadu Plan to build a better World Wide Web

#### [Chapter 8. Growth of the Internet: Statistics](#)

Statistics of the Internet & World Wide Web: Hosts, Domains, WebSites, Traffic, ...

#### [Chapter 9. Conclusion](#)

What is the nature of World Wide Web?

About This Book: [As They Said It](#)

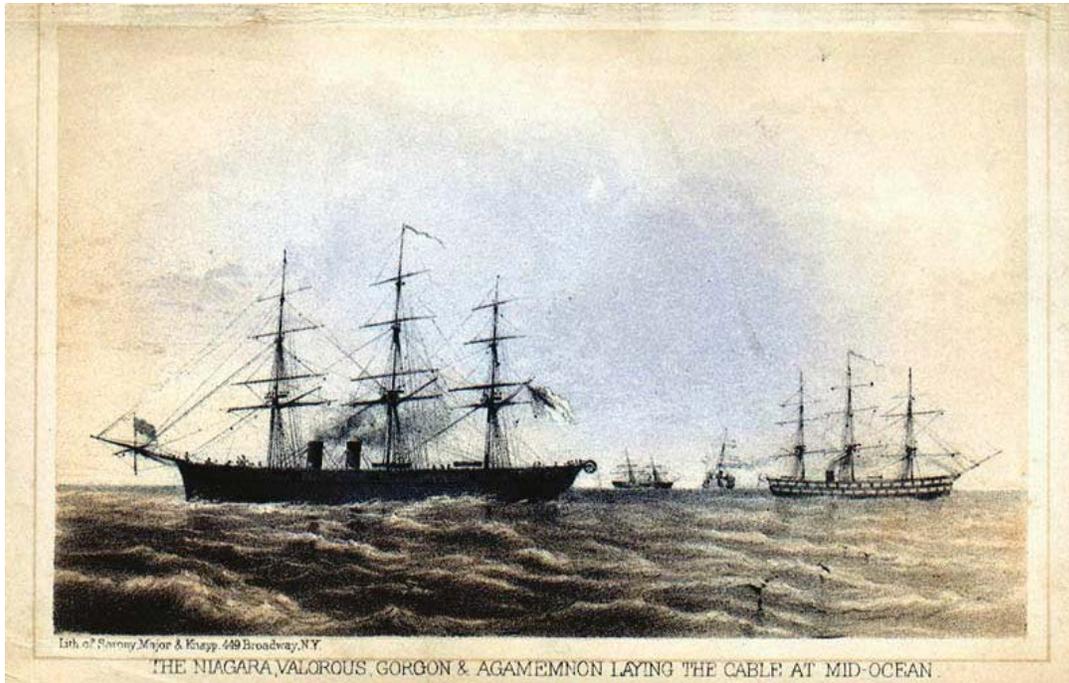
Citation Index: [1995 - 2012](#)

### Chapter 1. Information Age Starting Milestones

## 1858:" In the beginning was the Cable..."

The Atlantic cable of 1858 was established to carry instantaneous communications across the ocean for the first time.

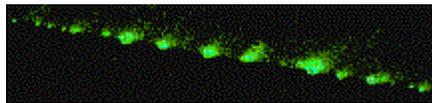
The manufacture of the cable started in early 1857 and was completed in June. Before the end of July it was stowed on the American "Niagara" and the British "Agamemnon" -- both naval vessels lent by their respective governments for the task.



Although the laying of this first cable was seen as a landmark event in society, it was a technical failure. It only remained in service a few days. Subsequent cables laid in **1866** were completely successful and compare to events like the moon landing of a century later... the cable ... remained in use for almost 100 years.

~ Smithsonian's National Museum of American History.

## 1957: Sputnik has launched ARPA



President Dwight D. Eisenhower saw the need for the Advanced Research Projects Agency (ARPA) after the Soviet Union's launch of [Sputnik](#).

**1957** - *October 4th* - the USSR launches Sputnik, the first artificial earth satellite:



1958 - February 7th - In response to the launch of Sputnik, the US Department of Defense issues directive **5105.15** establishing the Advanced Research Projects Agency (ARPA).

The organization united some of America's most brilliant people, who developed the United States' first successful satellite in 18 months. Several years later ARPA began to focus on computer networking and communications technology.

In 1962, Dr. J.C.R. Licklider was chosen to head ARPA's research in improving the military's use of computer technology. Licklider was a visionary who sought to make the government's use of computers more interactive. To quickly expand technology, Licklider saw the need to move ARPA's contracts from the private sector to universities and laid the foundations for what would become the ARPANET.

The Atlantic cable of **1858** and Sputnik of **1957** were two basic milestones of the Internet prehistory. See also: [Telecommunications and Computers preHistory](#)

### The Internet as a tool to create "critical mass" of the intellectual resources:

To appreciate the importance the new computer-aided communication can have, one must consider the dynamics of "critical mass," as it applies to cooperation in creative endeavor. Take any problem worthy of the name, and you find only a few people who can contribute effectively to its solution. Those people must be brought into close intellectual partnership so that their ideas can come into contact with one another. But bring these people together physically in one place to form a team, and you have trouble, for the most creative people are often not the best team players, and there are not enough top positions in a single organization to keep them all happy. Let them go their separate ways, and each creates his own empire, large or small, and devotes more time to the role of emperor than to the role of problem solver. The principals still get together at meetings. They still visit one another. But the time scale of their communication stretches out, and the correlations among mental models degenerate between meetings so that it may take a year to do a week's communicating. There has to be some way of facilitating communication among people without bringing them together in one place.

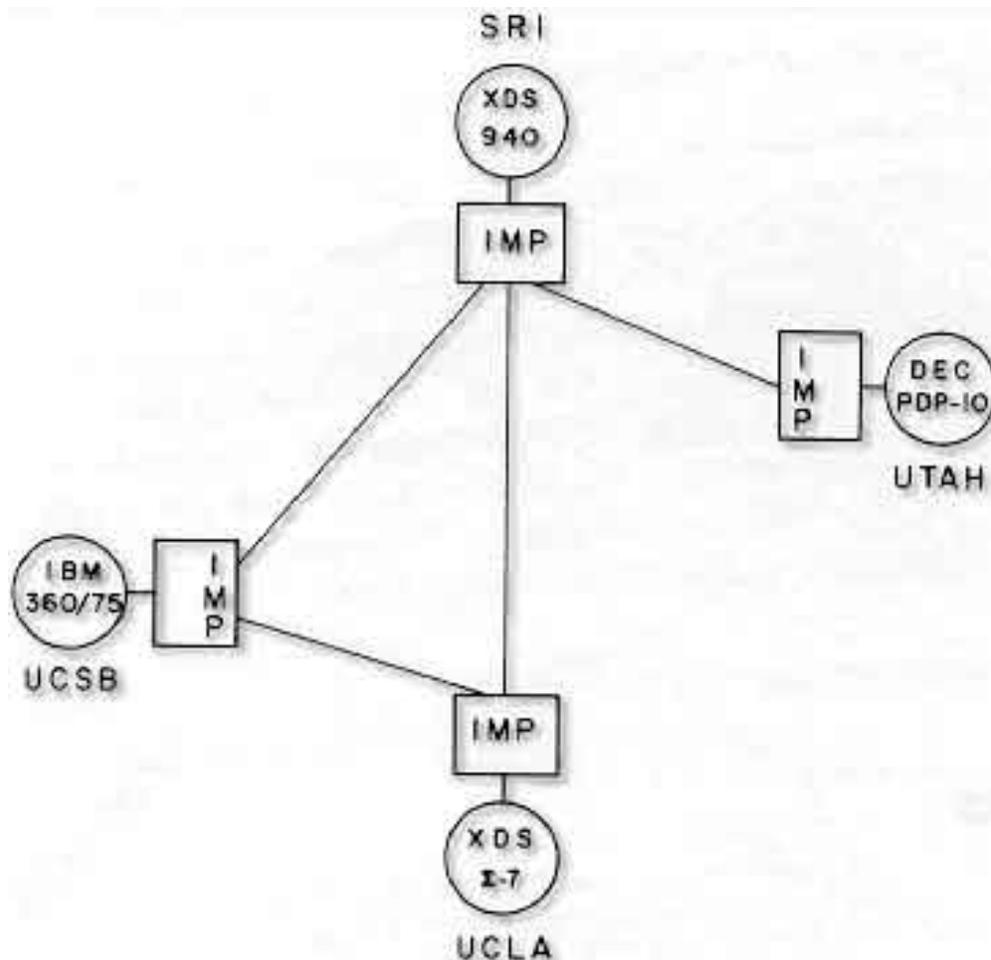
The Computer as a Communication Device by J.C.R. Licklider, Robert W. Taylor, Science and Technology, April 1968.

The visible results of Licklider's approach comes shortly ...

## 1969: The first LOGs: UCLA -- Stanford

According to [Vinton Cerf](#), the UCLA people proposed to DARPA to organize and run a Network Measurement Center for the ARPANET project...

Around Labor Day in 1969, BBN delivered an Interface Message Processor (IMP) to UCLA that was based on a Honeywell DDP 516, and when they turned it on, it just started running. It was hooked by 50 Kbps circuits to two other sites (SRI and UCSB) in the four-node network: UCLA, Stanford Research Institute (SRI), UC Santa Barbara (UCSB), and the University of Utah in Salt Lake City.



The plan was unprecedented: Kleinrock, a pioneering computer science professor at UCLA, and his small group of graduate students hoped to log onto the Stanford computer and try to send it some data. They would start by typing "login," and seeing if the letters appeared on the far-off monitor:

"We set up a telephone connection between us and the guys at SRI...,"  
Kleinrock ... said in an interview: "We typed the L and we asked on the phone,

- Do you see the L?
- Yes, we see the L,

came the response. We typed the O, and we asked:

- Do you see the O.
- Yes, we see the O.

Then we typed the G, and ... the system crashed...

Yet a revolution had begun".

## 1972: First public demonstration of ARPANET

In late 1971, Larry Roberts at DARPA decided that people needed serious motivation to get things going. In October 1972 there was to be an International Conference on Computer Communications, so Larry asked Bob Kahn at BBN to organize a public demonstration of the ARPANET.

It took Bob about a year to get everybody far enough along to demonstrate a bunch of applications on the ARPANET. The idea was that we would install a packet switch and a Terminal Interface Processor or TIP in the basement of the Washington Hilton Hotel, and actually let the public come in and use the ARPANET, running applications all over the U.S ....

The demo was a roaring success, much to the surprise of the people at AT&T who were skeptical about whether it would work.

By [Vinton Cerf](#)

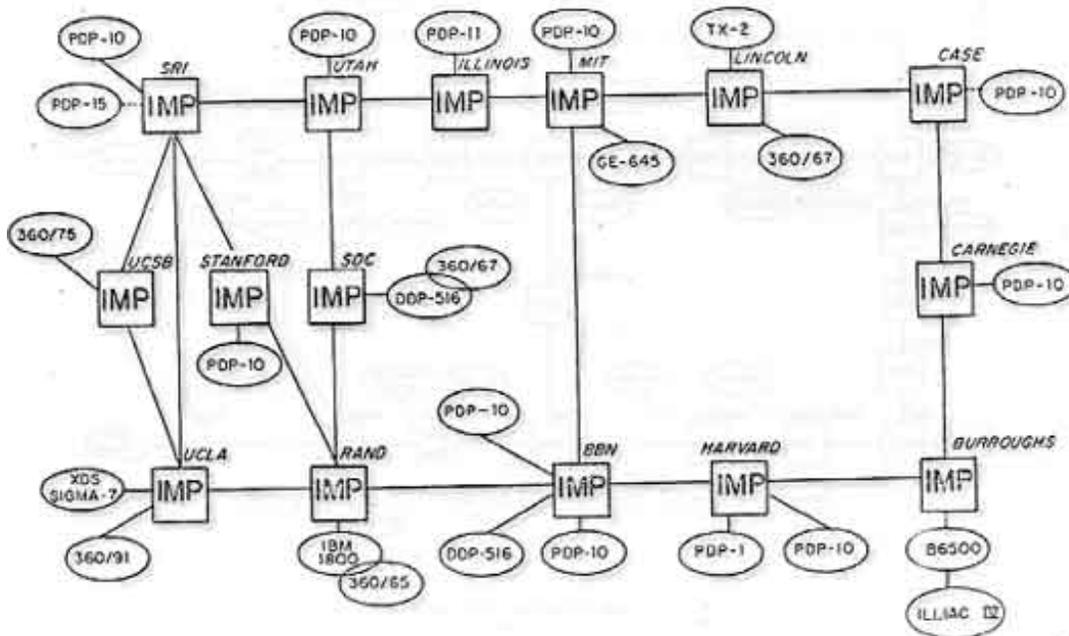
About one-two years after the first online demo of how "actually let the public come in and use the ARPANET, running applications all over the U.S ...." ([Vinton Cerf](#)) the NET became really busy especially "every Friday night":

Around about 1973 - 1975 I maintained PDP 10 hardware at SRI.

I remember hearing that there was an ARPANET "conference" on the Star Trek game every Friday night. Star Trek was a text based game where you used photon torpedos and phasers to blast Klingons. I used to have a pretty cool logical map of the ARPANET at the time but my ex-wife got it. (*She got everything but the debts.*)

By [Bob Bell](#), DEC Field Service.

It seems we found "*a pretty cool logical map of the ARPANET*" which Bob has kindly reminded us about . Thanks, Bob!



Logical map of the ARPANET, April 1971

### ARPA Timeline:

- 1958 Advanced Research Projects Agency (ARPA) created by Department of Defense (DoD).
- 1961 Director of Defense Research and Engineering (DDR&E) assigns a Command and Control Project to ARPA.
- 1962 Information Processing Techniques Office (IPTO) formed to coordinate ARPA's command and control research.
- 1972 ARPA renamed Defense Advanced Research Projects Agency (DARPA).
- 1986 The technical scope of IPTO expands and it becomes the Information Science and Technology Office (ISTO).
- 1991 ISTO splits into the Computing Systems Technology Office (CSTO) and the Software and Intelligent Systems Office

By Charles Babbage Institute, Center For the History of Information Processing, University of Minnesota

See also:

- [Telegraph, Telephone, Radio Timeline](#)
- [The Birth of the ARPANET](#)
- [DARPA-Internet History](#)
- [Internet Timeline: 1836 - 1997](#)

The Internet has changed the way we currently communicate... But could the Internet have performed the function it was originally designed for?

### CNN: Would the internet survive nuclear war?

The Internet Post-Apocalypse There's a common myth that the Internet could survive a nuclear attack. If the Internet, or pieces of it, did withstand such a war, how would it be used post-apocalypse? Would the Internet itself be used to wage war? Would it become a sole source of information for the surviving masses?

Or would it be too cluttered with dead sites and falsehoods to be worth anything?

B. Porter - 05:09pm Oct 3, 1998 ET ... It is very doubtful the Internet would

survive ANY sort of large-scale nuclear attack.... A few years ago a single "surge" in a major West Coast power line, caused a large portion of the West Coast to be blacked out for several hours. (If you live on the West Coast you probably remember this.) The effect of so many power-stations going out at once would be catastrophic to the power grid for ALL of North America, and Western Europe...

Finally, however, the biggest problem, as was previously mentioned, is the EMP (Electro Magnetic Pulse - ed.) pulse. The first missiles to fly ... would then explode, at high-altitude.... These explosions would result in an unprecedented EMP pulse that would cripple virtually 90% (Military estimates put this at closer to 95% of more) of all electronics in the U.S... Almost anything with a microchip in it would be gone.... Imagine the effect of this...

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D. Callahan\_- 09:42am Oct 6, 1998 ET ... This question is somewhat stupid: In keeping with the Cold War theme, I'll end with a quote from Kruschev (spelling): "In a nuclear war-the living will envy the dead..."

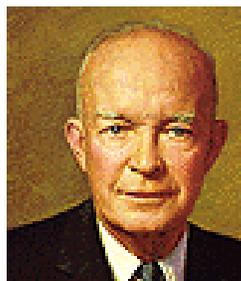
The point that I do want to dust off and raise again is that ARPA wouldn't have happened, if what used to be the Soviet Union hadn't shaken complacent U.S. awake with a tin can in the sky, Sputnik.

Wars do wonders for the advancement of technology, and the Cold one was certainly no exception. The way to get a technology advanced is to gather a lot of really smart people under one roof and get them to concentrate on a single project. Of course, that takes some organization and money. Where does that come from? But that's another can of worms - to be opened with relish at a later date. In this case, it was the only body that had a stake in making sure the Net worked - the government.

What with the Cold War in full swing and all, the military, specifically its think tank the Rand Corporation, was concerned that if the war ever got hot and large chunks of the country were vaporized, those phone lines (not to mention considerable segments of the population) would be radioactive dust. And the top brass wouldn't be able to get in touch and carry on. Thus the packets bouncing from node to node, each of those nodes able to send, receive and pass on data with the same authority as any other. It was anarchy that worked, and on a technical level, it still does, obviously.

REWIRE'D by David Hudson, JOURNAL OF A STRAINED NET, August 9th, 1996

Many people don't realize that there is more than a metaphor which connects the **"Information Superhighway"** with the **Interstate Highway System** as the Roads That Were Built By Ike. "[I like Ike](#)" was an irresistible slogan in 1952.



In 1957, while responding to the threat of the Soviets in general and the success of Sputnik in particular, President Dwight Eisenhower created both the Interstate Highway System and the Advanced Research Projects Agency, or ARPA.

By Steve Driscoll, Online Computer Library Center Inc.

Information Superhighway: what exactly does it mean?

*In Europe:* A term often used by the media to describe the Internet. "The Internet Dictionary", Bradford, England

*In USA: Information Superhighway / Infobahn:* The terms were coined to describe a possible upgrade to the existing Internet through the use of fiber optic and/or coaxial cable to allow for high speed data transmission. This highway does not exist - the Internet of today is not an information superhighway. "Internet Glossary", *SquareOne Technology*



Before Web (BW)

Tipper Gore: "When my husband Vice President Gore served in the House of Representatives, he coined the phrase "*information superhighway*" to describe how this exciting new medium would one day transport us all. Since then, we have seen the Internet and World Wide Web revolutionize the way people interact, learn, and communicate." Photo of Tipper and Al Gore wedding: 20-th year

Gore has become the point man in the Clinton administration's effort to build a national information highway much as his father, former Senator Albert Gore, was a principal architect of the interstate highway system a generation or more earlier.

~ "*Principal Figures in the Development of the Internet*".  
The University of North Carolina at Chapel Hill

**24 Jun 1986:** Albert Gore (D-TN) introduce **S 2594**  
*Supercomputer Network Study Act of 1986*

**21 March 1994:** Gore's Buenos Aires "*International Telecommunications Union*"  
Speech: ... By means of electricity, the world of matter has become a great nerve, vibrating thousands of miles in a breathless point of time ... The round globe is a vast ... brain, instinct with intelligence!"

This was not the observation of a physicist--or a neurologist. Instead, these visionary words were written in 1851 by Nathaniel Hawthorne, one of my country's greatest writers, who was inspired by the development of the telegraph. Much as Jules Verne foresaw submarines and moon landings, Hawthorne foresaw what we are now poised to bring into being...

... I opened by quoting Nathaniel Hawthorne, inspired by Samuel Morse's invention of the telegraph. Morse was also a famous portrait artist in the U.S.--his portrait of President James Monroe hangs today in the White House. While Morse was working on a portrait of General Lafayette in Washington, his wife, who lived about 500 kilometers away, grew ill and died. But it took seven days for the news to reach him.

In his grief and remorse, he began to wonder if it were possible to erase barriers of time and space, so that no one would be unable to reach a loved one in time of need. Pursuing this thought, he came to discover how to use electricity to convey messages, and so he invented the telegraph and, indirectly, the ITU.

See also:

- [Al Gore's Pileup on the Information Superhighway](#) By Gregory Gromov
- [Al Gore and the Internet](#) By Robert Kahn and Vinton Cerf.

▲ top

Roads and Crossroads of the Internet History. By Gregory Gromov

## Chapter 2. World Wide Web as a Side Effect of Particle Physics Experiments.

... Too often we're inclined to perceive the world wide web as strictly an American phenomenon, and this in spite of the fact that we all know the origins of the web are [European](#). It's amazing to us how little emphasis has come to be placed on the world wide aspect of the world wide web.

April 2, 1996. [blow](#)

The history of every great invention is based on a lot of pre-history. In the case of the World-Wide Web, there are two lines to be traced: the development of hypertext, or the computer-aided reading of electronic documents, and the development of the Internet protocols which made the global network possible.

By Robert Cailliau, [Text of a speech delivered at the launching of the European branch of the W3 Consortium](#), Paris, November 1995

See *also*: Robert Cailliau: "[How It Really Happened](#) "

As usually... in the beginning was - **chaos** and ...

In the same way that the theory of high energy physics interactions was itself in a **chaotic** state up until the early 1970's, so was the so-called area of "Data Communications" at CERN.

The variety of different techniques, media and protocols used was staggering; open warfare existed between many manufacturers' proprietary systems, various home-made systems (including CERN's own "FOCUS" and "CERNET"), and the then rudimentary efforts at defining open or international standards...

The Stage is Set - early **1980's**.

To my knowledge, the first time any "Internet Protocol" was used at CERN was during the second phase of the STELLA Satellite Communication Project, from 1981-83, when a satellite channel was used to link remote segments of two early local area networks (namely "CERNET", running between CERN and Pisa, and a Cambridge Ring network running between CERN and Rutherford Laboratory). This was certainly inspired by the ARPA IP model, known to the Italian members of the STELLA collaboration (CNUCE, Pisa) who had ARPA connections...

TCP/IP Introduced at CERN.

In August, **1984** I wrote a proposal to the SW Group Leader, Les Robertson, for the establishment of a pilot project to install and evaluate TCP/IP protocols on some key non-Unix machines at CERN including the central IBM-VM mainframe and a VAX VMS system....

By **1990** CERN had become the largest Internet site in Europe and this fact, as mentioned above, positively influenced the acceptance and spread of Internet techniques both in Europe and elsewhere...

The **Web** Materializes.

A key result of all these happenings was that by 1989 CERN's Internet facility was ready to become the medium within which Tim Berners-Lee would cle <="" p="">

By Ben M. Segal / CERN PDP-NS / April, 1995

The WWW's Baker: Who is this Guy?

**Ben Segal:** I'm British, graduated in Physics and Mathematics in 1958 from Imperial College, London, then worked for the UK Atomic Energy Authority and later in the USA for the Detroit Edison Company on fast breeder reactor development.



I've been at CERN since 1971, after finishing my Ph.D. at Stanford University in Mechanical and Nuclear Engineering...

Except for a sabbatical in 1977, when I worked at Bell Northern Research in Palo Alto on a PABX development project (and encountered UNIX for the first time), CERN has kept me pretty busy on five main projects, including the coordinated introduction of the Internet Protocols at CERN beginning in 1985.

### What does it mean: CERN?

We've received this question from one of our readers:

Date: Sun, 28 Jul 1996 13:17:23 -0700  
From: ... Jin.Whitt ....@ ... on.net>  
Subject: CERN

You give no explanation of the acronym CERN beyond "European Laboratory for Particle Physics". Could you insert the correct name somewhere?

forwarded it to Ben and have got the following answer :

... the acronym "CERN" stands for "Centre European pour la Recherche Nucleaire", the original French name of the organization. More recently it was felt that "Nucleaire" implied reactor or even military applications, so the name of the organization was changed to the ""European color="#400040" y for Part color="#400040" icle Physics" but the acronym was left as it was. Confusing, isn't it?

~ Ben Segal

### Why the WWW was born in CERN:

CERN is now the world's largest research laboratory with over 50% of all the active particle physicists in the world taking part in over 120 different research projects. 3000 staff members, 420 young students and fellows supported by the Organization and 5000 visiting physicists, engineers, computer experts and scientists specializing in a variety of front-line technologies are collaborating with CERN from 40 countries and 371 scientific institutions .

Binding together the creativity of so many different nationalities, backgrounds and fields of research...

... has established CERN as the global centre for High Energy Physics and set a precedent in scientific collaboration which has been followed by Europe's other fundamental research organizations (ESO, ESA, EMBL, ESRF)...

"Scientific research lives and flourishes in an atmosphere of freedom - freedom to doubt, freedom to enquire and freedom to discover. These are the conditions under which this new laboratory has been established"; these were the words written in 1954 by Sir Ben Lockspeiser, first President of the CERN Council. This is the atmosphere in which CERN has flourished for 40 years and in which the Organization looks forward to continuing successfully into the future.

[Highlights of CERN History: 1949 - 1994](#)

### Web as a "Side Effect"

*of the 40 years of Particle Physics Experiments.*

Below is our email exchange with Ben Segal:

It happened many times during history of science that the most impressive results of large scale scientific efforts appeared far away from the main directions of those efforts.

I hope you agree that Web was a side effect of the CERN's scientific agenda.

After the World War 2 the nuclear centers of almost all developed countries became the places with the highest concentration of talented scientists.

For about four decades many of them were invited to the international CERN's Laboratories.

So specific kind of the CERN's intellectual "entire culture" (as you called it) was constantly growing from one generation of the scientists and engineers to another.

When the concentration of the human talents per square foot of the CERN's Labs reached the critical mass, it caused an intellectual explosion

The Web, -- crucial point of human's history, was born...

Nothing could be compared to it. You wrote the best about it: "*synergy, serendipity and coincidence*"...

We cant imagine yet the real scale of the recent shake, because there has not been so fast growing multi-dimension social-economic processes in human history...

P.S. It is quite remarkable that "Highlights of CERN History: 1949 - 1994" do not have a word about Web. So, it looks like a classic **side effect** that normally is not be mentioned at the main text of official record...

~ Gregory Gromov

---

Date: Thu, 23 May 1996 08:47:54 +0200  
From: ben@dxcern.cern.ch (Ben Segal)  
Subject: Gregory, here are some CERN...

*>I hope you agree that Web was a side effect of the CERN's scientific agenda.*

Absolutely! (And it was not 100% appreciated by the masters of CERN, the physicists and accelerator builders, that such a "side effect" with world shaking consequences was born in the obscure bit of the organization that handled computing, a relatively low-status activity...).

~ Ben Segal

 [top](#)

Roads and Crossroads of the Internet History. By Gregory Gromov

## Chapter 3: Next Crossroad of Web History

The first web client and server -- built with NEXTSTEP. The WWW project was originally developed to provide a distributed hypermedia system which could easily access -- from any desktop computer -- information spread across the world. The web includes standard

formats for text, graphics, sound, and video which can be indexed easily and searched by all networked machines. Using NeXT's object-oriented technology, the first Web server and client machines were built by CERN -- the European Laboratory for Particle Physics in November 1990. Since then the Web has truly encompassed the globe and access has proliferated across all computer platforms in both the corporate and home markets.

Source: NeXT Software, Inc., 1996

## The Web as a NextStep of PC Revolution.

On the road to World Wide Web's development, the baton was thus passed from Steven Paul Jobs, co-founder of the Apple that ignited the PC revolution, to Tim Berners-Lee, co-inventor of the WWW.

It's a long way to...

[Siberia](#),

It's a long way to ...

[Next](#)

The below following text is the quotation from "Steve Paul Jobs" biography. By Lee Angelelli, Undergraduate Student, Department of Computer Science, Virginia Tech, Fall 1994. (Assignment as part of the requirements for the course "Professionalism in Computing", CS 3604), very lightly edited by J.A.N. Lee

... Over the past seven years of Apple's creation, Jobs had created a strong productive company with a growth curve like a straight line North with no serious competitors. From 1978 to 1983, its compound growth rate was over 150% a year. Then IBM muscled into the personal computer business. Two years after introducing its PC, IBM passed Apple in dollar sales of the machines. IBM's dominance had made its operating system an industry standard which was not compatible with Apple's products.

Jobs knew in order to compete with IBM, he would have to make the Apple compatible with IBM computers and needed to introduce new computers that could be marketed in the business world which IBM controlled. [Morrison, 1984, p. 86]

To help him market these new computers Jobs recruited John Sculley from Pepsi Cola for a position as president at Apple.

Jobs enticed Scully to Apple with a challenge:

"If you stay at Pepsi, five years from now all you'll have accomplished is selling a lot more sugar water to kids. If you come to Apple you can change the world."

[Gelman and Rogers, 1985, p. 46], [Conant and Marbach, 1984, p. 56]

...As the Macintosh took off in sales and became a big hit, John Sculley felt Jobs was hurting the company, and persuaded the board to strip him of power.

John Sculley tried to change the discipline of the company by controlling costs, reducing overhead, rationalizing product lines to an organization that some in the industry called Camp Runamok. [Morrison, 1984, p. 90]

Sculley came to the conclusion that "we could run a lot better with Steve out of operations," he says.

[Gelman and Rogers, 1985, p. 46]

Jobs tended to value technological "elegance" over customer needs which is a costly luxury at a time of slowing sales. And Jobs's intense involvement with the Macintosh project had a demoralizing effect on Apple's other divisions.

[Gelman and Rogers, 1985, p. 47]

Jobs was exiled to an office in an auxiliary building that he nicknamed "Siberia"

Jobs says he did not get any assignments and gradually found that important company documents no longer landed on his desk. He told every member of the executive staff that he wanted to be helpful in any way he could, and he made sure each had his home phone number. Few ever called back. "It was very clear there was nothing for me to do," he says, "I need a purpose to make me go." [Gelman and Rogers, 1985, p. 47]

He soon came to believe that he would find no purpose within Apple. In July, Sculley had told security analysts in a meeting that Jobs would have no role in the operations of the company "now or in the future.

When Jobs heard of the message he said, "You've probably had somebody punch you in the stomach and it knocks the wind out you and you cannot breathe. The harder you try to breathe, the more you cannot breathe. And you know that the only thing you can do is just relax so you can start breathing again."  
[Gelman and Rogers, 1985, p. 48]

... After leaving Apple, Jobs' new revolutionary ideas were not in hardware but in software of the computer industry. In 1989 Jobs tried to do it all over again with a new company called NextStep.

He planned to build the next generation of personal computers that would put Apple to shame.

It did not happen. After eight long years of struggle and after running through some \$250 million, NextStep closed down its hardware division in 1993.

Jobs realized that he was not going to revolutionize the hardware. He turned his attention to the software side of the computer industry...

Comments to: "...NextStep closed down its hardware division in 1993. Jobs realized that he was not going to revolutionize the hardware."

Before this sad event has happened lots of the NeXT machines successfully infiltrated into an elite area of the IT professional community and has created the new level of computer culture. One of these machines was the "[Tim's NeXT machine](#)", that was used as a detonator of the WorldWideWeb explosion (G.R.G. -- 1996).

During summer 1998 some of the Web surfing people, who usually visited the NeXT Software, Inc. Web site: <http://www.next.com>, began to receive the following message: "The site has moved to <http://www.apple.com/enterprise/> "

Steve Jobs, is spouting off grandiose claims in support of his company's new product (Internet Mac).... Is this 1986?

Apple Touts iMac's Speed ..., by Matt Hines, Newsbytes 08/14/98

Success is never final, and failure is never fatal.  
~ Winston Churchill

<="" p="">

 [top](#)

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## Chapter 4: Birth of Web, Browsers Wars ...

*The Web reminds me of early days of the PC industry.  
No one really knows anything. All experts have been wrong.*

~ Steve Jobs, Wired, February 1996

### WorldWideWeb: Proposal for a HyperText Project

To: P.G. Innocenti/ECP, G. Kellner/ECP, D.O. Williams/CN  
Cc: R. Brun/CN, K. Gieselmann/ECP, R.Jones/ECP, T. Osborne/CN, P. Palazzi/ECP, N.Pellow/CN, B. Pollermann/CN, E.M.Rimmer/ECP

From: T. Berners-Lee/CN, R. Cailliau/ECP  
Date: 12 November 1990

... HyperText is a way to link and access information of various kinds as a web of nodes in which the user can browse at will. It provides a single user-interface to large classes of information (reports, notes, data-bases, computer documentation and on-line help). We propose a simple scheme incorporating servers already available at CERN.

The project has two phases: firstly we make use of existing software and hardware as well as implementing simple browsers for the user's workstations, based on an analysis of the requirements for information access needs by experiments. Secondly, we extend the application area by also allowing the users to add new material.

Phase one should take 3 months with the full manpower complement, phase two a further 3 months, but this phase is more open-ended, and a review of needs and wishes will be incorporated into it.

The manpower required is 4 software engineers and a programmer, (one of which could be a Fellow). Each person works on a specific part (eg. specific platform support).

Each person will require a state-of-the-art workstation, but there must be one of each of the supported types. These will cost from 10 to 20k each, totalling 50k. In addition, we would like to use commercially available software as much as possible, and foresee an expense of 30k during development for one-user licences, visits to existing installations and consultancy.

We will assume that the project can rely on some computing support at no cost: development file space on existing development systems, installation and system manager support for daemon software.

.....

**Abstract:** HyperText is a way to link and access information of various kinds as a web of nodes in which the user can browse at will. Potentially, HyperText provides a single user-interface to many large classes of stored information such as reports, notes, data-bases, computer documentation and on-line systems help. We propose the implementation of a simple scheme to incorporate several different servers of machine-stored information already available at CERN, including an analysis of the requirements for information access needs by experiments.

**Introduction:** The current incompatibilities of the platforms and tools make it impossible to access existing information through a common interface, leading to waste of time, frustration and obsolete answers to simple data lookup. There is a potential large benefit from the integration of a variety of systems in a way which allows a user to follow links pointing from one piece of information to another one. This forming of a web of information nodes rather than a hierarchical tree or an ordered list is the basic concept behind HyperText.

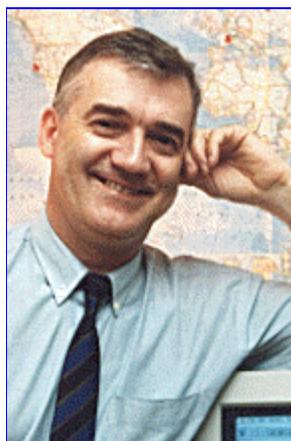
At CERN, a variety of data is already available: reports, experiment data, personnel data, electronic mail address lists, computer documentation, experiment documentation, and many other sets of data are spinning around on computer discs continuously. It is however impossible to "jump" from one set to another in an automatic way: once you found out that the name of Joe Bloggs is listed in an incomplete description of some on-line software, it is not straightforward to find his

current electronic mail address. Usually, you will have to use a different lookup-method on a different computer with a different user interface. Once you have located information, it is hard to keep a link to it or to make a private note about it that you will later be able to find quickly.

**Hypertext concepts:** ... A program which provides access to the hypertext world we call a *browser*. When starting a hypertext browser on your workstation, you will first be presented with a *hypertext page which is personal to you* : your personal notes, if you like. A hypertext page has pieces of text which refer to other texts. Such references are highlighted and can be selected with a mouse (on dumb terminals, they would appear in a numbered list and selection would be done by entering a number). When you select a reference, the browser presents you with the text which is referenced: you have made the browser follow a hypertext *link* ...

*T. Berners-Lee, R. Cailliau*

### W W Why are they green? "Because I see all "W"s as green..."



Robert Cailliau: Recently I discovered that I'm a synaesthetic. Well, I've known it for a long time, but I did not realise that there was a name for it. I'm one of those people who combine two senses: for me, letters have colours.

Only about one in 25'000 have this condition, which is perfectly harmless and actually quite useful. Whenever I think of words, they have colour patterns. For example, the word "CERN" is yellow, green, red and brown, my internal telephone number, "5005" is black, white, white, black. The effect sometimes works like a spelling checker: I know I've got the right or the wrong number because the colour pattern is what I remember or not...

And now wait for it folks: you have all seen the World-Wide Web logo of three superimposed "W"s. Why are they green? Because I see all "W"s as green... It would look horrible to me if they were any other colour. So, it's not because it is a "green" technology, although I also like that...

So, here I am: twenty years of work at CERN: control engineering, user-interfaces, text processing, administrative computing support, hypertexts and finally the Web.

The Web timeline according to R. Cailliau:

## 1990

CERN: A Joint proposal for a hypertext system is presented to the management.

Mike Sendall buys a NeXT cube for evaluation, and gives it to Tim. Tim's prototype implementation on NeXTStep is made in the space of a few months, thanks to the qualities of the NeXTStep software development system. This prototype offers WYSIWYG browsing/authoring! Current Web browsers used in "surfing the Internet" are mere passive windows, depriving the user of the possibility to contribute.

During some sessions in the CERN cafeteria, Tim and I try to find a catching name for the system. I was determined that the name should not yet again be taken from Greek mythology. Tim proposes "World-Wide Web". I like this very much, except that it is difficult to pronounce in French...

## 1991

The prototype is very impressive, but the NeXTStep system is not widely spread. A simplified, stripped-down version (with no editing facilities) that can be easily adapted to any computer is constructed: the Portable "Line-Mode Browser".

SLAC, the Stanford Linear Accelerator Center in California, becomes the first Web server in USA.

It serves the contents of an existing, large data base of abstracts of physics papers.

Distribution of software over the Internet starts.

The Hypertext'91 conference (San Antonio) allows us a "poster" presentation (but does not see any use of discussing large, networked hypertext systems...).

## 1992

The portable browser is released by CERN as freeware.

Many HEP laboratories now join with servers: DESY (Hamburg), NIKHEF (Amsterdam), FNAL (Chicago).

Interest in the Internet population picks up.

The Gopher system from the University of Minnesota, also networked, simpler to install, but with no hypertext links, spreads rapidly.

We need to make a Web browser for the X system, but have no in-house expertise. However, Viola (O'Reilly Assoc., California) and Midas (SLAC) are wysiwyg implementations that create great interest.

The world has 50 Web servers!

<="" p=""> <="" p="">

Some of the other viewpoints on the first 5 years of the Web:

<="" p="">

... as Tim Berners-Lee and other Web developers enriched the standard for structuring data, programmers around the world began to enrich the browsers.

One of these programmers was Marc Andreessen, who was working for the NCSA in Urbana-Champaign, Illinois.

In January 1993, Andreessen released a version of his new, handsome, point-and-click graphical browser for the Web, designed to run on Unix machines.

In August, Andreessen and his co-workers at the center released free versions for Macintosh and Windows.

In December, a long story about the Web and Mosaic appeared in The New York Times...

The (Second Phase of the) Revolution Has Begun,  
By Gary Wolf, Wired 2.10

In the Web's *first* generation, Tim Berners-Lee launched the Uniform Resource Locator (URL), Hypertext Transfer Protocol (HTTP), and HTML standards with

prototype Unix-based servers and browsers. A few people noticed that the Web might be better than Gopher.

In the *second* generation, Marc Andreessen and Eric Bina developed NCSA Mosaic at the University of Illinois. Several million then suddenly noticed that the Web might be better than sex.

In the *third* generation, Andreessen and Bina left NCSA to found Netscape...

Ether Microsoft and Netscape open some new fronts in escalating Web Wars, By Bob Metcalfe, InfoWorld, August 21, 1995, Vol. 17, Issue 34.

Meanwhile -- between all these 3 generations -- a lot of historical scale events happened. Eric W. Sink clarifies some of them:

**Life in the browser wars** was a unique time period for me in my career...

I started work on Spyglass Mosaic on April 5th, 1994. The demo for our first prospective customer was already on the calendar in May. ... Yes, we licensed the technology and trademarks from NCSA (at the University of Illinois), but we never used any of the code. We wrote our browser implementations completely from scratch, on Windows, MacOS, and Unix.

... Netscape didn't even exist yet, but things happened fast. Just a few weeks after I started coding, Jim Clark rode into town and gathered a select group of programmers from NCSA. Mosaic Communications Corporation was born. It was interesting to note that certain people on the NCSA browser team were not invited to the special meeting. I can still remember hearing about how ticked off they were to be excluded. Champaign-Urbana is a very small town.

Spyglass had the legal right to the "Mosaic" trademark. A few tantrums and lots of lawyering later, MCC changed its name to Netscape.

We thought we had a nice head start on Netscape. We had a really top-notch team and we moved the rest of our developers over to browser work quickly. We were ready to compete with anybody. But Jim Clark was, after all, Jim Clark. His SGI-ness knew how to work the advantages of being in Silicon Valley. He provided his young company with lots of press coverage and very deep pockets.

We decided to approach this market with an OEM business model. Instead of selling a browser to end users we developed core technology and sold it to corporations who in turn provided it to their end users. We considered ourselves to be the *arms dealer for the browser wars*. Over 120 companies licensed Spyglass Mosaic so they could bundle it into their product. Our stuff ended up in books, operating systems, ATM machines, set-top boxes, help systems, and kiosks. It was an extremely profitable business. The company grew fast and ours was one of the first Internet IPOs.

Along the way, we got involved in the standards process. In fact, I became the chair of the IETF HTML Working Group for the standardization of HTML 2.0. I learned a lot through this experience. In May 1994 I went to the first WWW conference in Geneva, Tim Berners-Lee took me aside and shared his plans for a World-Wide Web Consortium. It didn't take too long for the W3C to become the venue for HTML standards discussions. Eventually this was A Good Thing. Both Netscape and Microsoft became active participants in the W3C HTML Working Group. Any group which didn't have their involvement was doomed to irrelevance.

For much of 1994, it seemed like we were ahead of Netscape. Shortly after we released our 2.0 version, I remember one of the Netscape developers griping about how their schedule had been moved up by six months. We smiled because we knew we were the reason. They had not been taking us seriously and they were being forced to do so.

But Netscape was running at a much faster pace. They got ahead of us on features and *they began to give their browser away at no cost to end users*. This made Netscape the standard by which all other browsers were judged. If our browser didn't render something exactly like Netscape, it was considered a bug. *I hated fixing our browser to make it bug-compatible with Netscape* even though we had already coded it to "the standard". Life's not fair sometimes.

We won the Microsoft deal. I suppose only the higher echelons of Spyglass management really know the gory details of this negotiation. I was asked to be the primary technical contact for Microsoft and their effort to integrate our browser into Windows 95. I went to Redmond and worked there for a couple of weeks as part of the "Chicago" team. It was fun, but weird. They gave me my own office. At dinner time, everyone went to the cafeteria for food and then went back to work. On my first night, I went back to my hotel at 11:30pm. I was one of the first to leave.

Internet Explorer 2.0 was basically Spyglass Mosaic with not too many changes. IE 3.0 was a major upgrade, but still largely based on our code. IE 4.0 was closer to a rewrite, but our code was still lingering around -- we could tell by the presence of certain esoteric bugs that were specific to our layout engine.

Licensing our browser was a huge win for Spyglass. And it was a huge loss. We got a loud wake-up call when we tried to schedule our second conference for our OEM browser customers. Our customers told us they weren't coming because Microsoft was beating them up. The message became clear: We sold our browser technology to 120 companies, but one of them slaughtered the other 119.

The time between IE 3 and IE 4 was a defining period for Spyglass. It was clear that the browser war had become a *two-player race*.

- Even with our IPO stash, we didn't have the funding to keep up with Netscape.
- What was interesting was the day we learned that Netscape didn't have the funding to keep up with Microsoft.

For the development of IE 4.0, a new Program Manager appeared. His name was Scott Isaacs and I started seeing him at the HTML standards group meetings. At one of those meetings we sat down for a talk which was a major turning point for me and for Spyglass. Scott told me that the *IE team had over 1,000 people*.

I was stunned. That was 50 times the size of the Spyglass browser team. It was almost as many people as Netscape had in their whole company. I could have written the rest of the history of web browsers on that day -- no other outcomes were possible ...

"Memoirs From the Browser Wars" by Eric W. Sink.

According to Gary Wolf, "Andreessen also left the NCSA, departing in December 1993 with the intention of abandoning Mosaic development altogether. He moved to California and took a position with a small software company. But within a few months he had quit his new job and formed a partnership with SGI founder Jim Clark.

"At the NCSA," Andreessen explains, "the deputy director suggested that we should start a company, but we didn't know how. We had no clue. How do you start something like that? How do you raise the money? Well, I came out here and met Jim, and all of a sudden the answers starting falling into place."

In March, Andreessen and Clark flew back to Illinois, rented a suite at the University Inn, and invited about half a dozen of the NCSA's main Mosaic developers over for a chat. Clark spent some time with each of them alone. By May, virtually the entire ex-NCSA development group was working for Mosaic Communications.

Andreessen answers accusations that corporate Mosaic Communications "raided" nonprofit NCSA by pointing out that with the explosion of commercial interest in Mosaic, the developers were bound to be getting other offers to jump ship. "We originally were going to fly them out to California individually over a period of several weeks," Andreessen explains, "but Jim and I said, Waita second, it does not make much sense to leave them available to be picked up by other companies. So we flew out to Illinois at the spur of the moment."

Since Mosaic Communications now has possession of the core team of Mosaic developers from NCSA, the company sees no reason to pay any licensing fees for NCSA Mosaic. Andreessen and his team intend to rewrite the code, alter the name, and produce a browser that looks similar and works better.

### The Anti-Gates

Clark and Andreessen have different goals. For Jim Clark, whose old company led the revolution in high-end digital graphics, Mosaic Communications represents an opportunity to transform a large sector of the computer industry a second time. For Andreessen, Mosaic Communications offers a chance to keep him free from the grip of a company he sees as one of the forces of darkness - Microsoft.

"If the company does well, I do pretty well," says Andreessen. "If the company doesn't do well" - his voice takes on a note of mock despair - "I work at Microsoft."

The chair of Microsoft is anathema to many young software developers, but to Andreessen he is a particularly appropriate nemesis...

As I ( ) reviewed my notes from interviews with Andreessen, I was struck by the thought that he may have conjured the Bill Gates nemesis out of the subtle miasma of his own ambivalence. After all it is he, not the programmers in Redmond, Washington, who is writing a proprietary Web browser. It is he, not Bill Gates, who is at the center of the new, ambitious industry. It is he who is being forced by the traditional logic of the software industry to operate with a caution that verges on secrecy, a caution that is distinctly at odds with the open environment of the Web."

The (Second Phase of the) Revolution Has Begun,  
By Gary Wolf, Wired 2.10

There are two ages of the Internet - before Mosaic, and after. The combination of Tim Berners-Lee's Web protocols, which provided connectivity, and Marc Andreessen's browser, which provided a great interface, proved explosive. In twenty-four months, the Web has gone from being unknown to absolutely ubiquitous.

A Brief History of Cyberspace, by Mark Pesce, ZDNet, October 15, 1995

Bill Gates, "...an Internet browser is a trivial piece of software. There are at least 30 companies that have written very credible Internet browsers, so that's nothing..."

The world according to Gates By Don Tennant, InfoWorld Electric, Jan 4, 1996.

"The most important thing for the Web is stay ahead of Microsoft."

Steve Jobs. Wired, February 1996, p.162

Microsoft may still be No. 2 in the Internet race, but it's rapidly closing the gap. What's more, Microsoft has forgotten more about PR and marketing than Netscape ever learned.

The contrast between the two companies was highlighted the day after Clark induced mass sedation when Microsoft's group vice president, Paul Maritz, wowed the crowd with the kind of polished, four-star presentation that the Redmondians seem to be able to do with their eyes closed.

Just like his boss, Maritz promised a lot of stuff that's still not here. But he generated excitement and energy and buzz. The upshot was to create the kind of halo effect that will pay dividends when it comes time for developers and corporate shoppers to make their buying and investment decisions. ....

Of Silicon Valley and Sominex, by Charles Cooper, PC Week, June 5, 1996.

Slate Magazine, June 26, 1996: *Is Microsoft Evil?*

Mark Andreessen: *I don't think it's a matter of good and evil -- Microsoft is a competitor, and a smart one. Jim (Clark) and I both think it's important to point out what Microsoft is doing in various areas, since they are very good at using FUD [fear, uncertainty, doubt] to attempt to paralyze the market.*

Why Bill Gates wants to be the next Marc Andreessen, Wired, 3.12, p.236.

"God is on the side of the big battalions." said Napoleon. Very few times in warfare have smaller forces overtaken bigger forces...

Netscape's Jim Barksdale, Wired 4.03 March 1996

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## December, 1995: i-Pearl Harbor

<="" font="" color="#400040" face="arial,helvetica" size="2">

"Pearl Harbor Day." Time Magazine reported it when Bill Gates declared war on December 7, 1995... By Jeff Sutherland

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## February, 1996: 2-year Prediction

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Steve Jobs: We have a two-year window. If the Web doesn't reach ubiquity in the next two years, Microsoft will own it. And that will be the end of it.

Wire, February 1996, p.162

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## June, 1996: "How many ...?"

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Question : Netscape has certainly come on awfully strong.  
Bill Gates: How many software developers do you think they have?

The world according to Gates By Don Tennant, InfoWorld Electric, Jan 4, 1996

<="" font="" color="#400040" face="arial,helvetica" size="2">**The turn-point in the Browser's War** <="" font="" color="#400040">

The Web Browser market share dramatically changed for a couple of month:

	Netscape	Microsoft Internet
--	----------	--------------------

Month	Navigator	Explorer
May-96	83.2%	7.0%
Jun-96	78.2%	8.3%
July-96	72.6%	15.8%
Aug-96	62.7%	29.1%

Data source: *Intersŭ Corporation.*

## October, 1996: How much?

X-Sender: bney@mail2.quiknet.com  
To: view@netvalley.com  
From: Bob Ney  
Date: Tue, 8 Oct 1996 18:24:41 -0700

.....

As an ISP, I want to give my customers a software package for their use. I contacted Netscape.

- They said they would let be customize and repackage their product, if I committed to buy 2500 the first year at \$17 each.

I said OK, I can do that.

- Then they said, great please send your check for 50% of the moneys due.

That's \$21,250. As a small ISP I dont have that available without dipping into my reserves.

I am then contacted by Microsoft and was told they would send me this really nice customization kit, which will build a release for Win95, Win NT, Win3.1 and install Explorer 3, Netmeeting, a commercial TCP dialer and stack. And it has a automated user sign up server built into it.

It will build a CD Rom image, if I want to distribute that way.  
It configures with a wizard in about 5 minutes.  
It's seamless and a really good piece of software and installer.

I said that it sounded great, how much?

- No charge. Distribute it all you want to your customers.  
Have fun.

Microsoft is such a monster company that they can drop multi millions into development of a product package that they will give away.

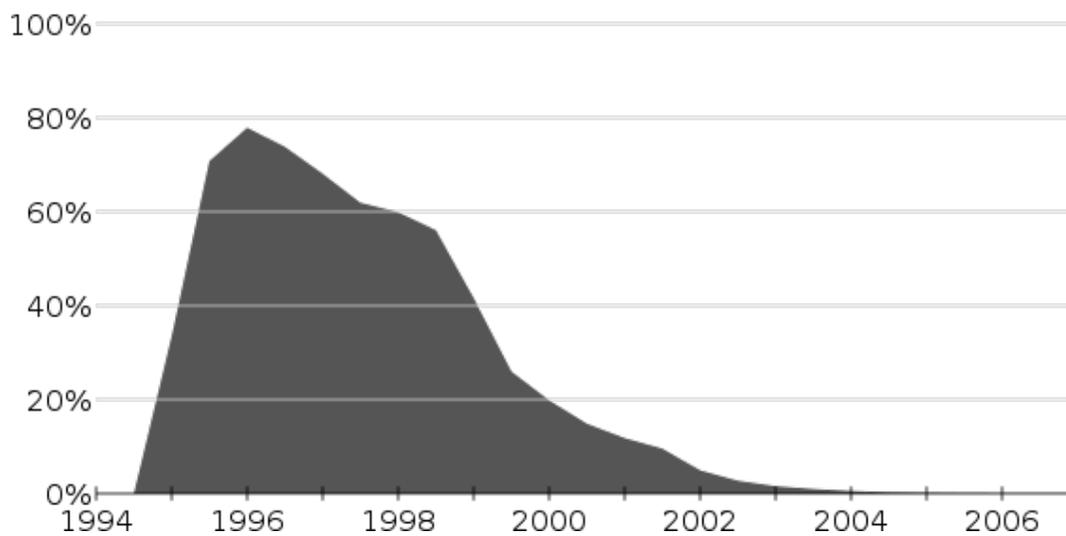
Netscape on the other hand actually wants to make a bit of money on their product.

Thinking of myself first, I took the Microsoft software.  
So will most other ISP's...

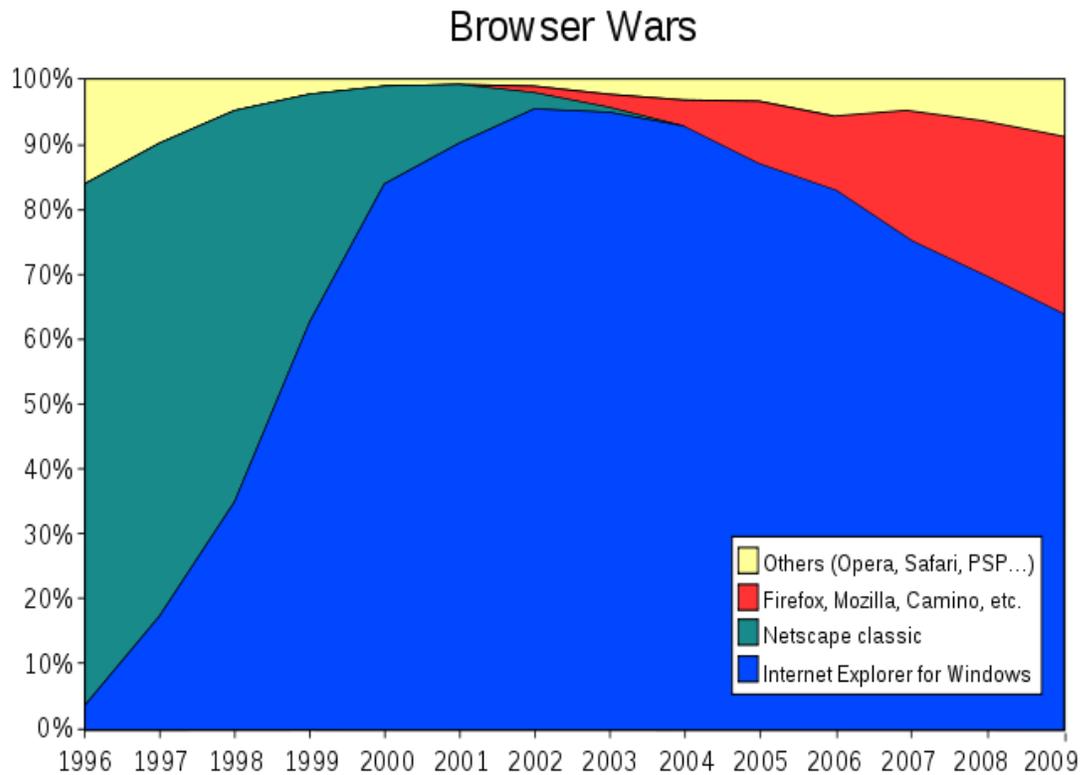
Bob Ney, [QuikNet, Inc.](#) Sacramento CA

Netscape Navigator market-share historical trend:

<="" font="" color="#400040">



The First 15 Years of the Browsers Wars:



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Roads and Crossroads of the Internet History. By Gregory Gromov

## Chapter 5 - Early History of Hypertext

50 years of HYPERTEXT concept's EVOLUTION  
The Foundation of World Wide Web Science

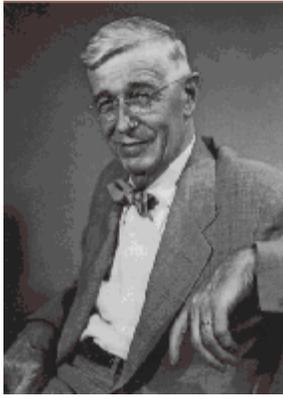
### Hypertext Timeline

**1945:** Vannevar Bush (Science Advisor to president Roosevelt during WW2) proposes Memex -- a conceptual machine that can store vast amounts of information, in which users have the ability to create information trails, links of related texts and illustrations, which can be stored and used for future reference.

"*As We May Think*" This article was originally published in the July 1945 issue of *The Atlantic Monthly*... Like Emerson's famous address of 1837 on "*The American Scholar*," this paper by Vannevar Bush calls for a new relationship between thinking man and the sum of our knowledge.

The Vannevar Bush's hyperlink concept:

Our ineptitude in getting at the record is largely caused by the artificiality of systems of indexing. When data of any sort are placed in storage, they are filed alphabetically or numerically, and



information is found (when it is) by tracing it down from subclass to subclass. It can be in only one place, unless duplicates are used; one has to have rules as to which path will locate it, and the rules are cumbersome. Having found one item, moreover, one has to emerge from the system and re-enter on a new path.

The human mind does not work that way. It operates by association.

With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain.

It has other characteristics, of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all else in nature.

Man cannot hope fully to duplicate this mental process artificially, but he certainly ought to be able to learn from it. In minor ways he may even improve, for his records have relative permanency.

The first idea, however, to be drawn from the analogy concerns selection. Selection by association, rather than by indexing, may yet be mechanized. One cannot hope thus to equal the speed and flexibility with which the mind follows an associative trail, but it should be possible to beat the mind decisively in regard to the permanence and clarity of the items resurrected from storage.

Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and to coin one at random, "memex" will do.

A memex is a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.

It consists of a desk, and while it can presumably be operated from a distance, it is primarily the piece of furniture at which he works. On the top are slanting translucent screens, on which material can be projected for convenient reading. There is a keyboard, and sets of buttons and levers. Otherwise it looks like an ordinary desk...

On the top of the memex is a transparent platen. On this are placed longhand notes, photographs, memoranda, all sort of things. When one is in place, the depression of a lever causes it to be photographed onto the next blank space in a section of the memex film, dry photography being employed.

There is, of course, provision for consultation of the record by the usual scheme of indexing. If the user wishes to consult a certain book, he taps its code on the keyboard, and the title page of the book promptly appears before him, projected onto one of his viewing positions.

Frequently-used codes are mnemonic, so that he seldom consults his code book; but when he does, a single tap of a key projects it for his use. Moreover, he has supplemental levers. On deflecting one of these levers to the right he runs through the book before him, each page in turn being projected at a speed which just allows a recognizing glance at each. If he deflects it further to the right, he steps through the book 10 pages at a time; still further at 100 pages at a time. Deflection to the left gives him the same control backwards.

A special button transfers him immediately to the first page of the index. Any given book of his library can thus be called up and consulted with far greater facility than if it were taken

from a shelf. As he has several projection positions, he can leave one item in position while he calls up another. He can add marginal notes and comments, taking advantage of one possible type of dry photography, and it could even be arranged so that he can do this by a stylus scheme, such as is now employed in the telautograph seen in railroad waiting rooms, just as though he had the physical page before him...

Wholly new forms of encyclopedias will appear, ready-made with a mesh of associative trails running through them, ready to be dropped into the **memex** and there amplified. The lawyer has at his touch the associated opinions and decisions of his whole experience, and of the experience of friends and authorities. The patent attorney has on call the millions of issued patents, with familiar trails to every point of his client's interest. The physician, puzzled by its patient's reactions, strikes the trail established in studying an earlier similar case, and runs rapidly through analogous case histories, with side references to the classics for the pertinent anatomy and histology. The chemist, struggling with the synthesis of an organic compound, has all the chemical literature before him in his laboratory, with trails following the analogies of compounds, and side trails to their physical and chemical behavior...

By Vannevar Bush - As We May Think - *The Atlantic Monthly*, July 1945

#### **1965:** Ted Nelson coins the word Hypertext



By 'hypertext' mean nonsequential writing - text that branches and allows choice to the reader, best read at an interactive screen.

Ted Nelson, *Literary Machines*

#### **1967:** Andy van Dam and others build the Hypertext Editing System ...

The first working hypertext system was developed at Brown University, by a team led by Andries van Dam. The Hypertext Editing System ran in 128K memory on an IBM/360 mainframe and was funded by IBM, who later sold it to the Houston Manned Spacecraft Center, where it was used to produce documentation for the Apollo space program.

The Hypertext Editing System (1967) and FRESS (1968) , by dr. P.M.E. De Bra

#### **1981:** Ted Nelson conceptualizes "Xanadu", a central, pay-per-document hypertext database encompassing all written information ...

The words "hypertext" and "hypermedia" were coined by my friend Ted Nelson in a paper to the ACM 20th national conference in 1965, before I (Andrew Pam) was even born! Although I had come across occasional articles Ted had written for Creative Computing magazine, my first exposure to his legendary Xanadu project did not occur until 1987 when I purchased the Microsoft Press second edition of his classic book *Computer Lib / Dream Machines...* , which outlined his idea of a "docuverse" or universal library of multimedia documents.

As an avid science fiction reader, my imagination had already been captured by this idea of a universally accessible computer storage and retrieval system as presented in the 1975 novel *Imperial Earth* by Arthur C. Clarke... But here was someone actually involved in trying to create such a system. I immediately sent off a US\$100 donation to Project Xanadu to reserve a Xanadu account name, and also purchased the 1988 edition of Ted's self-published book *Literary Machines...* and the Technical

Overview video describing the Xanadu project in detail...

By Andrew Pam, Xanadu Australia

All the children of Nelson's imagination do not have equal stature. Each is derived from the one, great, unfinished project for which he has finally achieved the fame he has pursued since his boyhood. During one of our (Gary Wolf) many conversations, Nelson explained that he never succeeded as a filmmaker or businessman because "the first step to anything I ever wanted to do was Xanadu."

Xanadu, a global hypertext publishing system, is the longest-running vaporware story in the history of the computer industry.

It has been in development for more than 30 years.

This long gestation period may not put it in the same category as the Great Wall of China, which was under construction for most of the 16th century and still failed to foil invaders, but, given the relative youth of commercial computing, Xanadu has set a record of futility that will be difficult for other companies to surpass.

The fact that Nelson has had only since about 1960 to build his reputation as the king of unsuccessful software development makes Xanadu interesting for another reason: the project's failure (or, viewed more optimistically, its long-delayed success) coincides almost exactly with the birth of hacker culture.

Xanadu's manic and highly publicized swerves from triumph to bankruptcy show a side of hackerdom that is as important, perhaps, as tales of billion-dollar companies born in garages.

Among people who consider themselves insiders, Nelson's Xanadu is sometimes treated as a joke, but this is superficial. Nelson's writing and presentations inspired some of the most visionary computer programmers, managers, and executives - including Autodesk Inc. founder John Walker - to pour millions of dollars and years of effort into the project.

Xanadu was meant to be a universal library, a worldwide hypertext publishing tool, a system to resolve copyright disputes, and a meritocratic forum for discussion and debate.

By putting all information within reach of all people, Xanadu was meant to eliminate scientific ignorance and cure political misunderstandings.

And, on the very hackerish assumption that global catastrophes are caused by ignorance, stupidity, and communication failures, Xanadu was supposed to save the world.

The Curse of Xanadu, by Gary Wolf, Wired 3.06

In the poem "Kubla Khan", by Samuel Taylor Coleridge, a "magic place of literary memory" appears and is called Xanadu. The Xanadu vision of Ted Nelson was to create a unified literary environment on a global scale, a repository for everything that anybody has ever written.

Ted Nelson and Xanadu, by Paul De Bra

We call the whole system of publication "open hypermedia publishing" because anyone can link to, and re-use, materials of any kind throughout the network.

We believe that Xanadu Open Hypermedia Publishing is the publishing

medium of the future, combining all forms of media -- text, graphics, audio and music, video, simulations, data structures -- into tomorrow's new information world.

By Ted Nelson. Xanadu: The Information Future.

If you think you're living in a revolutionary period now, wait till you start getting unsolicited e-mail from the Bolsheviks or Mao, or find yourself on Catherine the Great's home page. World Wide Web will sound like an awfully modest enterprise. You laugh? Go ahead. They laughed at Galileo... Not to mention the Internet.

Philadelphia Online:Philadelphia Inquirer : Books, November 1996



Roads and Crossroads of the Internet History. By Gregory Gromov

## Chapter 6: Living History of Hypertext

Theodor Holm Nelson: *The Fate of Thinking Person in Silicon Valley*

**1960.** It occurs to me that the future of humanity is at the interactive computer screen, that the new writing and movies will be interactive and interlinked. It will be united by bridges of transclusion (see below) and we need a world-wide network to deliver it with royalty. I begin.

. . . . .

February, **1988.** Autodesk buys the Xanadu project, which has been bundled into XOC, Inc. Nelson gives up the trademark.

LATE 1988 the program designed in 1981 is finished (and dubbed 88.1), then set aside, to begin work on a MUCH FINER design-

August, **1992.** Autodesk drops the project and gives us carfare. Our heroes find themselves out in the street.

Interesting Times Number Three, October 1994,  
Theodor Holm Nelson , Mindful Press, 1994

Nelson's life is so full of unfinished projects that it might fairly be said to be built from them, much as lace is built from holes or Philip Johnson's glass house from windows... He has been at work on an overarching philosophy of everything called General Schematics, but the text remains in thousands of pieces, scattered on sheets of paper, file cards, and sticky notes.

Curse of Xanadu, by Gary Wolf, Wired

**Theodor Holm Nelson:** A retort to Gary Wolf's "*Curse of Xanadu*" in Wired Magazine.

*Magazine:* Nelson's response to the Web was "*nice try*".

**Nelson:** This is a pretty seriously out-of-context quote. I have great respect for the Web and great personal liking for Tim Berners-Lee.



..after the Advisory Committee meeting of the WWW Consortium, in Tokyo, June 1997. This one [photo] was made by Hakon Lie at dinner.

It shows me [Robert Cailliau], sitting between Tim Berners-Lee and Ted Nelson. Tim and Ted are clearly engaged in a serious debate about some hypertext phenomenon behind my back, while I'm discussing philosophy with Hakon, who was sitting opposite me and took the photo."

By R. Cailliau: "*Tim, Robert and Ted*"

The picture was taken by me [Hakon Wium Lie] in June 97 in the top-floor restaurant of Hotel Shingawa Prince in Tokyo. The table had just finished a "Hokkaido wedding dinner" when this amazing scene revealed itself in front of me. Thankfully there was one last picture left in my "film with lens".

Tim and Ted are clearly talking behind Robert's back, but Robert doesn't seem to mind. Maybe because he had just presented his latest theory about religion in Europe, and -- given that scale - - even hypertext theories fall short.

By Hakon Wium Lie: "*Tim, Robert and Ted*"

[▲ top](#)

Roads and Crossroads of the Internet History . By Gregory Gromov

## Chapter 7: Plan "Xanadu"

*I was right for some wrong reasons or whether I was right, ...*  
Ted Nelson, Wired, 3.09

*The best way to predict the future is to invent it*  
Peter Cochrane, British Telecom Laboratories

### **Where World WideWeb Went Wrong**

by Andrew Pam"

- Lack of transparent support for mirroring
- Lack of an underlying distributed file system
- Lack of bivisibility and bifollowability
- Lack of versioning and alternates
- Limited support for metadata

Limited support for Computer Mediated Communication Cyberspace/"Hyperspace"  
as a pervasive user interface metaphor  
Limited support for transclusions  
Transcopyright - the Xanadu solution for business on the Net - New financial  
instruments for the new media

Nelson: **Trying to fix HTML is like trying to graft arms and legs onto hamburger...**

"The problem is how to clean up the mess that is strewn around us.... We have the World Wide Web with all sorts of marvelous new conceptual methods proposed every month, all of them contradictory," said Nelson.

"I come from a slightly different position [than the Web], where we have long presented and implemented an integrated solution for all of these problems in parallel, which will eventually prevail once people understand it," Nelson said.

Hypertext Guru Has New Spin on Old Plans, Wired, 17.Apr.98.by James Glave

Xanadu *Timeline*:

**1960** Ted Nelson's designs showed two screen windows connected by visible lines, pointing from parts of an object in one window to corresponding parts of an object in another window. No existing windowing software provides this facility even today.

**1965** Nelson's design concentrated on the single-user system and was based on "zipper lists", sequential lists of elements which could be linked sideways to other zipper lists for large non-sequential text structures.

**1970** Nelson invented certain data structures and algorithms called the "enfilade" which became the basis for much later work (still proprietary to Xanadu Operating Company, Inc.)

**1972** Implementations ran in both Algol and Fortran.

**1974** William Barus extended the enfilade concept to handle interconnection.

**1979** Nelson assembled a new team (Roger Gregory, Mark Miller, Stuart Greene, Roland King and Eric Hill) to redesign the system.

**1981** K. Eric Drexler created a new data structure and algorithms for complex versioning and connection management.

The Project Xanadu team completed the design of a universal networking server for Xanadu, described in various editions of Ted Nelson's book "Literary Machines" ...

**1983** Xanadu Operating Company, Inc. (XOC, Inc.) was formed to complete development of the 1981 design.

**1988** XOC, Inc. was acquired by Autodesk, Inc. and amply funded, with offices in Palo Alto and later Mountain View California. Work continued with Mark Miller as chief designer. ..

**1992** Autodesk entered into the throes of an organisational shakeup and dropped the project, after expenditures on the order of five million US dollars. Rights to continued development of the XOC server were licensed to Memex, Inc. of Palo

Alto, California and the trademark "Xanadu" was re-assigned to Nelson.

**1993** Nelson re-thought the whole thing and respecified Xanadu publishing as a system of business arrangements. Minimal specifications for a publishing system were created under the name "Xanadu Light", and Andrew Pam of Serious Cybernetics in Melbourne, Australia was licensed to continue development as Xanadu Australia.

**1994** Nelson was invited to Japan and founded the Sapporo HyperLab...

By Andrew Pam, Xanadu Australia

The Xanadu database makes it possible to address any substring of any document from any other document.

This requires an even stronger addressing scheme than the Universal Resource Locators used in the World-Wide Web.

Every single byte (character) in every document (in the whole world) needs a unique address.

Xanadu will never delete any text.

It keeps a permanent record of all versions of every document. This is necessary because someone may have created links to parts of a specific version of a document, which may no longer be present in later versions of that document.

Xanadu uses a sophisticated versioning system that requires only one version (the current one) of a document to be stored completely. By keeping a record of the changes made to the document, other versions can be generated on the fly.

Ted Nelson and Xanadu, by Paul De Bra

### **...epic tragedy:**

It was the most radical computer dream of the hacker era.

Ted Nelson's Xanadu project was supposed to be the universal, democratic hypertext library that would help human life evolve into an entirely new form.

Instead, it sucked Nelson and his intrepid band of true believers into what became the longest-running vaporware project in the history of computing -

a 30-year saga of rabid prototyping and heart-slashing despair.  
The amazing epic tragedy.

The Curse of Xanadu, Wired 3.06, 1995, by Gary Wolf

Wolf calls the general idea that we need freedom and availability of information to avoid disaster a "very hackerish assumption."

Perhaps. But it is an ideal I believe in, bound up with the ideals I learned from the Pledge of Allegiance in grade school. Ironically, that ideal seemed to be what Wired stood for. Wolf's piece is a perfect example of such a disaster.

Ted Nelson, Wired, 3.09

Nelson and his colleagues of Project Xanadu pioneered in issues of distributed hypermedia, distributed documents and evolving edit systems. It can be argued that HyperCard, World Wide Web, Lotus Notes and much of "multimedia" all derive from this work.

Nelson's theories of software center around arbitrary Virtuality, which he divides into conceptual structure and feel. He condemns "metaphors" as presently used, and instead advocates the design of deep new construct logics

Ted Nelson, Be-In, 1996

I continue to hold exactly to my original vision, that transclusive hypermedia will be the publishing medium of the future, under whatever brand name.

There are far more varieties of interactive media than anyone has yet tried; but I believe that open transmedia - unique in power to aid understanding and to solve the copyright issue - represents a vital singularity in the great family of media cosmologies; until this is disproven, I continue to stake my life and career on it. If I am right about the centrality of transclusion to the media of the future, it may all have been worth it, and we will see who understood media design after all.

Ted Nelson, Wired, 3.09

One profound insight can be extracted from the long and sometimes painful Xanadu story: the most powerful results often come from constraining ambition and designing only microstandards on top of which a rich exploration of applications and concepts can be supported. That's what has driven the Web and its underlying infrastructure, the Internet.

Xanks and No, Xanks, Wired, 3.09 , by Vint Cerf

 [top](#)

Roads and Crossroads of the Internet History. By Gregory Gromov

## Chapter 8: **Growth of the Internet** - Statistics

*Simplicity almost never happens by itself;  
it must be designed.*  
Ted Nelson

The First Decade of the Internet History: Brief Stats Story

Date	Hosts	Domains*	WebSites	WHR(%)**
Jul 01	126,000,000	30,000,000	28.200,000	22.0
Jul 98	37,000,000	4,300,000	4,270,000	12.0
Jul 97	19,540,000	1,301,000	1,200,000	6.2
Jul 96	12,881,000	488,000	300,000	2.3
Jul 95	6,642,000	120,000	25,000	0.4

Jul 94	3,212,000	46,000	3,000	0.1
Jul 93	1,776,000	26,000	150	0.01
Jul 92	992,000	16,300	50	0.005
Jul 89	130,000	3,900	-	
Jul 81	210			
1969	4			
© Gregory Gromov 1996 - 2002				

Data sources: Network Wizards (US), Dr A D Marshall (UK), and some of the Netvalley estimations

\*/ The total number of the all types of Domains (commercial -- com.; non-profit organizations -- org.; educational -- edu.; ... etc.)

\*\*/The WebSites to Hosts Ratio (WHR):

**WHR** estimates the percent of content active part of Internet community. By other words, WHR reflects what is the percent of Web surfing people are trying to become the Web authors by creating their own Web sites. So we (- G.R.G) consider the WHR as a **creative temperature** of Web

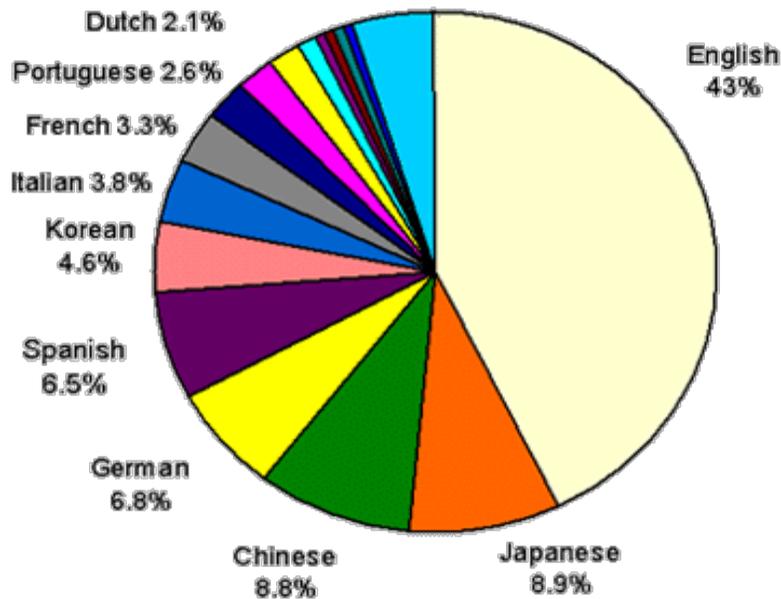
### Growth of the Internet: Statistics

DATE	NUMBER	% POP	SOURCE
August 2001	513.41 million	8.46	Nua Ltd
August 2000	368.54 million	6.07	Nua Ltd
August 1999	195.19 million	4.64	Nua Ltd
Sept 1998	147 million	3.6	Nua Ltd
November 1997	76 million	1.81	Reuters
December 1996	36 million	.88	<a href="#">IDC</a>
December 1995	16 million	.39	<a href="#">IDC</a>

World Total	513.41 million
Africa	4.15 million
Asia/Pacific	143.99 million
Europe	154.63 million
Middle East	4.65million
Canada & USA	180.68 million
Latin America	25.33 million

Compiled from: Nua Internet Surveys

**Online Language Populations**  
**Total: 529 Million**  
**(Dec., 2001)**



Source: Global Internet Statistics (by Language)

ISP Sources of Revenue: ... early beginning ...

	1996	1997	1998
Internet Access	1.21	1.21	5.53
Web Hosting & Security	0.17	0.17	0.99
Electronic Commerce	0.01	0.01	0.24

Revenue above: In billions of dollars. Source: Forrester Research, Riggs, B (April 28, 1997) Hard Times for the Small ISP, LanTimes. 55-58 Online quote: The Internet: from Backbone to End-Use

Great **AmeriNet** Dream:

Andy Grove, the boss of Intel, ... summed up the online pioneers' attitude when asked about the return on investment (ROI) from his firm's Internet ventures: "...

This is Columbus in the New World. What was his ROI?

~ Christopher Anderson, The Economist, 1997

... e-commerce sales could balloon to \$37.5 billion this (1998 - ed.) year, according to market researcher Jupiter Communications in New York.

by Jon Swartz, Jamie Beckett, SF Chronicle, November 25, 1998

Projections for the year 2002 from Forrester and Jupiter currently range between USD200 to USD300 billion .

CEO of Cisco Systems, John Chambers reckons that figure will be closer to 1 trillion .

At Network World 98, industry analyst Nicholas Lippis announced that online commerce would generate USD1.5 trillion of US GDP by 2002.

Paradigm Shifts, Nua Internet Surveys, November 2nd 1998

... and what happened in real life:

E-Commerce Growth Rates and 2001 Monthly Spending (U.S.)		
Month	Yearly Growth (2000-2001)	2001 Monthly Spending (billions)
April	73.1%	\$4.5
May	103.5%	\$5.4
June	71.2%	\$5.3
July	39.0%	\$4.9
August	57.2%	\$5.6
September	53.7%	\$4.7
October	25.0%	\$4.6
November	10.1%	\$5.3

Source: Nielsen//NetRatings and Harris Interactive

New York and Rochester, NY, January 7, 2002—Over the eight weeks of November and December, Americans spent \$13.8 billion online. A Goldman Sachs, Harris Interactive SM, and Nielsen//NetRatings eSpending report revealed this latest economic information.

In comparison, \$12 billion was spent during the 2000 holiday season

“Online holiday spending continued its growth, despite pressures from the slowing U.S. economy.

Source: Business Channels

- Number of the Web pages in July 1998: 300 millions, 1.5 Million Web Pages Born Daily,
- 50% of all traffic goes to the top 900 Web sites currently available.  
Alexa Internet, InternetWorld online, 31-Aug-1998

- Percentage increase in Internet traffic, per month: 30

- Number of security incidents reported to the Computer Emergency Response Team Coordination Center in 1995: 2412
- Number reported in 1988: 6

- Number of Internet Service Providers (ISPs) in the U.S. and Canada, in August,

1997: 4,133

- Number of ISP, worldwide in July, 1996: 3,054

- Average number of customers at an ISP: 1,850

Data source: [Win Trees](#)

...40 percent of global Internet traffic either originated or terminating in California.  
*Pacific Bell* - December, 1995

... traffic over the Internet doubling every 100 days  
By Frances Hong, Internet Capacity Major Theme For 1999  
Study, NEW YORK (Reuters), December 6, 1998

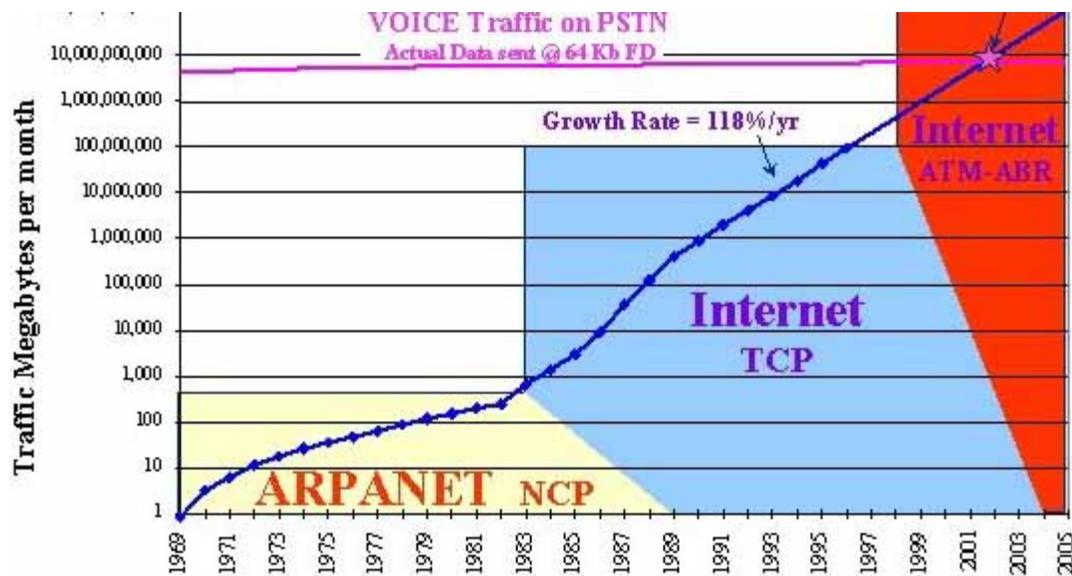
Net traffic will quadruple in 2001  
Larry Roberts, Forbes, December 10, 2001

Internet traffic grew more than 100% in 2001 from 48 PB/month to 100 PB/month  
(PB = Petabyte or 1,000,000,000,000,000 bytes). This growth continues in 2002.

Majority of users -- 84%, according to the National Telecommunications and Information Administration's report: *A Nation Online*, Feb 2002 -- connecting to the Internet for email or instant messaging services...

By John Ryan of RHK, Inc. 2002

Internet Traffic Growth, by Larry Roberts



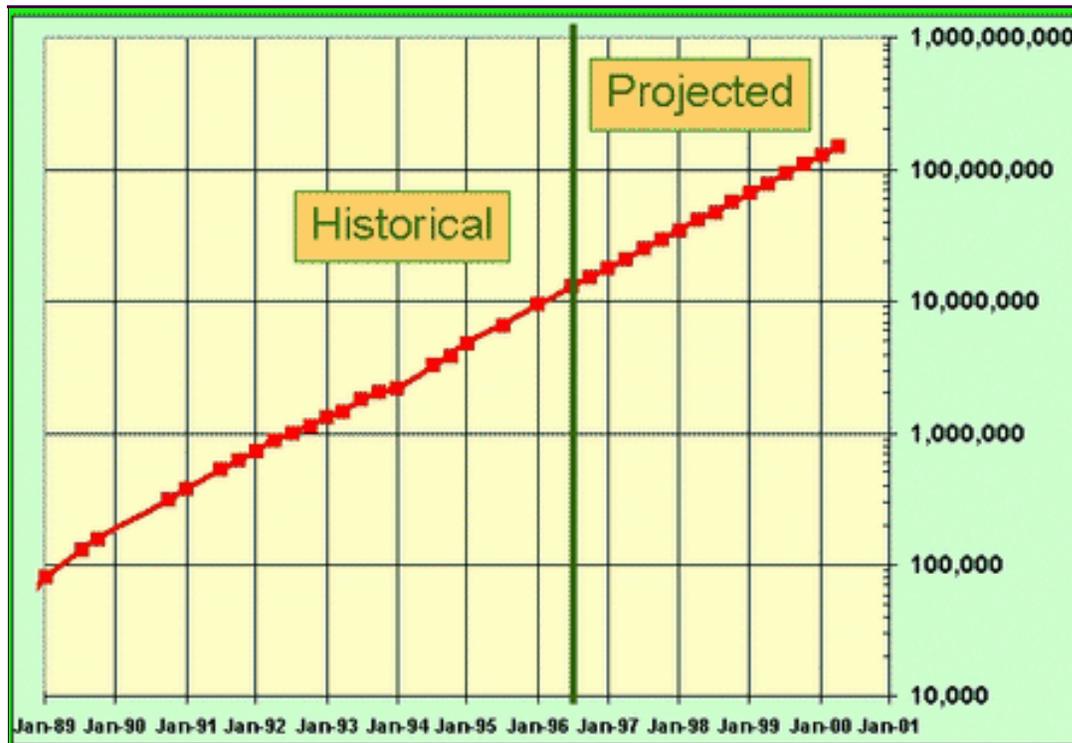
- Traffic is for US backbone network, not including local calls, for both Internet and PSTN;
- Traffic growth is higher than host growth because the traffic/host ratio growth at 14 percentage per year



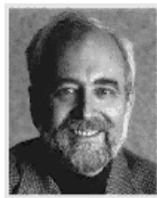
**Lawrence G. Roberts:** One of the leading founders of the basic technical basement of Internet - packet network: "... was responsible for the design, initiation, planning and development of ARPANET, the world's first major packet network, the predecessor to Internet, while the Director of Information Processing Techniques for DARPA. After ARPA, ... founded the world's first packet data comm carrier, Telenet, and was the CEO from 1973 to 1980. Telenet was sold to GTE in 1979 and subsequently became the data division of Sprint...

... **more data than voice conversations** now take place daily on British Telecommunications Plc's domestic network ... traditional telephone calls were being replaced by electronic mail (e-mail) ... increased use of e-mail, electronic commerce (e-commerce) and multimedia services in addition to conventional and mobile telephony would double the size of the British communications market from its current \$49.62 billion within five years  
Yahoo! News: Technology Headlines, November 5, 1998

**Internet Hosts** Growth, by Tony Rutkowski



[The Host means *iniquely* reachable Internet connected computer]



**Anthony M. Rutkowski:** global enterprise strategist, public official, organization leader, consultant, lecturer, and author in both the Internet and telecom worlds ...

**Why Hosts?** Because there is not any other ways to count the Internet populations at all: "No one has any clue how many users there are, but most people would agree that there is at least

*one user per host."*

Internet Domain Survey. The Nua Ltd.

Estimated number of web users in the U.S.: **57,037,000**

Win Treese , May 1998

...the active number of Internet users in the United States is only **37** million, well below the widely reported range of 50 million to 70 million seen in most published reports.

Bits & Bytes, by Michael Bush , July, 1998.

... about 15 million of the total **23** million U.S. households on the Internet receive their online service through AOL.

AOL Eyes Half Of All New Online Users, September, 1998

So, according to "*Irresponsible Internet Statistics...*", .. there is no absolute way to measure any statistic regarding the growth of the Internet. As John Quarterman of MIDS says:

The Internet is distributed by nature. This is its strongest feature, since no single entity is in control, and its pieces run themselves, cooperating to form the network of networks that is the Internet. However, because no single entity is control, nobody knows everything about the Internet. Measuring it is especially hard because some parts choose to limit access to themselves to various degrees. So, instead of measurement, we have various forms of surveying and estimation.

So all the statistics presented here are based on estimates and conjecture. And even if they were absolutely true, growth rates change. I (Robert Orenstein) read somewhere (if you know where I saw this, please tell me) that there is only one conclusion that can possibly be drawn from such vague data: *The Internet is getting big, and it's happening fast.*

So, "*the Internet is getting big,...*" Is it always good?

	Percentage of U.S. public schools connected to the Internet
1994	35
1996	65

Data source: WinTrees

In a poll taken early last year (1996 -ed.) U.S. teachers ranked computer skills and media technology as more "essential" than the study of European history, biology, chemistry, and physics; than dealing with social problems such as drugs and family breakdown; than learning practical job skills; and than reading modern American writers such as Steinbeck and Hemingway or classic ones such as Plato and Shakespeare.

... The Kittridge Street Elementary School, in Los Angeles, killed its music program last year to hire a technology coordinator; ... Mansfield, Massachusetts, administrators dropped proposed teaching positions in art, music, and physical education, and then spent \$333,000 on computers; in one Virginia school the art room was turned into a computer laboratory. (Ironically, a half dozen preliminary studies recently suggested that music and art classes may build the physical size of a child's brain, and its powers for subjects such as language, math, science, and engineering -- in one case far more than computer work did.) ...

The Computer Delusion , by Todd Oppenheimer,



Roads and Crossroads of the Internet History. By Gregory Gromov

## Chapter 9: **Conclusion.**

"Subjects." There are no *subjects*." Everything is deeply intertwined.  
~ Ted Nelson

Date: Sun, 20 Oct 1996 21:21:34 -0400  
From: BRUCECLYN@aol.com  
To: view@netvalley.com  
Subject: Comments to :View from Internet Valley

Your site is riveting history - but, what are the practical differences between the Internet and the World Wide Web?

You describe a continuous evolution of a system and I, for one, don't know the practical differences between the manmade information links whose terms are commonly bandied about in the press.

Please respond - enquiring minds want to know.

Sincerely,  
Bruce D. Clyne

Dear Bruce,

... The Internet is a global networks' system that consist of the millions of local area networks (LANs) and computers (hosts). So it's a tech system that is working according to the basic computer science concepts and rules. It was developed 25 - 30 years ago.

The WWW is only one of the ways of practical implementations of the Internet.

Some of the other ways are the following ones: gophers -- the dispersed system of menu driven subject oriented data bases; ftp -- the remote files' exchange system; email systems, and so on...

The WWW (that was born 5 years ago) is a method (and system) that provides the members of the Internet's community with historically new opportunity to create and permanently develop the global field of the texts (as well as images, animations, sounds, etc.), all parts of which are able to crossconnect with each others.

In other words, the WWW is a fast growing (millions of authors are adding new pages every day) global field of text that consist of billions of words (as well as sounds, images, animations, ... etc.) all (!) parts (every of billions of WORDS) of which are able to realtime crossconnect and interact with each others.

As it was mentioned by Alberto Cavicchiolo, "the network is not a computer science concept, but a linguistic concept".

I often quote this definition, even though I do not fully agree with it. From my viewpoint the network itself is definitely a computer science concept. The Internet is a computer science concept as well as biological concept.

... the Web (!) only "... is not a computer science concept, but a linguistic concept".

So my definition of the Web is the following one:

The Web is a method (and technology) of the global WORDS' fields dynamic crossconnection and interaction (again, I mean the words, as well as all other communication symbols: the images, animations, sounds and so on...).

The Web uses the Internet to store, locate and connect the WORDS as some of the others more tradition methods of the WORDS's connection used the stones, skins, papyruses, papers, phone, recorders, radio, TV ...

The phone teleconferences, some of the radio and TV shows and tele-reportages were partly using the Web's basic hyperlink approach.

The hyperlinks concept itself was known for thousands of years . For instance, some of the Bible stories include different source stories inside the main story, and those source stories contain some other source stories and so on...

All those well known attempts to use hyperlinks concept had one technical disadvantage: they were based on the static, fully prediscrined scenarios of the WORDS' crossconnections.

There were strong crossconnection levels limits, link's delay time limits, and so on..

The WWW has broken any limits for any WORDS' crosconnections.

After that the "chain reaction" of crossconnections was launched...

For instance, according to the Sun Microsystems' statistics "*the total number of the Internet's sites crossconnections more than doubled every month*". (Sun press-seminar , January 1995, Mountain View, CA).

...

Once again, thank you for your interest.

Sincerely,  
Gregory Gromov

The Net is a unique creation of human intelligence.

... the first intelligent artificial organism.

... represents the growth of a new society within the old.

... represents a new model of governance.

... represents a threat to civil liberties.

... the greatest free marketplace of ideas that has ever existed.

The Net is in imminent danger of extinction.

The Net is immortal.

By Henry Edward Hardy The History of the Net,  
Master's Thesis, September 28, 1993

The growth of the Net is not a fluke or a fad, but the consequence of unleashing the power of individual creativity. If it were an economy, it would be the triumph of the free market over central planning. In music, jazz over Bach. Democracy over dictatorship...

by Christopher Anderson. The Economist Newspaper Limited.

I feel most deeply that this whole question of Creation is too profound for human intellect...

Let each man hope and believe what he can.

~ Charles Darwin

## Epilogue and Prologue ...

The Web 's Way to the WORD's WORLD

*In the beginning was the WORD ...*

The WWW creates a multidimensional Web of Roads.

Those Roads have their beginning at the civilization that was raised on a concept of a plane BOOK; the civilization that has existed for thousands of years.

The Hyperlinks -- Roads of World Wide Web -- lead from a BOOK of a plane text to the multidimensional Universe of WORDs, to the WORD's WORLD, which becomes the kernel concept of the next civilization...

If all this seems like a wild idea, that means you understand it.  
These are times wild with possibility.

Ted Nelson, 1982

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See also:

[Internet pre-History: Ancient Roads of Telecommunications & Computers](#)

[Silicon Valley History](#)



Roads and Crossroads of the Internet History . By Gregory Gromov

## About This Book: **As They Said it ...**

For a history of the Internet readers should consult Gregory Gromov's The Roads and Crossroads of the Internet's History.

*Virtual Seminar for Teaching Literature. Internet Teaching 1. Some Basic Concepts. Humanities Computing Unit of Oxford University,*

*Oxford University UK, 1996*

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This is one of the Great Classic Websites. It's a history of the Internet and what led up to it, told in hypertext, both eloquently and chaotically, as strange in its own way

as the Mel Brooks movie, History of the World, Part One. But it's one [REDACTED] of a lot more accurate than the Brooks movie. All Internet users, even those of you who just signed up for Web-TV or AOL last week and are still fumbling around, should check out this site.

When you jump into this online story, make sure you have a couple of hours free. It takes that long to read. Imagine a collaborative writing project that tells you more than you ever wanted to know (and more than probably thought there was to tell) about the Internet, starting with the laying of the first telegraph cable across the Atlantic in 1858 (which was NOT a success, BTW).

You'll learn why the WWW Consortium [W3C] is based at a physics lab in Switzerland called CERN, instead of at a computer research center where you'd logically expect it to be, and why CERN doesn't even stand for the lab's real name - in either English or French, along with lots of other neat factoids that'll come in handy if you ever find yourself playing Trivial Pursuit: The Internet Edition.

There's also a picture of Al and Tipper Gore at their wedding, twenty years before the WWW came into existence. And I'm not going to tell you why it's there. You can find out for yourself. (And if you want to be a killjoy you can post the reason below ..)

*by Robin Miller. Best High-Tech Sights on the Net! 26 Oct. 1998*

.Read The Roads and Crossroads of Internet 's History, Gregory R. Gromov, et al. This is a hypertext of nine main pages with side links. It is written as a kind of mosaic rather than as a straight narrative, including email questions and answers, fragments of interviews, and the like. It focuses primarily on the Web and hypertext over the Internet...

*by M. C. Morgan. College of Arts and Letters, Department of English. Bemidji State University, MN*

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The Roads and Crossroads of Internet 's History by Gregory R. Gromov... is an excellent history of the internet and a good example of a "web document." ... You also should experience what "hypertext" is and why this experience is more like exploring than reading. But just like an exploration, it is up to you how extensively you explore. And just like any explorer you may end up "lost." Don't panic, just click on one of the links at the top of the window to return to one of the "pages" in the document. There are links at the top to each of the nine parts to this document. Now go explore and remember what you're looking for:

- an understanding of the history of the internet.
- the experience of exploring a topic through the internet.

*Robert Melczarek. Introduction for EDU 606 School of Education Troy State University, Dothan*

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The Roads and Crossroads of the Internet's History. By Gregory R. Gromov. A critically acclaimed site for a comprehensive history of the Internet.

*The University of Texas, System Digital Library.*

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For anyone who has ever wondered how and why the Internet was created comes this extensive essay, "The Roads and Crossroads of Internet's History." With this document, users can follow the development of the Net from its early stages as a

military communication system to the multimedia extravaganza we know today.

*Webcrawler: Internet User Guides Reviews \*Hot\* Web Sites, 1996*

---

... an excellent 9-part review of the Internet's history and its relationship with the information revolution. Very informative and quite amusing at times too!

*CADVision Development Corporation*

---

An excellent summary of key milestones in Internet history.

*BellSouth. 1996*

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History of the Internet. We all need it. We all want it. But how did it happen in the first place? Gregory Gromov provides a ... brief (one page) and comprehensive (nine page) history of the Worldwide Web before it was the Net we all know and love...

*By Matthew Holt, NetworkWorld June, 1997*

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If you've ever wondered how the Internet came into being then be sure to check this site out...If you've never wondered how the Internet came into being then go anyway. You shouldn't be such a barbarian. Hitch a lift with us on the information superhighway

*LineOne, UK*

---

... A must for someone researching the evolution of the Net.

*Jason Parkhill The Historian and the Internet Bibliography College of Wooster, Ohio.*

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Gregory R. Gromov's version is a fun to read and thoughtful look into the history of the Internet and the WWW.

*The Maine Science and Technology Foundation. USM - Professional Development Center*

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Access the website designed by Gregory R. Gromov ... Study all nine (9) pages ... as well as:

1. Road #1 "Information Age's Milestones"
2. Road #2 "Internet at CERN: 1976 - 1990"
3. Road #3 "The 50 Years of the Hypertext Concept's Evolution"
7. The team should write two or three questions regarding the history of the Internet... Write your questions based on Gromov's website.

*The Individual Learner Within American Culture, by Larry Garrett, Social Foundations of American Education. Troy State University. Florida, 1998*

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Read through your history- wonderful!

*Dionne Dames. 25 Oct 1998*

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Hi, I don't mean to be mean, but your website is very hard to understand. Next time you make a website about the history of something, don't jump around as much! You confused the hell out of me.

*SCU Computer Lab. Santa Clara University. 28 Sep 1998*

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This site is a genuine pleasure to use! Thank you.

*Don Hester. 14 Sep 1998 22:59:13 -0700*

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A somewhat wild and wacky history of the internet....

*EBEAB: Internet History. by Marcus Kazmierczak*

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Gregory Gromov provides an impressionistic overview in "The Roads and Crossroads of Internet's History," ... with a particular concentration on the development of hypertext and the Web.

*Current Literature of the online community by Eron Main ErmineTech Ltd, Faculty of Information Studies, University of Toronto*

---

Great site very informative, interesting type usage...

*Maurice Roach 20 Oct 1998 16:53:40 -0700*

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tnx for your wonderful history of the inet, by far the best I have seen *Tom Lamb. 26 Oct 1998 06:06:39 -0800*

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Thank you for telling the history of the internet in a manner that I could comfortably read, follow and understand. You guys were obviously in touch with your potential target audience.

*Jens Morrison 13 Apr 1999 18:40:31*

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Thank you for the great site (and sight), friendly, easy to read and gives a new perspective on the Net

*Jazz Veld 12 Apr 1999 14:38:31*

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... Well done on an interesting and informative piece of work

*Simon Cockroft 12 Apr 1999 15:52:15*

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Gregory R. Gromov's *The Roads and Crossroads of Internet History* is probably the history that most students will enjoy as it is sprinkled liberally with files that illustrate

his points. Commencing with Internet pre-history work your way through 9 sections to read about the web, browser wars, and Xanadu to name a few topics. It is a long essay but extremely interesting.

*The Australian National University. Faculty of Art, Canberra*

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The Roads and Crossroads of Internet History - Gregory Gromov's comprehensive and fascinating overview of the philosophy and history of the Internet.

*Course STS 3700B 6.0: "History of Computing and Information Technolog" by Luigi M Bianchi. School of Analitical Studies & Information Technology. Science and Technology Studies. York University, Canada*

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Finally, an entertaining and eye-catching approach to Internet history is Gregory R. Gromov's History of Internet and WWW: The Roads and Crossroads of Internet History. This site is worth visiting, as much for its unorthodox approach using dazzling visuals and hypertext style as its content.

*By Deborah Husted Koshinsky and Rick McRae, University Libraries State University of New York at Buffalo*

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The Roads and Crossroads of Internet History by Gregory Gromov ... can be a great resource where an informed 'Net surfer can come and let hypertext do the walking and the inventors of the 'Net themselves do the talking.

*"Nettalk : A Brief History of the 'Net" by Kelly Ward. The Bulletin. Special Libraries Association, San Francisco Bay region. The School of Information Management and Systems (SIMS) -- a graduate program at the University of California, Berkeley.*

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For anyone who has ever wondered how and why the Internet was created comes this extensive essay, "*The Roads and Crossroads of Internet's History.*" With this document, users can follow the development of the Net from its early stages as a military communication system to the multimedia extravaganza we know today.

*Course Education 2751: "Power and Communication Technology" by Bridget A. Ricketts Prince of Wales Collegiate, Newfoundland Canada*

 [top](#)

Roads and Crossroads of the Internet History . By Gregory Gromov

## Citation Index:

### Encyclopedias:

- [The Internet: A Historical Encyclopedia](#). p. 197
- [Encyclopedia of New Media : An Essential Reference to](#)

Communication and Technology - p. 489

- [Encyclopedia of library and information science: Volume 3 - p. 2817; Volume 68 - p. 340](#)
- [Encyclopedia of computer science and technology - p. 261](#)
- [The Gale Encyclopedia of Science - p 2176](#)

#### Scholars & Books

- [Innovation and the Communications Revolution: From the Victorian Pioneers to Broadband Internet. The Institution of Engineering and Technology \(April 29, 2002\). Page. 285](#)
- [On-Line Teaching: Tools and Projects. Oxford University. Pages.10, 15, 79](#)
- [Law, Economics and Cyberspace: The Effects of Cyberspace on the Economic Analysis of Law \(New Horizons in Law and Economics Series\) Page 179](#)
- [Cyberimperialism?: Global Relations in the New Electronic Frontier - Politics in the Electronic Global Village. 2000. Page 90](#)
- [CREATING A SILICON VALLEY IN INDIA? Delhi Business Review. Vol. 1, No. 1, Jan.2000](#)
- [Entrepreneurship Models of the Countries that Leverage Silicon Valey. University of California, Berkeley. 2004. page 1](#)
- [How can we strengthen links between entrepreneurial companies and entrepreneurial universities in the UK? Cambridge-MIT Institute Technology Policy Programme; Judge Institute of Management, University of Cambridge March 2005. Page 16](#)
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- [Internet Infrastructure in Israel. A proposal for reform. Institute for Advanced Strategic and Political Studies. Division for Economic Policy Research. No. 43, August 1999](#)
- [New York State Meta-Regional History and Current Need for an Upstate Transformational Network: "Canal Innovation Corridor".](#)
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- [Growing industrial clusters in Asia: serendipity and science. World Bank. Washington, D.C. page 42](#)
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- [Socio-Economic Impacts of ICT. E-government, the Local Level. A Discussion Paper. Social Science Research Centre. Department of Sociology and Anthropology University of Canterbury. June 2002. Page 4](#)
- [The cyberspace handbook - Page 295](#)
- [Fundamentals Of Computer Networks - Page 84](#)
- [The Internet: the basics - Page 202](#)
- [The cyberspace handbook - Page 295](#)
- [Fundamentals Of Computer Networks - Page 84](#)
- [Financing economic development in the 21st century - Page 345](#)
- [Cybercrime: criminal threats from cyberspace - Page 225](#)
- [Growing industrial clusters in Asia: serendipity and science - Page 42](#)
- [Fundamentals Of Computer Networks - Page xxxi](#)

- [Adolescents and literacies in a digital world - Page 212](#)
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- [Choice: books for college libraries. Association of College and Research Libraries. Volumes 41, 43](#)
- [Global enterprise transitions: managing the process - Page 156](#)
- [XML Family of Specifications: A Practical Guide 2002. Addison-Wesley. Page 29](#)
- [Understanding community: The implications of information flow and social interactions in online discussion groups by Combs Turner, Tammara, Ph.D., UNIVERSITY OF WASHINGTON, 2008](#)
- [Liberty and research and development: science funding in a free society – Page. 49](#)
- [Public Administration: An Introduction - Page 415](#)
- [The Internet and the construction of the immigrant public sphere : ... - Page 92](#)
- [Politics on the Internet: a student guide - Page 12](#)
- [Bill Clinton - Page 20](#)
- [Steve Jobs Thinking Differently: An Unauthorized Biography. Simon & Schuster. 2011](#)

and [much more](#). [Hundreds of print titles](#).

The Internet founding fathers that are referring to NetValley :

- The [World Wide Web Consortium](#) was founded by Tim Berners-Lee at MIT and currently headed by him, is referring to [History of Internet and WWW: The Roads and Crossroads of Internet History](#) from their [A Little History of the World Wide Web](#) that was created circa 1995 by Robert Cailliau.
- The [Internet Society](#) (ISOC) provides leadership in Internet related standards, education and policy since 1992. The ISOC is referring to [History of Internet and WWW: The Roads and Crossroads of Internet History](#) from their List of reputable sources of the [Histories of the Internet](#)

The universities that are referring to Netvalley.com publications in their online courses:

- Harvard University. The course of [CSCI E-12, Fundamentals of Web Site Development](#)
- Stanford University, Stanford Humanities Laboratory - STS 145 - [Command and Conquer in the Development of Real-Time Strategy](#)
- University of Illinois at Urbana-Champaign, White Papers on Technology Issues for Educators of 1999, 2002, 2003, 2005, 2006: [History of the Internet](#)
- York University, Canada. SCHOOL OF ANALYTIC STUDIES & INFORMATION TECHNOLOGY. The course of [STS 3700B 6.0 -- History of Computing and Information Technology](#)
- Duke University, Department of Computer Science . The course of [Internet Discussion Links & Questions](#)

- University of Regina, Canada. Department of Media Production + Studies. The Language of New Media. INTRODUCTION TO DIGITAL MEDIA, FILM 208.001. Fall Semester 2002
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- The San Diego Supercomputer Center, The Regents of the University of California. [The History of the Internet](#)
- American Institute of Physics, Online resources for the history of physics & allied fields. [History of the Internet](#)
- Drexel University, Department of Mathematics Swarthmore College, The course: [Mathematics and the WWW - Section 8: Beyond the Web](#)
- American Studies at the University of Virginia. Science and Technology - Science and Culture - [History of the Internet](#)
- New Mexico State University: The course Isc311 - [Internet History & Development](#)
- Cornell University, Department of Computer Science. The course of [CS 502 Architecture of Web Information Systems and Digital Libraries](#)
- University of Montevallo. [President's Message: What would it take to create a 'Golden Age' at Montevallo?](#)
- University of Alabama in Huntsville. The course of CM 100 - Introduction to Computer-Mediated Communication. [History of the Internet](#)
- Universitat de Barcelona, Spain. Tutorials, traduccions i altres documents. [How it all began: a brief history of the Internet](#)

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