



NE'TWORK, nê't'wûrk. *n. s.* [*net and work.*]  
Any thing reticulated or decussated, at  
equal distances, with interstices between  
the intersections.

# Advent of the Internets



## Chefertown and Baltimore, PACKET-BOAT.

THE Subscribers respectfully inform  
the public, that they continue run-  
ning a Packet-Boat, which is now in ex-  
cellent order. The Cabin is large and  
commodious, well calculated for the Ac-  
comodation of Passengers. Merchandise,  
Produce, &c. carried on the lowest Terms.  
From experience they can assuredly say,  
that the Packet is safe, and sails remark-  
ably well -- Will regularly leave Chester-  
town, every MONDAY at *Nine* o'clock,  
A. M. and set out from Baltimore, every  
THURSDAY, at *Nine* o'clock, A. M.

John Constable,

Master of said Boat, and one of the pro-  
prietors, will use all possible Diligence to  
accommodate Passengers, as well as be  
careful to execute, with punctuality, every  
trust committed to his charge.

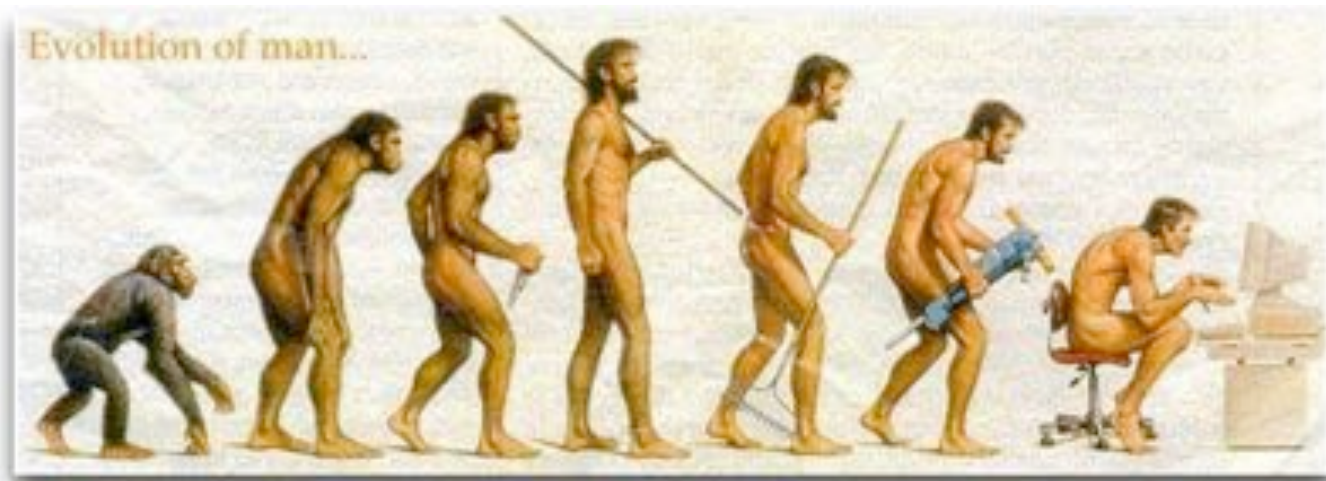
JOHN CONSTABLE,  
JAMES PIPER.

*Chefertown, May, 17, 1791.*

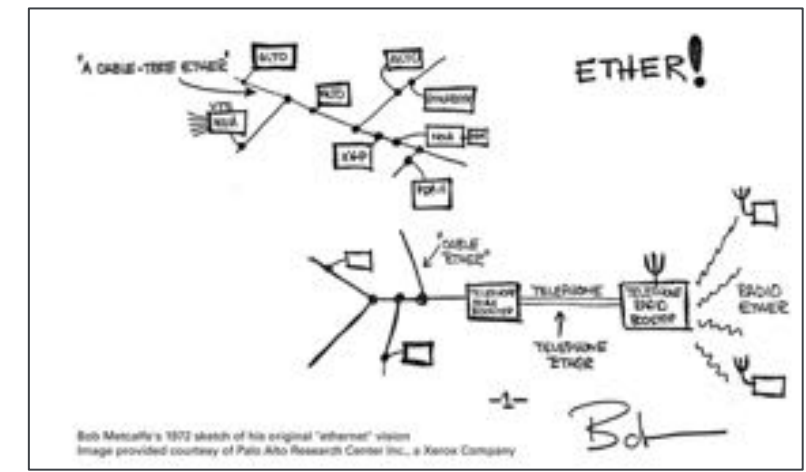
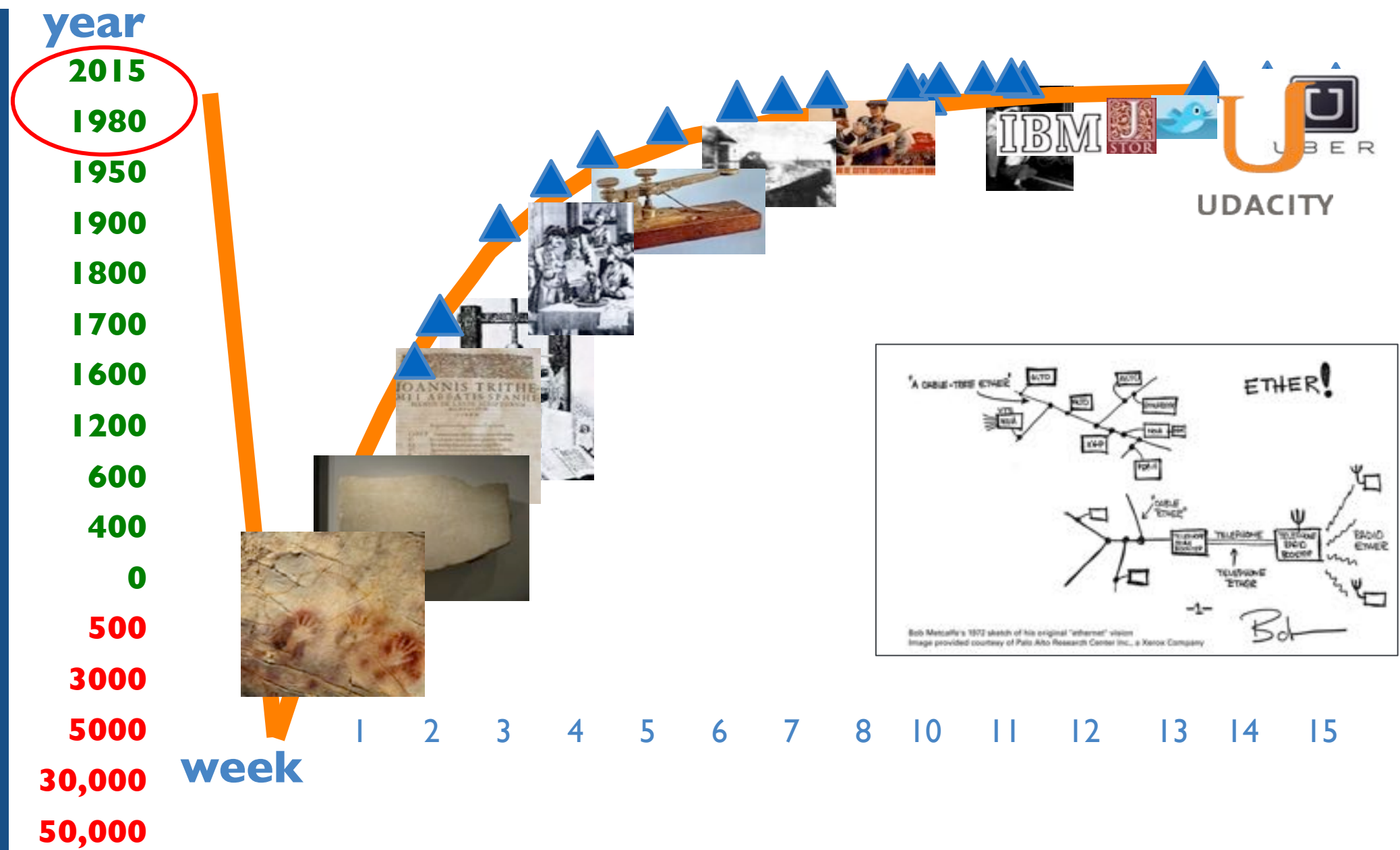
**Geoff Nunberg**

**il03 History of Information**

April 6, 2017



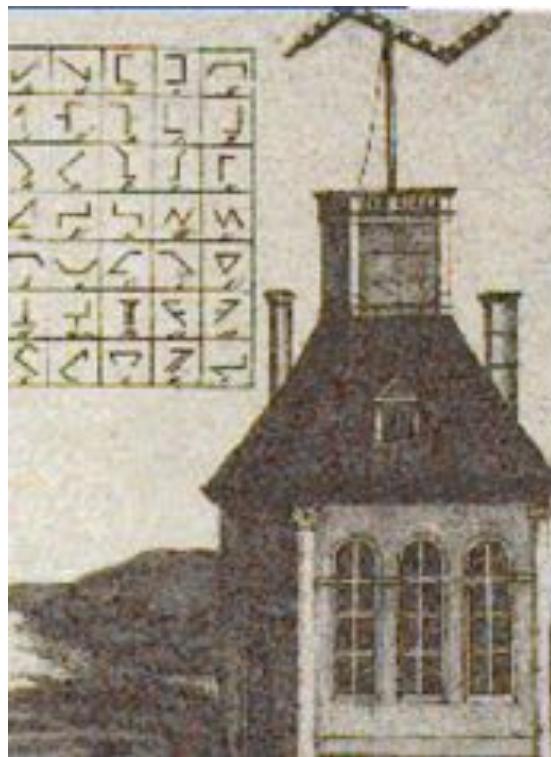
# Where We Are





NE'TWORK, nēt'wûrk. *n. s.* [*net* and *work.*]  
Any thing reticulated or decussated, at  
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the intersections.

# The persistence of networks



## national system

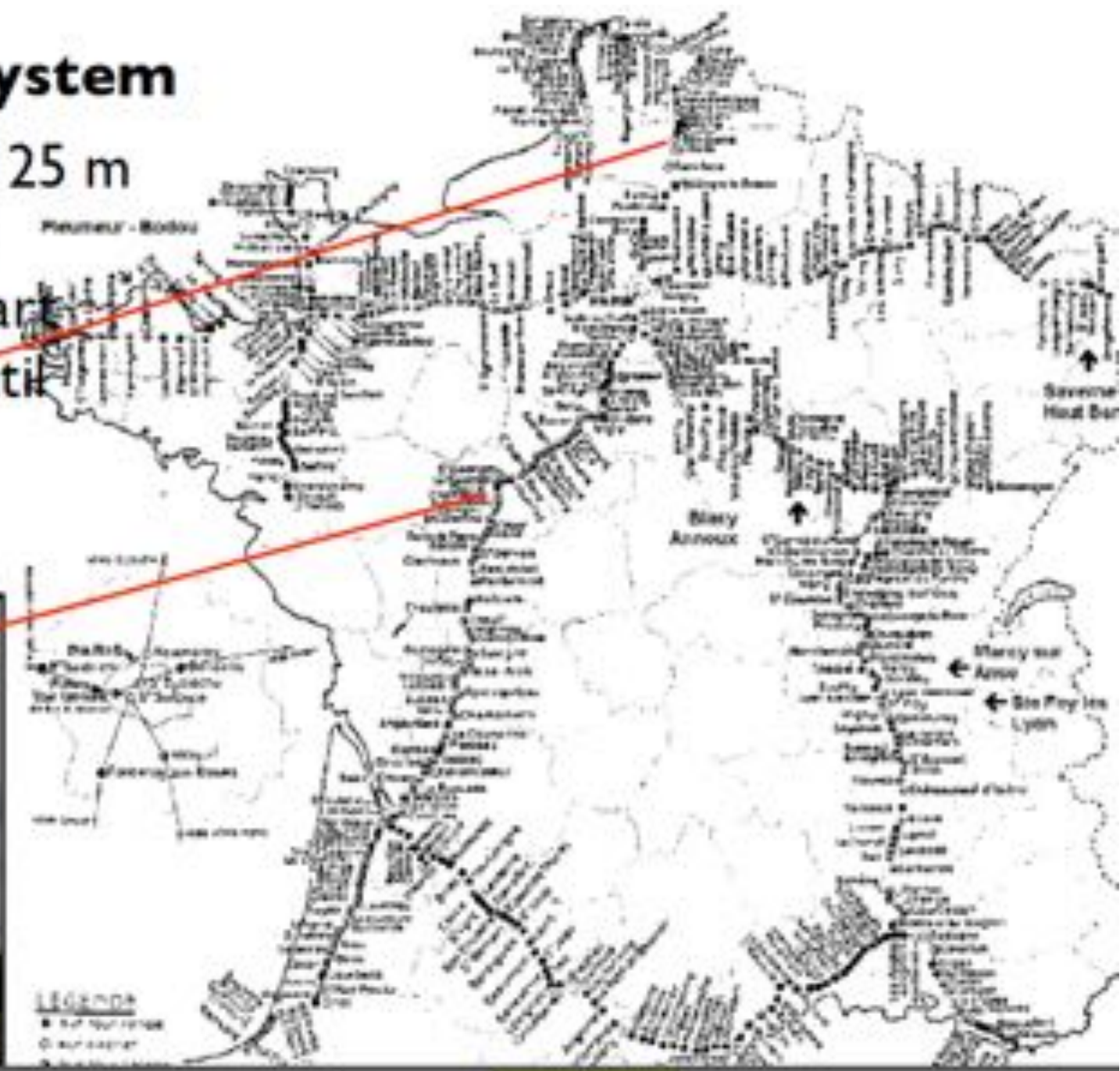
5,000 km/3,125 m

534 stations

c. 6 miles apart

in service until

c 1853





NE'TWORK, nê't'wûrk. *n. s.* [*net and work.*]  
Any thing reticulated or decussated, at  
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the intersections.

# The persistence of networks

Map of US, showing postal routes, 1809





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Any thing reticulated or decussated, at  
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# The persistence of networks

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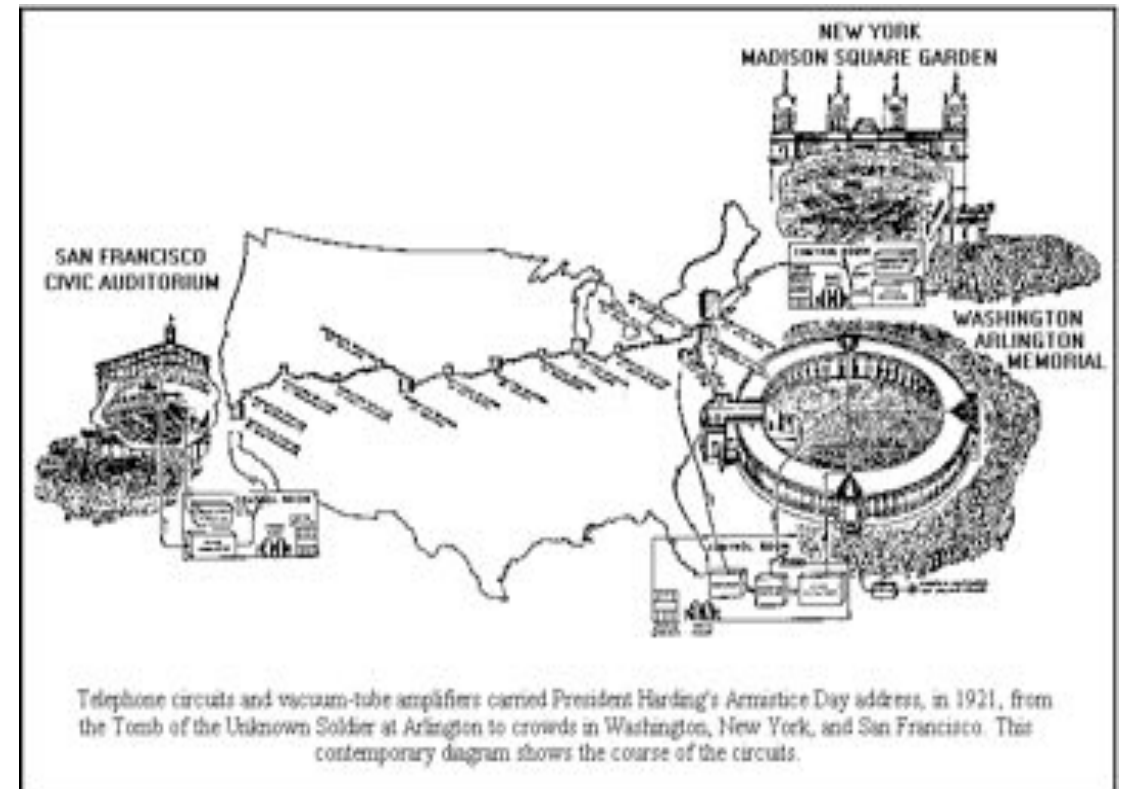
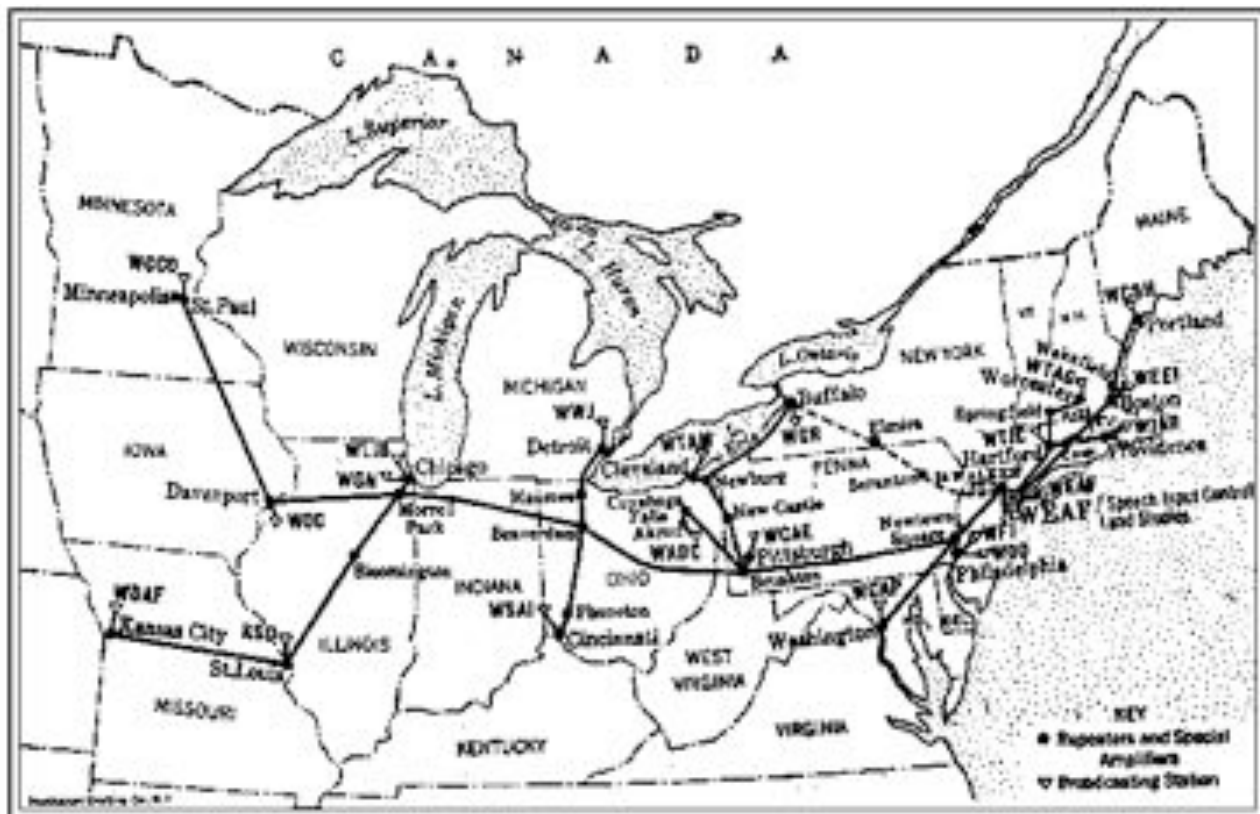


NE'TWORK, nê'twûrk. *n. s.* [*net* and *work*.]  
Any thing reticulated or decussated, at  
equal distances, with interstices between  
the intersections.

# The persistence of networks



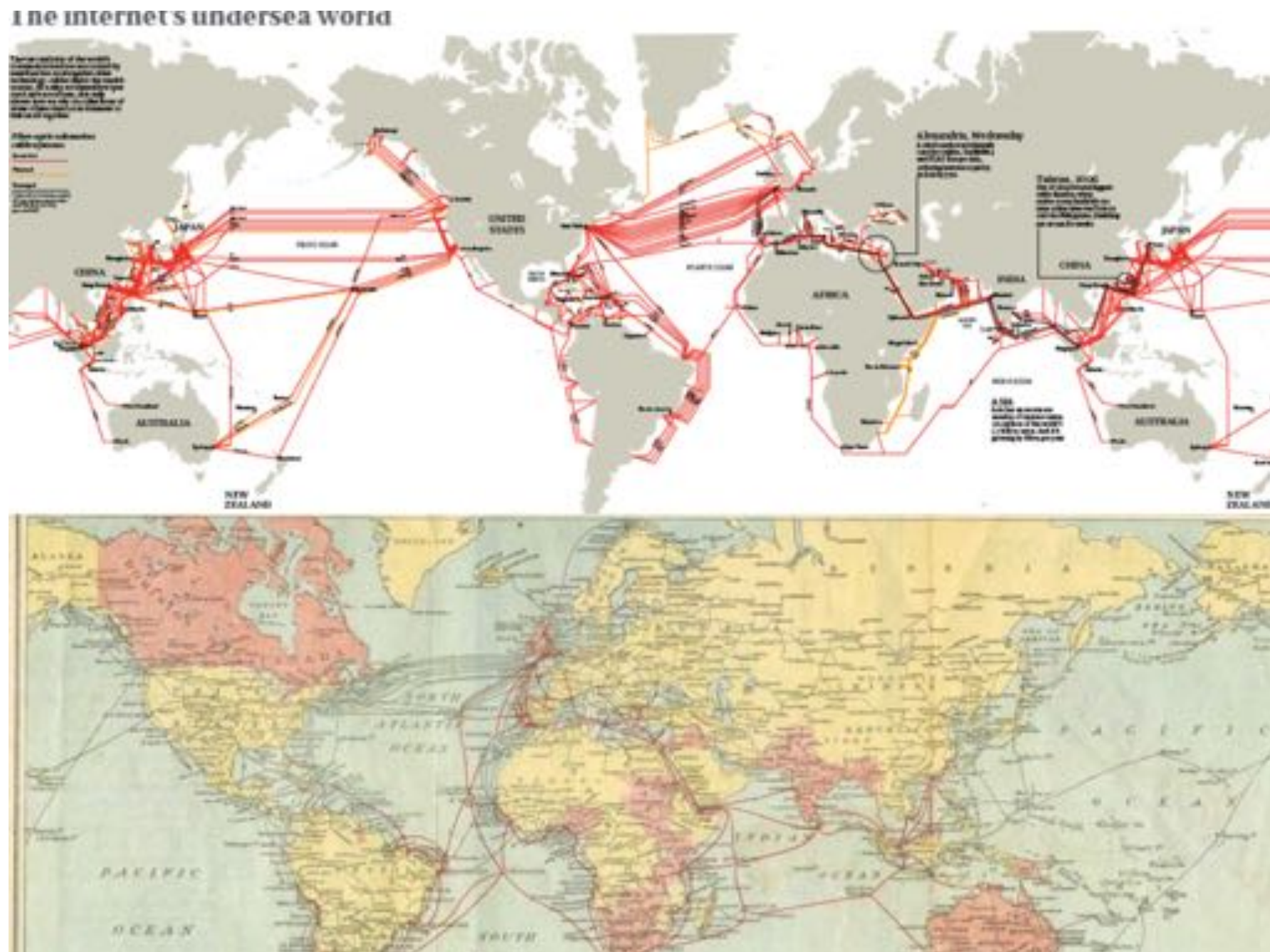
US Radio Networks, 1922





NE'TWORK, nēt'wûrk. *n. s.* [*net* and *work.*]  
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equal distances, with interstices between  
the intersections.

# The persistence of networks



# Itinerary, April 6

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The “internet” as devices/network/content

Internet beginnings:

time-sharing, communications protocols, packet switching

Arpanet to internet

Growth of the internet: email, browsers, the WWW

The Wired World

How to think about the Internet



# What Are We Talking About?

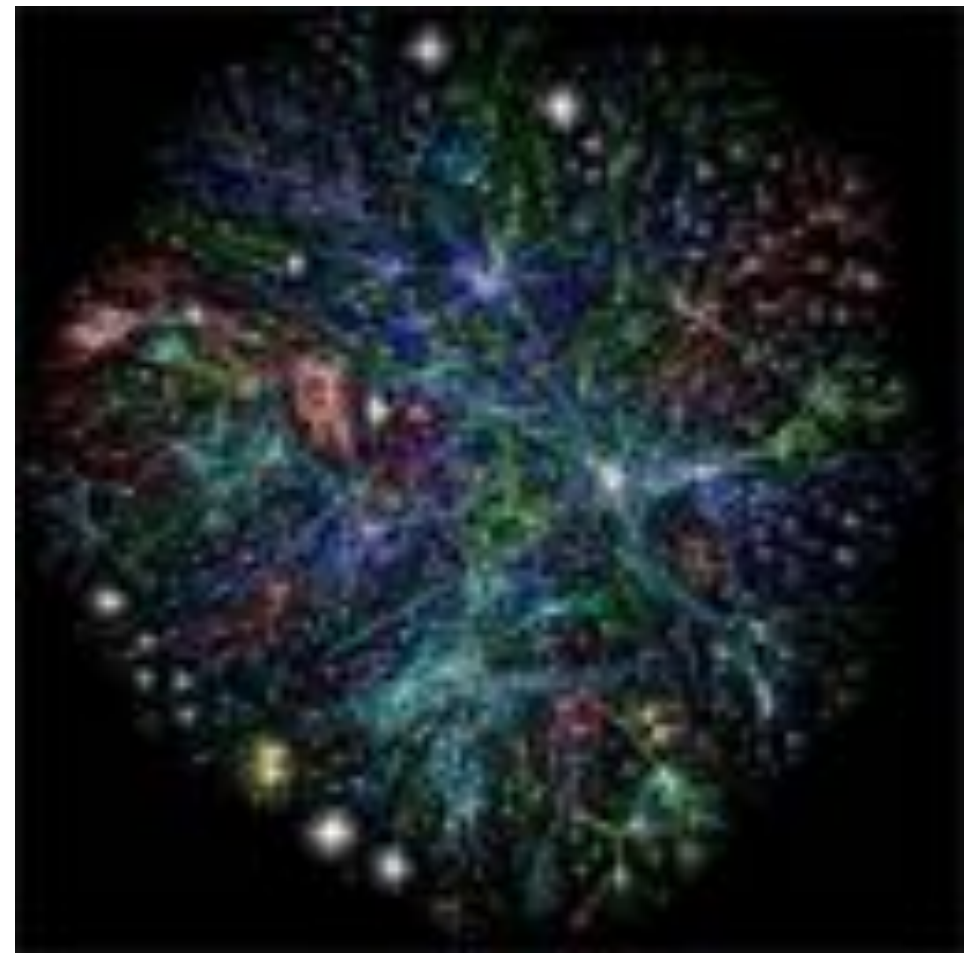
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The **Internet** is a global system of interconnected computer networks that use the standard Internet protocol suite ... to serve billions of users worldwide. It is a *network of networks*... linked by a broad array of electronic, wireless and optical networking technologies.

--a well-known infallible source of conventional wisdom

Cyberspace. A consensual hallucination experienced daily by billions of legitimate operators...A graphic representation of data abstracted from the banks of every computer in the human system. Unthinkable complexity. Lines of light ranged in the nonspace of the mind, clusters and constellations of data...

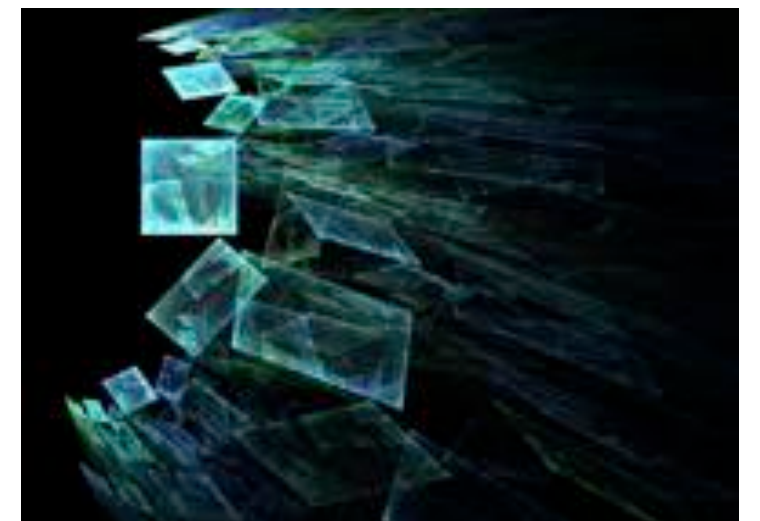
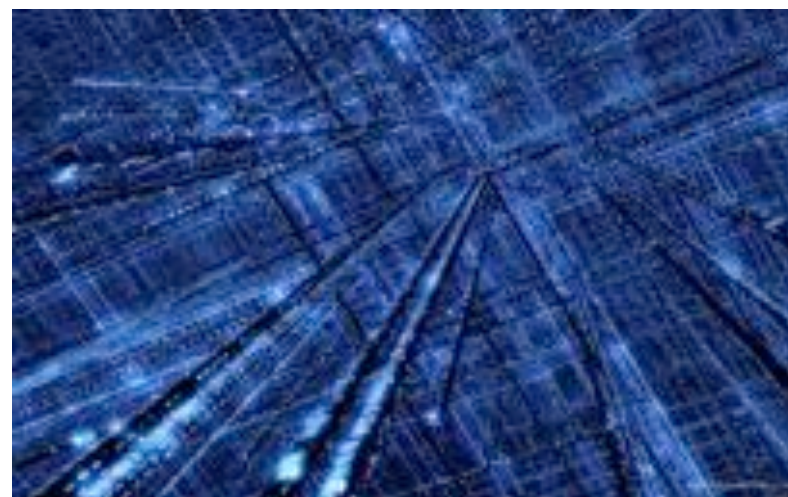
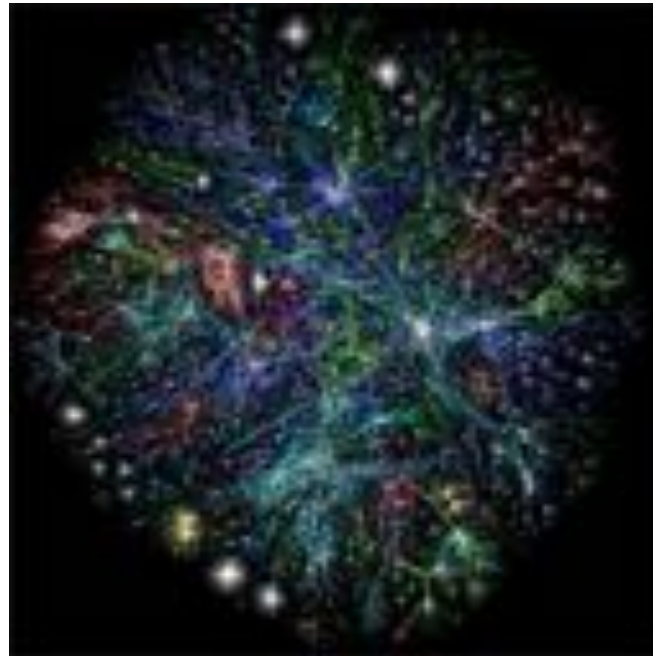
Wm. Gibson, "Burning Chrome" 1982



Visualization of Internet

# (Why is it always night in cyberspace?)

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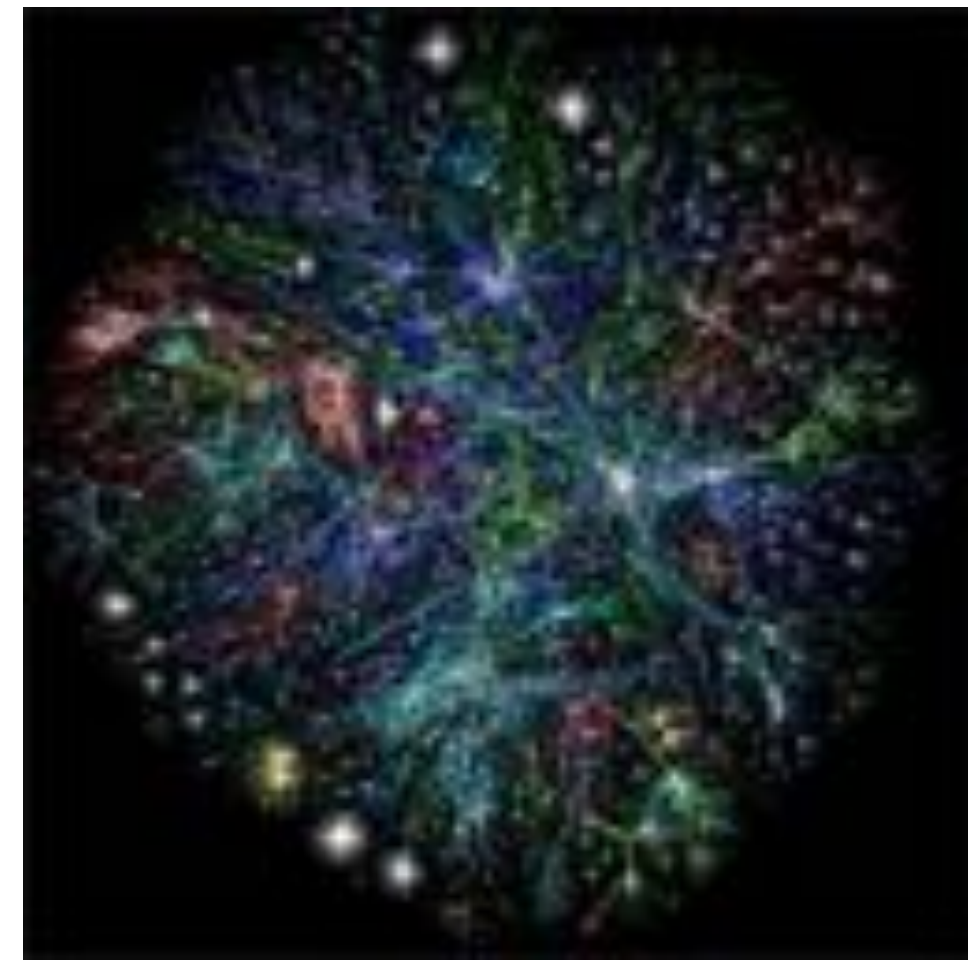
# What makes a "technology": Devices

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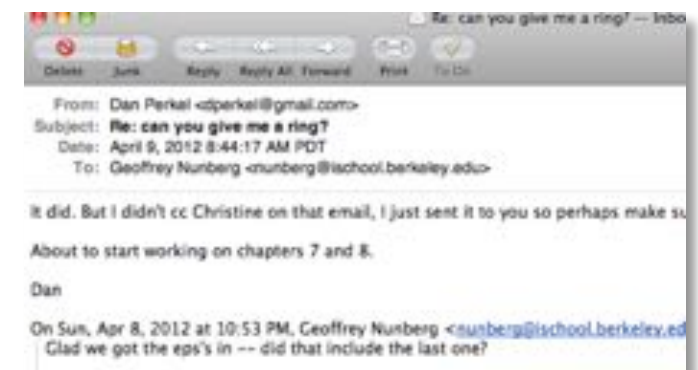
# What makes for a "technology"?: Networks

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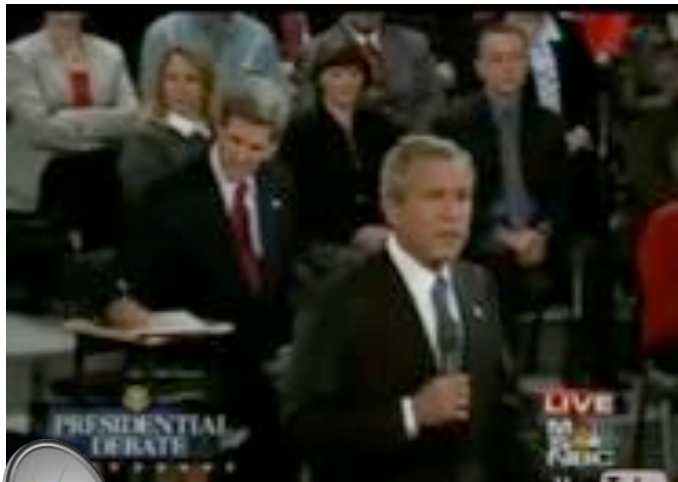


# What makes for a "technology"?: Content



# Looking for the Internet: W was right!

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Is the "internet":

a technology?

a network?

a set of applications & protocols?

a communication carrier?

a medium?

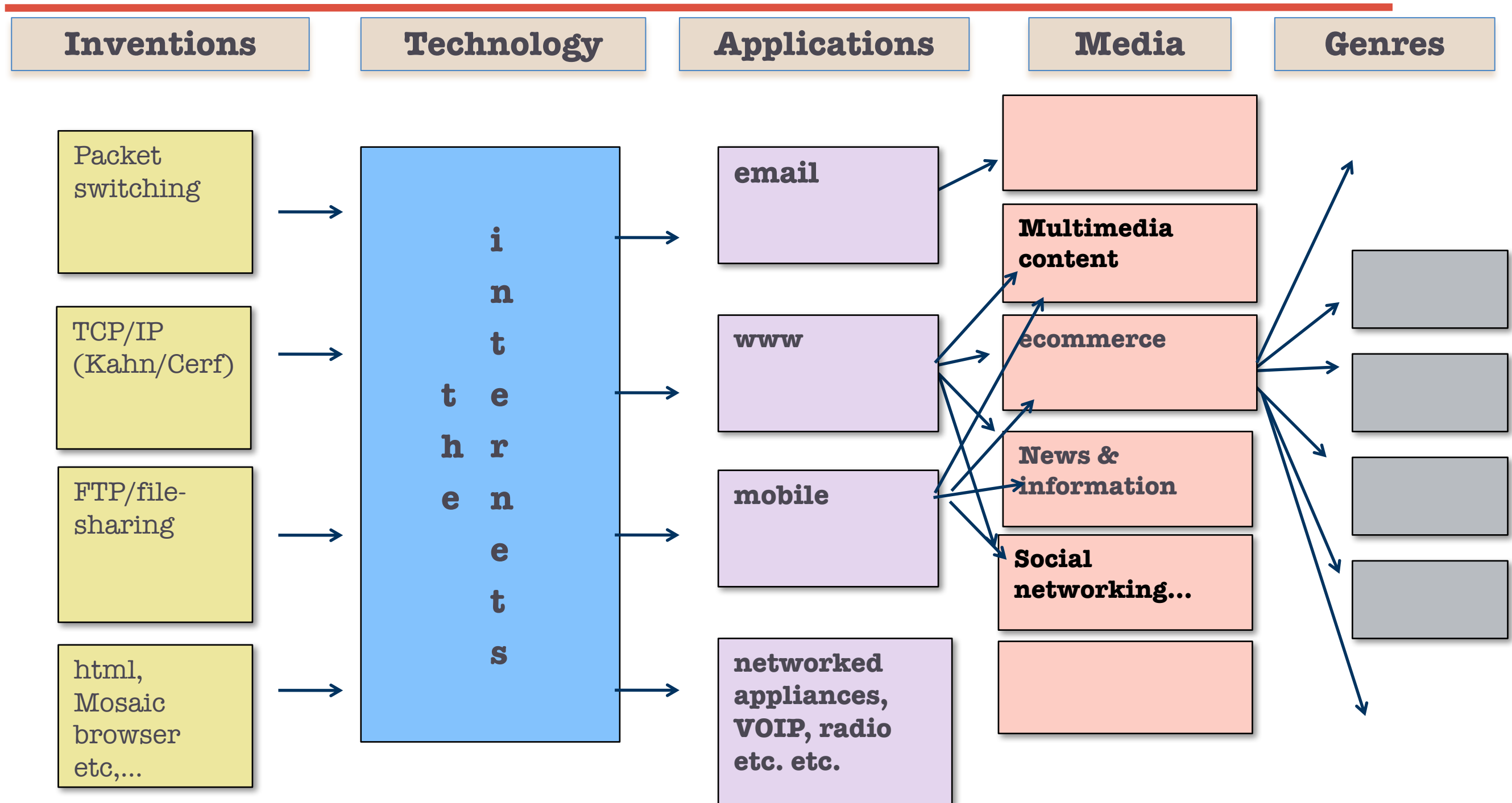
a collection of content?

a place?

YES

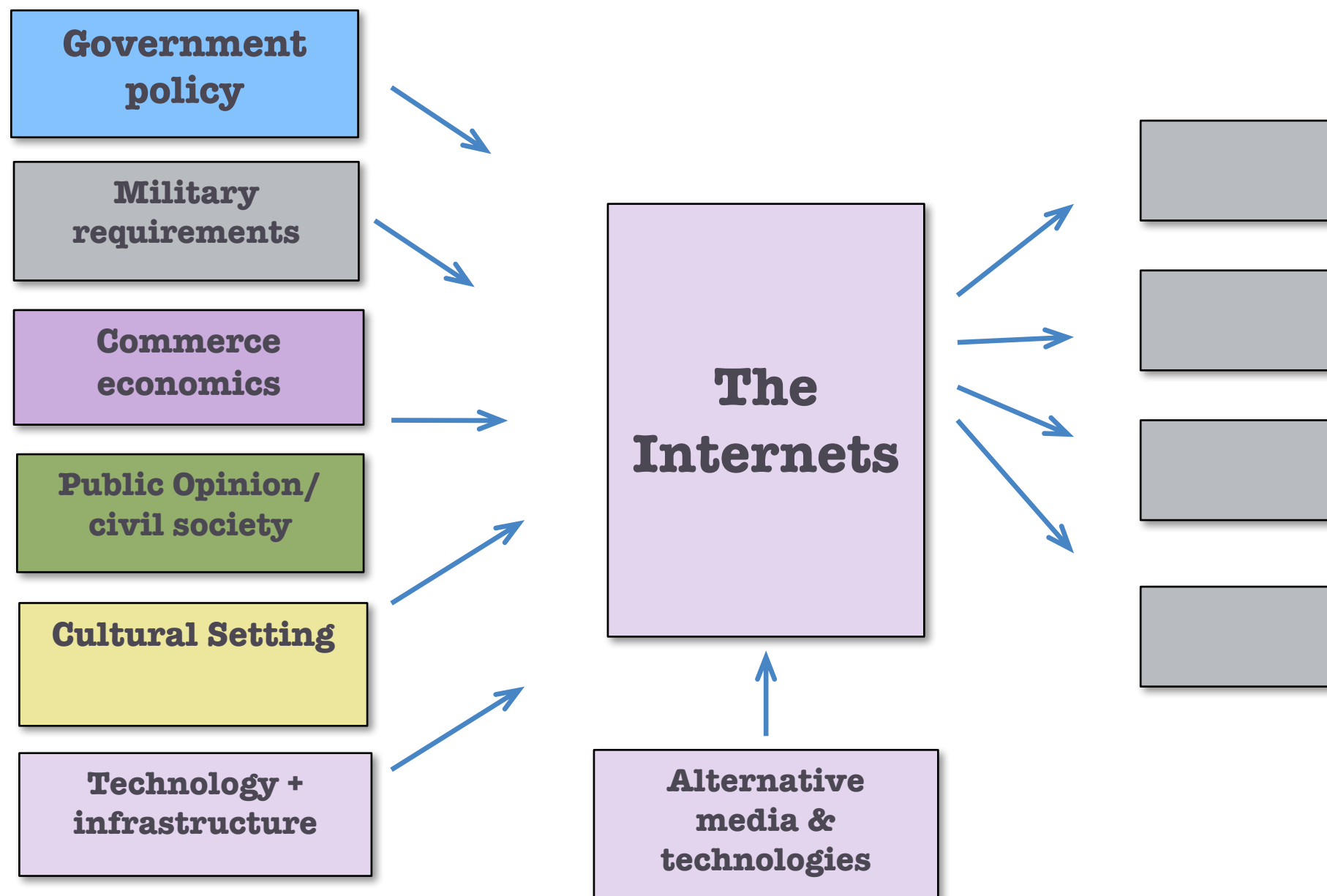


# Inventions, Technologies, Applications, Media



# Multiple Influences

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# The “Vanishing” Internet

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“...the Internet will disappear. There will be so many IP addresses...so many devices, sensors, things that you are wearing, things that you are interacting with that you won't even sense it.” Eric Schmidt, 2015



How many electric motors in your car?





Alexis de  
Tocqueville

# Beginnings

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*"a vast unintended consequence"*



# (some) Technological Bases of the Internet/Web

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Chefertown and Baltimore,  
PACKET-BOAT.

THE Subscribers respectfully inform the public, that they continue running a Packet-Boat, which is now in excellent order. The Cabin is large and commodious, well calculated for the Accommodation of Passengers. Merchandise, Produce, &c. carried on the lowest Terms. From experience they can assuredly say, that the Packet is safe, and sails remarkably well --Will regularly leave Chefertown, every MONDAY at Nine o'clock, A. M. and sit out from Baltimore, every THURSDAY, at Nine o'clock, A. M.

John Constable,

Master of said Boat, and one of the proprietors, will use all possible Diligence to accommodate Passengers, as well as be careful to execute, with punctuality, every trust committed to his charge.

JOHN CONSTABLE,  
JAMES PIPER.

*Chefertown, May, 17, 1791.*

Packet switching/communications protocols

Physical Networks

Addressing system

Hypertext transfer protocols

Browsers/ Graphical browsers

Indexing & search

Broadband

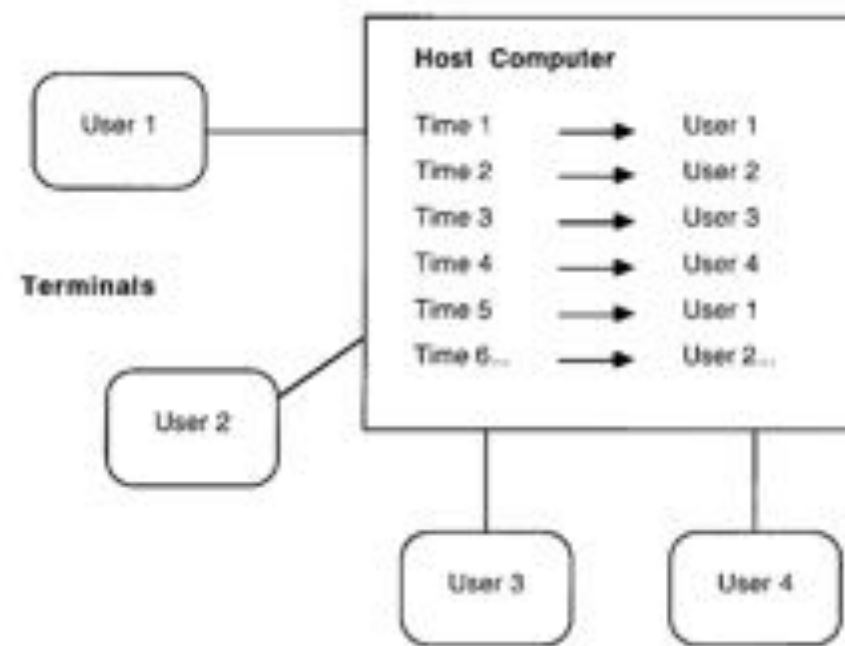


Cards for batch processing

# Communicating



John McCarthy



**intra-machine**  
time-sharing (1960s)



The new “time-sharing”

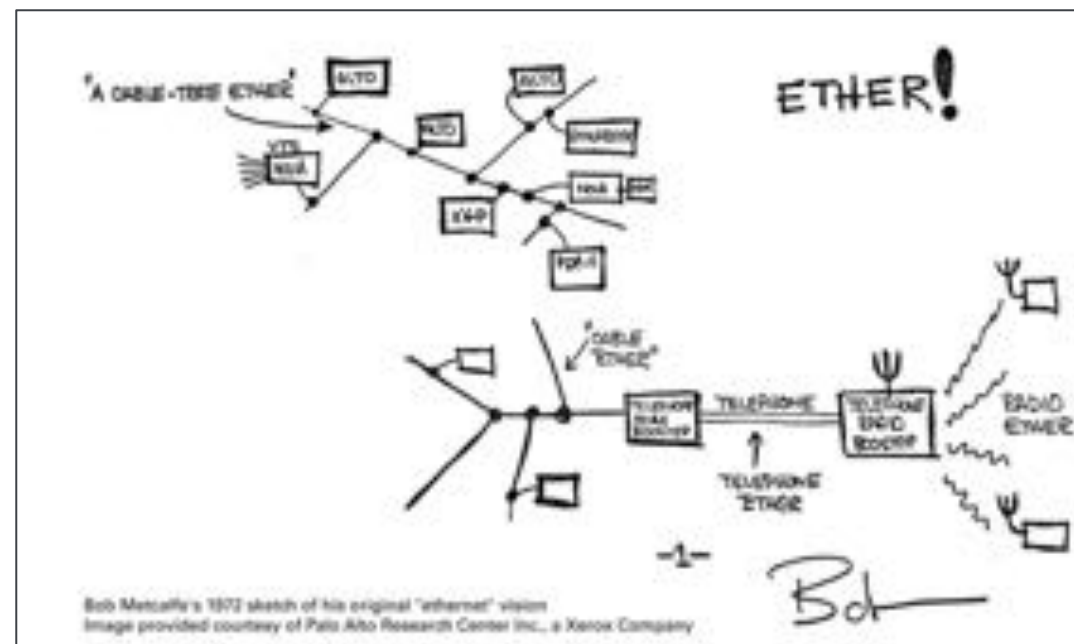


## different machines

## different machines



## Bob Metcalfe at Xerox PARC in 1973



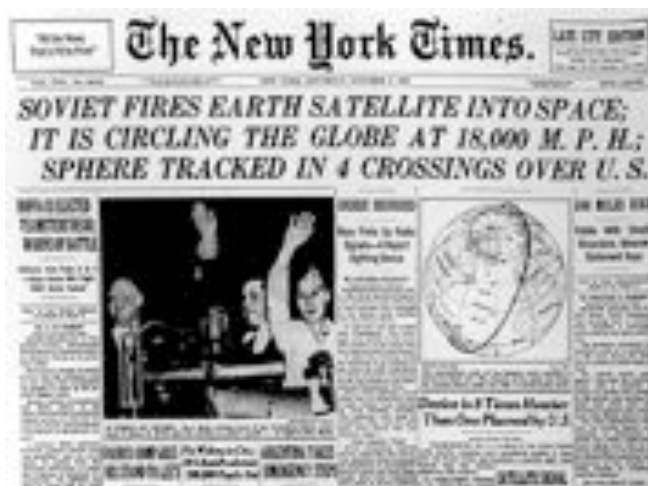
# The Sixties Setting



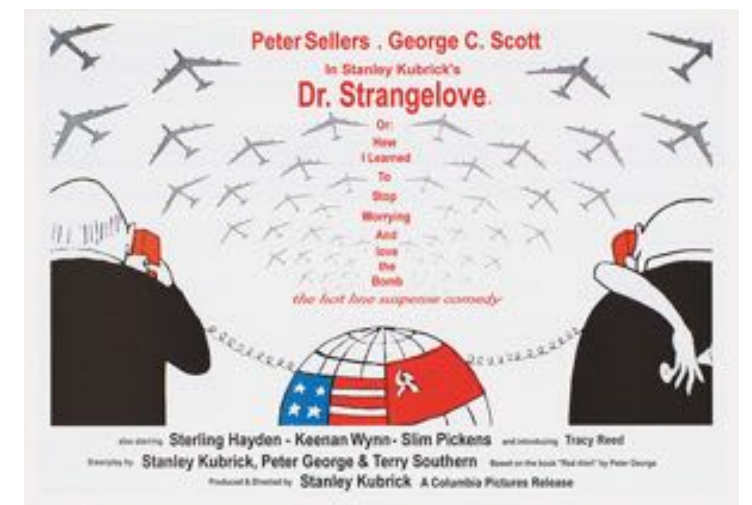
1960



1962



1957

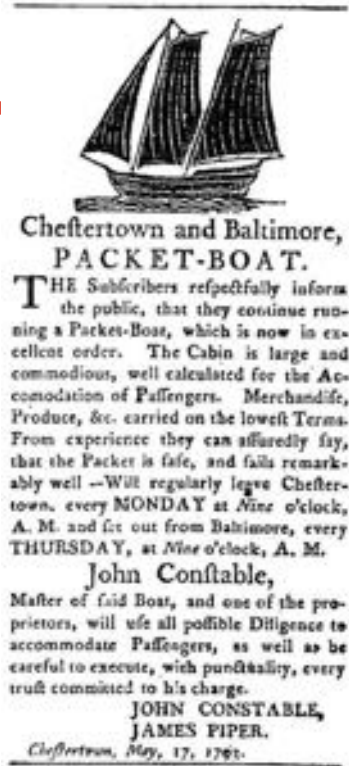


Doctor Strangelove (Stanley Kubrick), 1963

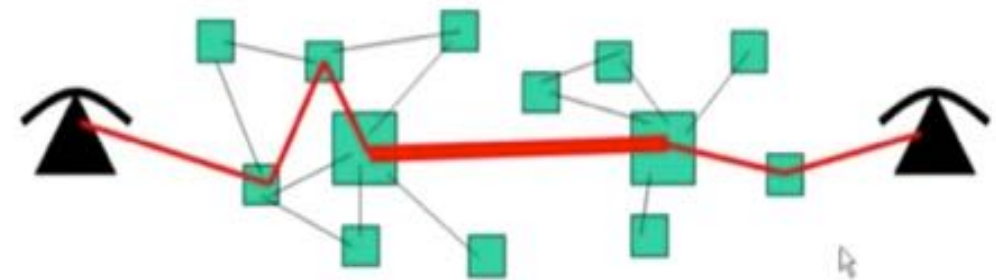




# Technological Foundations: Packet Switching



Switching ensures “survivability” but also maximizes network efficiency...



Traditional (continuous) switching

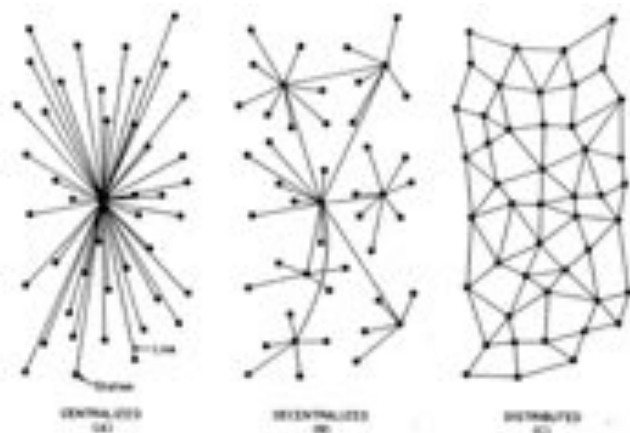
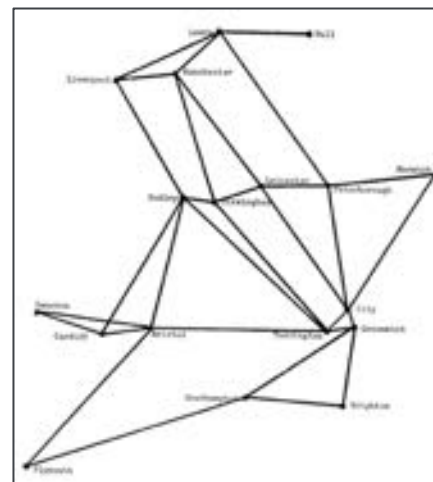
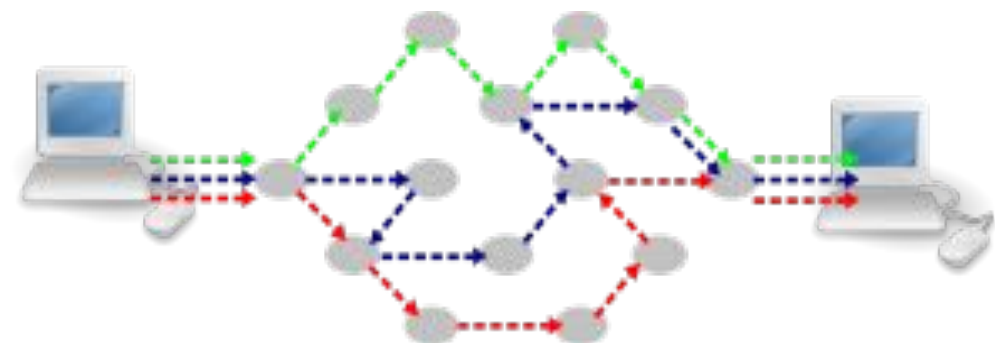


FIG. 1 - Centralized, Decentralized and Distributed Networks

Paul Baran, "On Distributed Communications, 1964 RAND report



Donald Davies proposed UK network 1967



Packet switching

# Technological Beginnings: 60s & 70s

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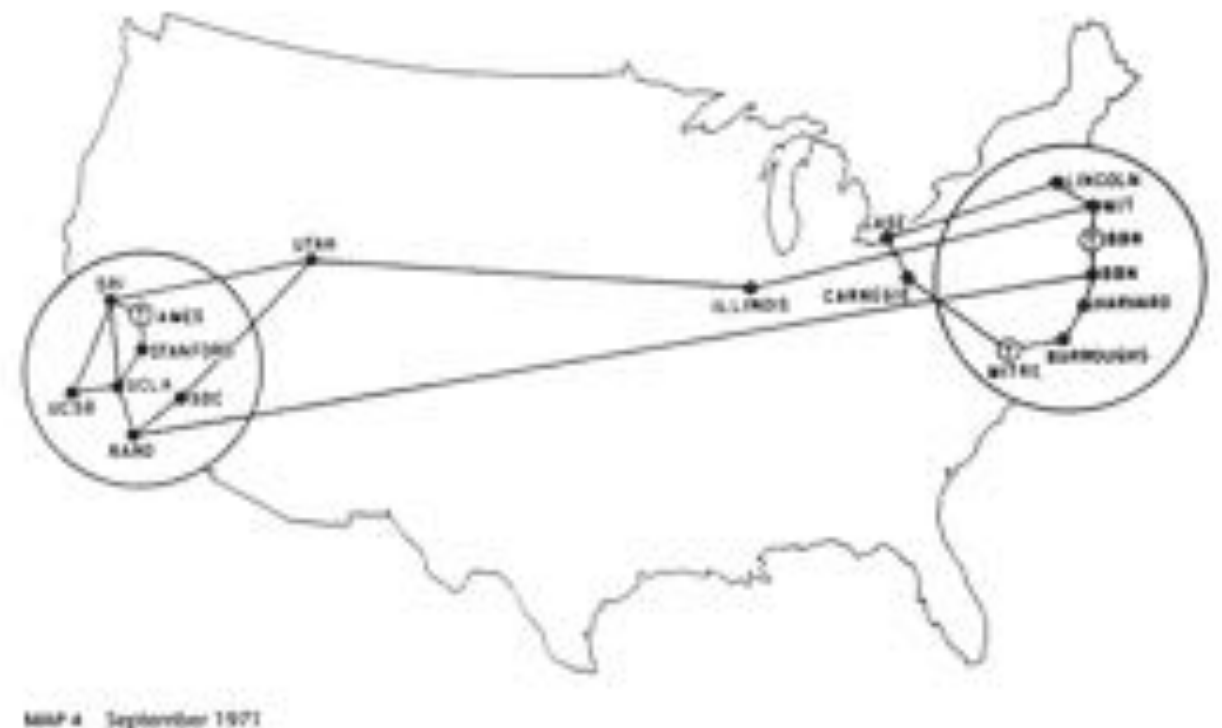
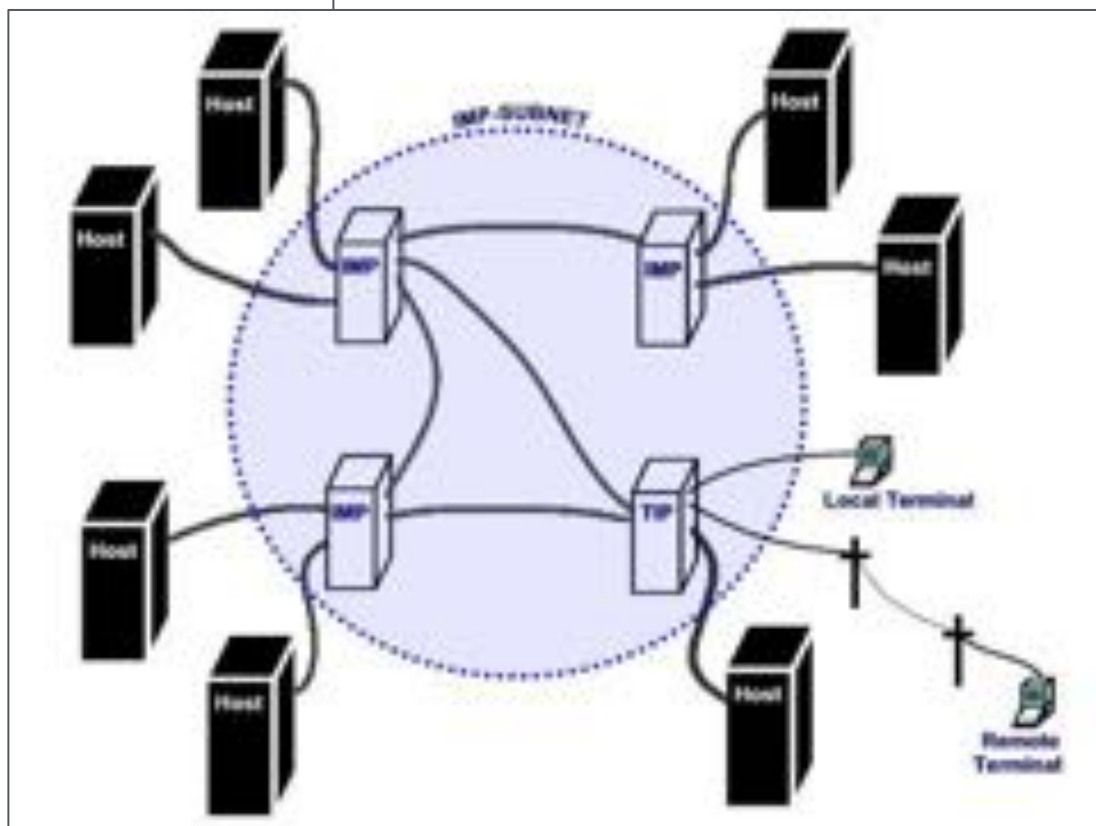
1971: File Transfer Protocol (FTP) permits easy exchange of files between sites.

1974 Bob Kahn and Vin Cerf ("Father of the Internet") demonstrate Transfer Control Protocol (TCP), which enables machines to route & assemble data packets. (Later TCP/IP).



# Technological Beginnings: The Arpanet

1969: ARPA (Advanced Research Projects Agency of DOD) (later DARPA) creates Arpanet, linking time-sharing computers at four (later 20) research sites by telephone lines. Communications handled by “subnet” of mincomputers called “Interface Message Processors” (IMPs).



ARPANET September 1971

Arpanet 1971



# Arpanet for Russkies

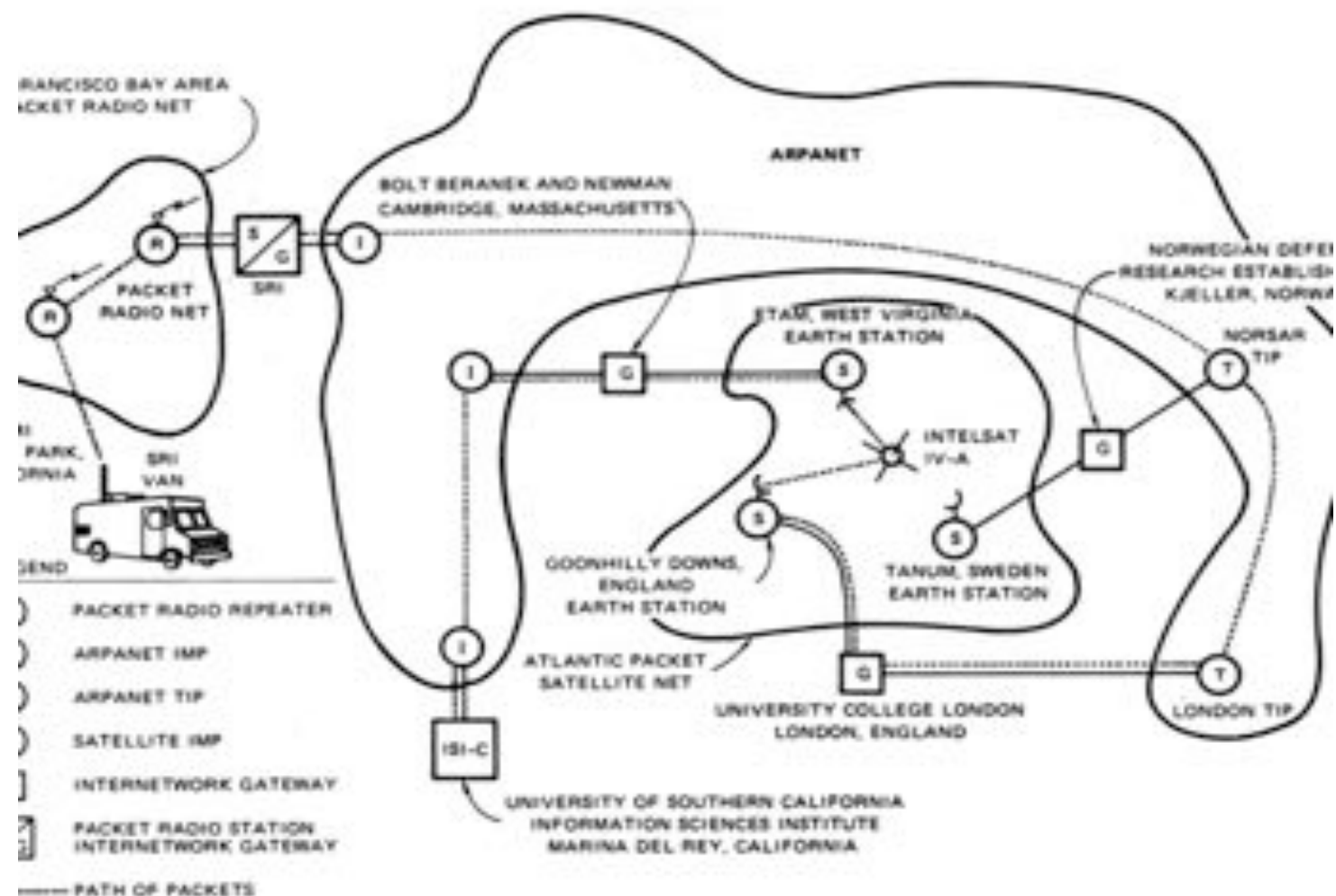
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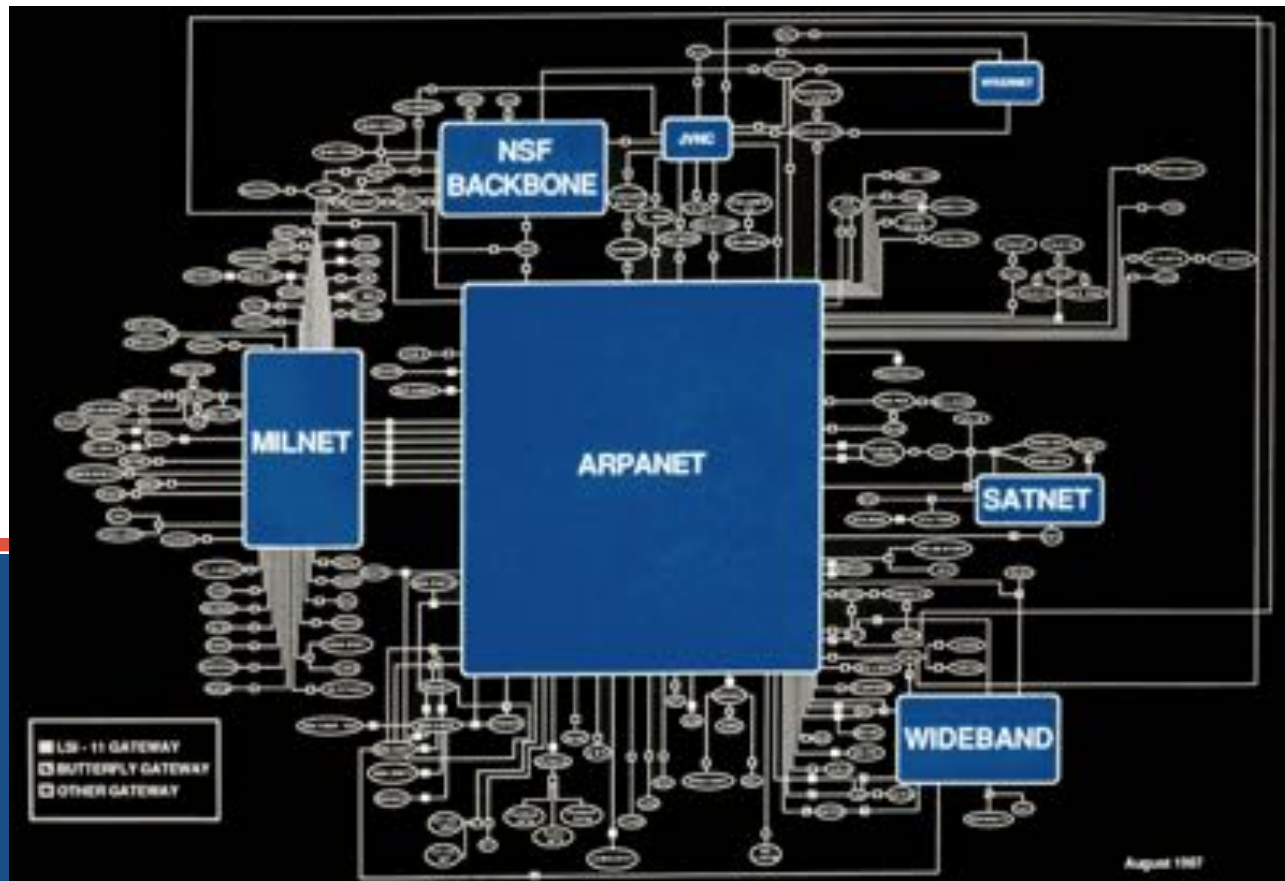


# The First “Internet”: Proof of Concept

1977: Demonstration of internetworking from GG Bridge to Norway, London, via satellite to W.Va., & Menlo Park w/ no loss of signal



# Internet Development: 80s



5/1/1978: First spam message sent to 593 addresses on ARPAnet,

1980's: NSF funds national backbone to connect computer research centers. Other gov't-funded networks (BITNET, CSNET) emerge.

1980 Usenet established at UNC Chapel Hill as “the poor man’s ARPANET.” User groups classified as comp., news., rec., talk., etc.

1980's: Commercial networks begin to emerge.

1983: Domain Name System (DNS) introduced to keep up with growing number of hosts, introduces domain names .com, .gov, .mil, .edu, etc./

Late 1980's: First Internet Service Providers emerge

1989: Australia, UK, Germany, Italy, etc. join Internet

1995 Netscape integrates Secure Sockets Layer (SSL), into its browser



# “Inventing the Internet”



1991 Congress passes High Performance Computing and Communication Act of 1991 (“Gore Bill”) creating “information superhighway.”

“...the U.S. should lead by building the information infrastructure essential if all Americans are to gain access to this transforming technology [...] high speed networks must be built that tie together millions of computer” Al Gore, 1991

“During my service in the United States Congress, I took the initiative in creating the Internet.” Al Gore, 1999

# Growth of the internet

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**Email inventor Ray Tomlinson dies at 74**

6 March 2016

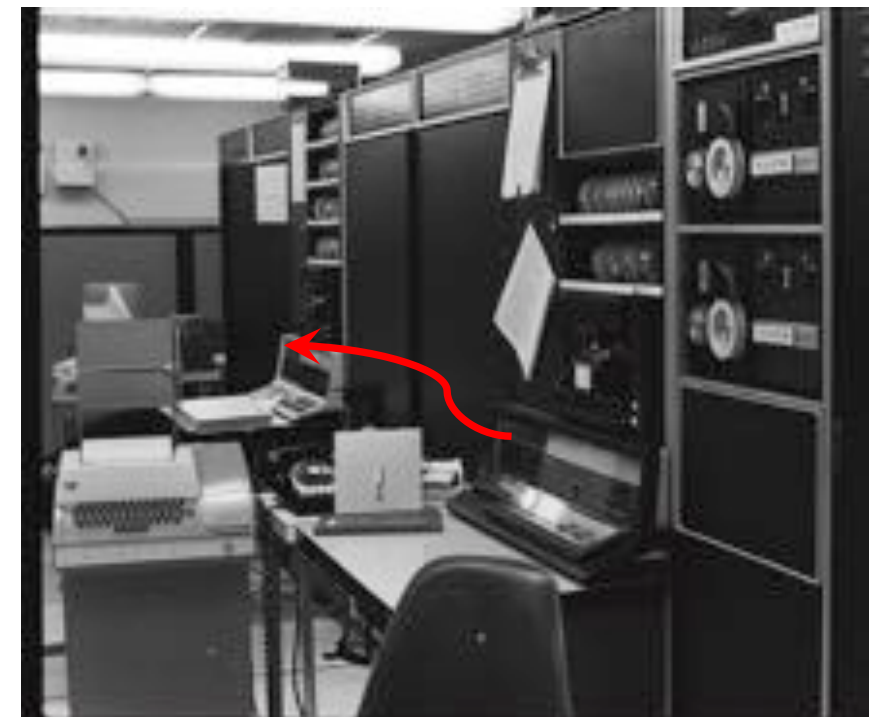
# The Origins of Email

1971: First network email program created by Ray Tomlinson at Bolt, Beranek & Newman (BBN), with "USER@hostname.domain" addressing system.

Email becomes ARPANET's most popular service ("unplanned, unanticipated, and mostly unsupported"—Admin. Report)

Email is immediate, asynchronous, permits 1-to-1 or 1-to-many...

"At ARPA. The appeal of email [had a lot to do] with access to power." Janet Abbate





# The short happy life of proprietary services

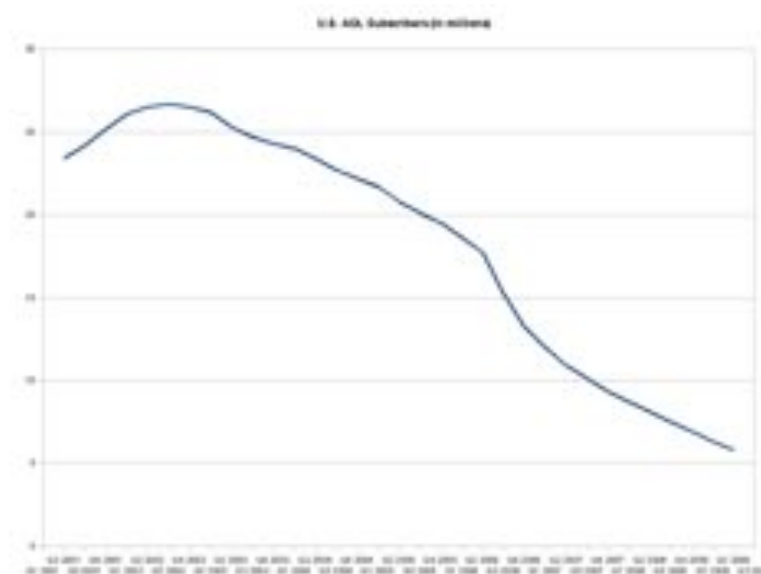


Gated communities:

ca 1990-: Pay-based online services like AOL, CompuServe, and Prodigy market connectivity + proprietary content (games, chat rooms, e-commerce, instant messaging etc.)

By 1998, AOL has 15m. Members, but then...

Hayes Smartmodem 1981



AOL subscribers 2001-2009





# The Emergence of the WWW



Sir Tim

”The method of storage must not place its own constraints on the information” T B-L.

1945: Vannevar Bush writes "As We May Think" in *The Atlantic*; envisions Memex machine to follow links between documents on microfiche

1965: Ted Nelson coins the term "hypertext" to describe "compound documents" formed by links among documents

1990: Tim Berners-Lee of CERN coins the term "World Wide Web"; develops HTTP protocol for transmitting hypertext documents between clients and servers and first Web browser making use of hypertext links.

**World Wide Web**

The WorldWideWeb (W3) is a wide-area [hypermedia](#) information retrieval initiative aiming to give universal access to a la

Everything there is online about W3 is linked directly or indirectly to this document, including an [executive summary](#) of the [Asked Questions](#).

[What's out there?](#)  
Pointers to the world's online information, [subjects](#), [W3 servers](#), etc.

[Help](#)  
on the browser you are using

[Software Products](#)  
A list of W3 project components and their current state. (e.g. [Line Mode](#), [X11](#), [Viola](#), [NeXTStep](#), [Servers](#), [Tools](#).)

[Technical](#)  
Details of protocols, formats, program internals etc

[Bibliography](#)  
Paper documentation on W3 and references.

[People](#)  
A list of some people involved in the project.

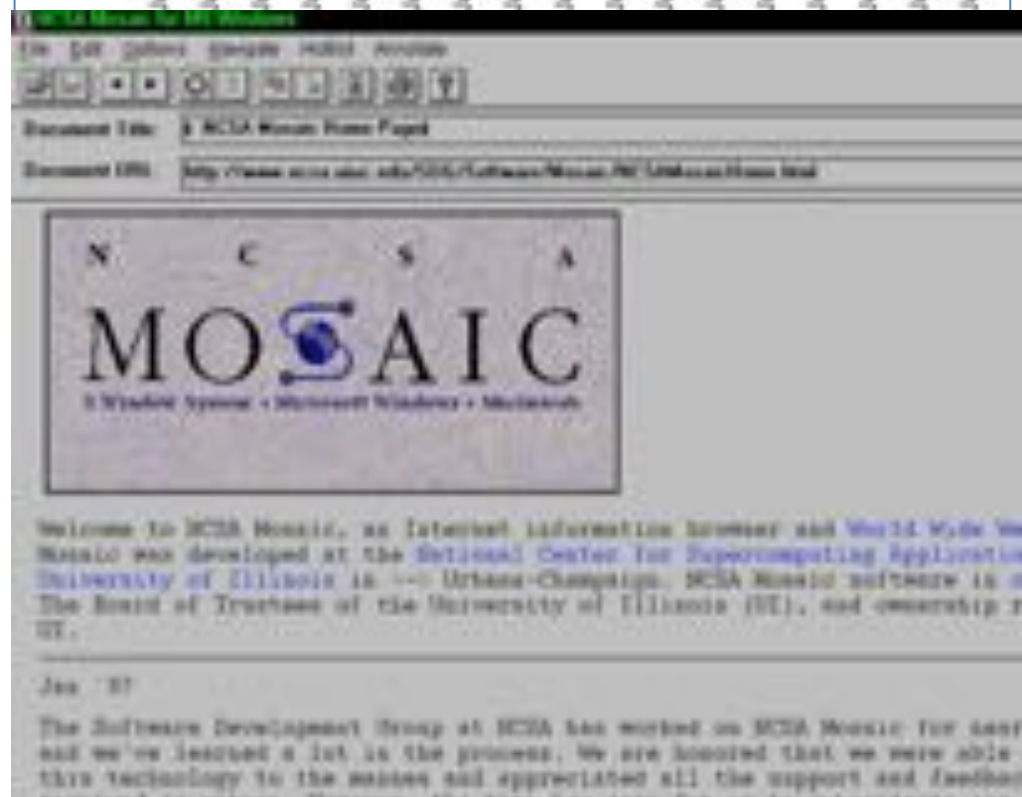
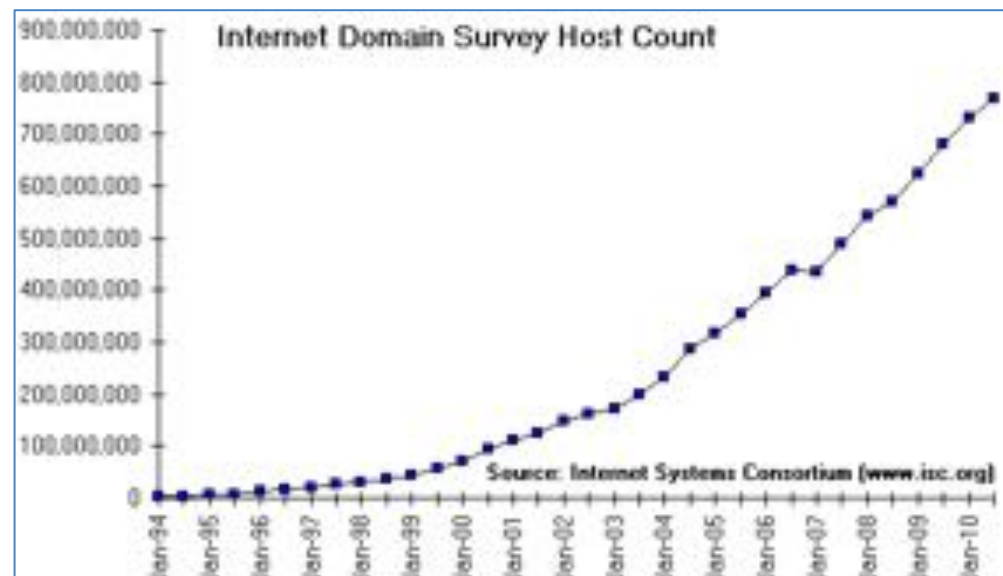
[History](#)  
A summary of the history of the project.

[How can I help?](#)  
If you would like to support the web..

[Getting code](#)  
Getting the code by [anonymous FTP](#), etc.

The First Web  
Page

# Browsers!



1993: Marc Andreessen's Mosaic browser released by NCSA, which runs on Windows and permits easy integration of graphics in Web pages.

1994: Andreessen, now in private sector, releases Netscape Navigator browser. *Soon incorporates SSL.*

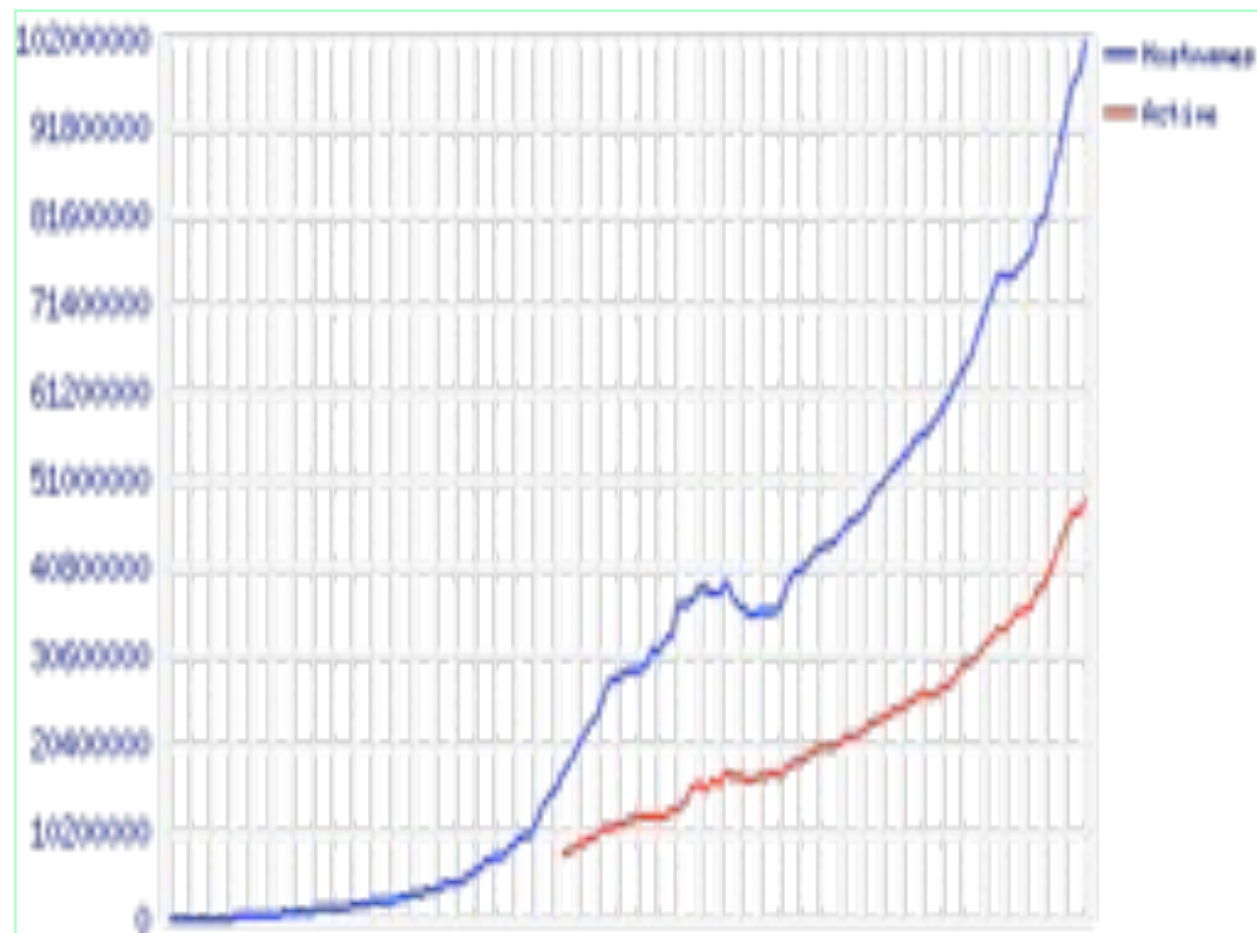
1995: Microsoft releases Internet Explorer bundled with Windows 95 to compete with Netscape.

1995 AOL makes Internet available to all subscribers



# The Web Takes Off

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Internet Hostnames  
1995-2006

1994-2005: Internet use increases rapidly, driven by email, E-commerce, news & information, pornography & gambling. By 2005 there are an estimated 100m Web sites.

~2000- Growth of broadband enables exchange of audio & video content; blogs and social networking sites proliferate, etc.

2005: 68 percent of American adults and 90 percent of American teenagers have used the Internet.



# Dot.comania

## PRICEY DOMAIN NAMES

VacationRentals.com 2007  
\$35m

Insure.com 2009 \$16m

Sex.com 2010 \$13m

Fb.com 2010  
by Facebook \$8.5m

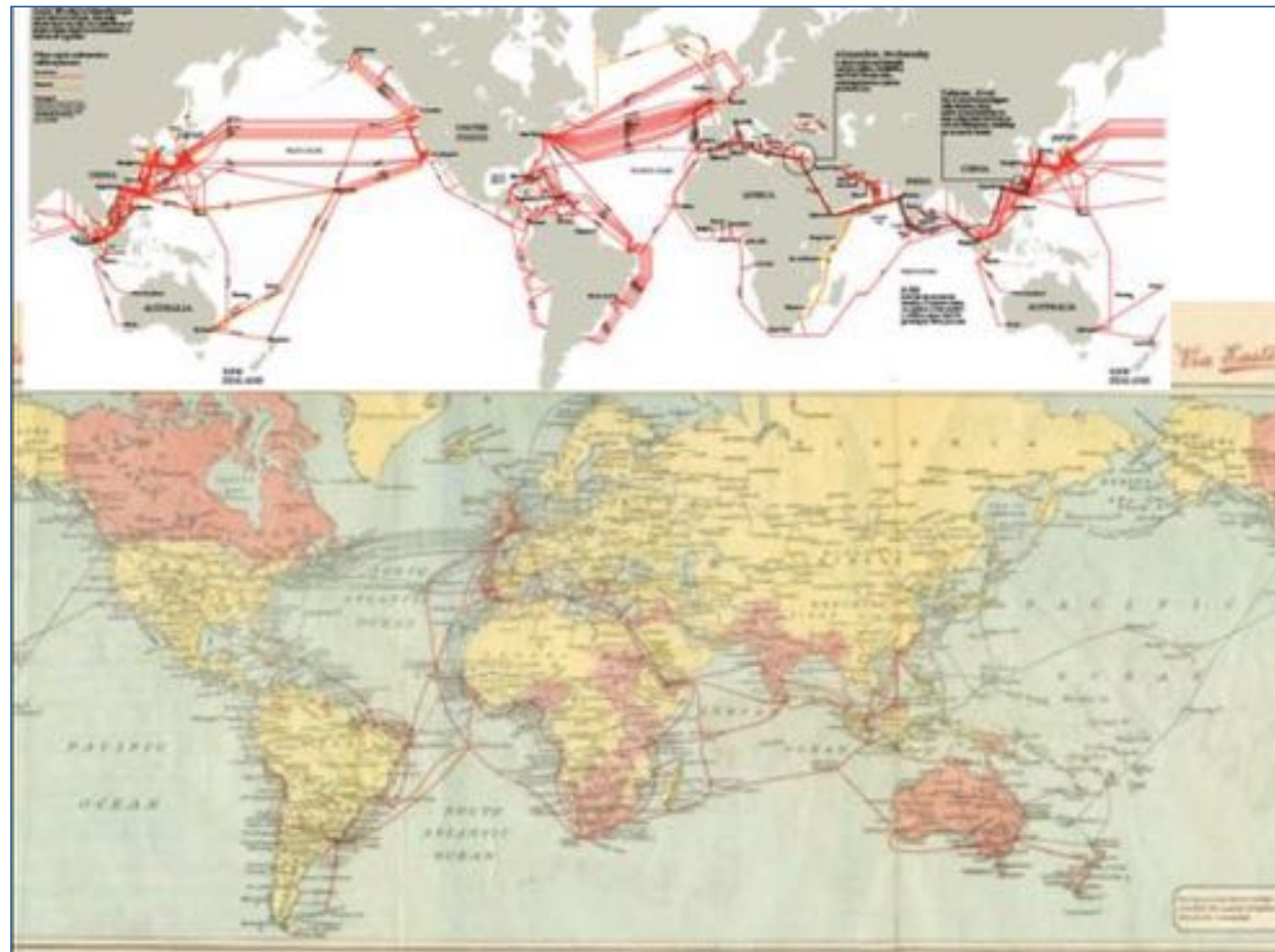
Slots.com 2003 \$5m

1998: Internet Corporation for Assigned Names and Numbers (ICANN) established to oversee assignment of domain names and IP addresses, formerly under control of US government.

The irony is that in all its various guises—commerce, research and surfing—the Web is already so much a part of our lives that familiarity has clouded our perception of the Web itself. Tim Berners-Lee

# The Wired World

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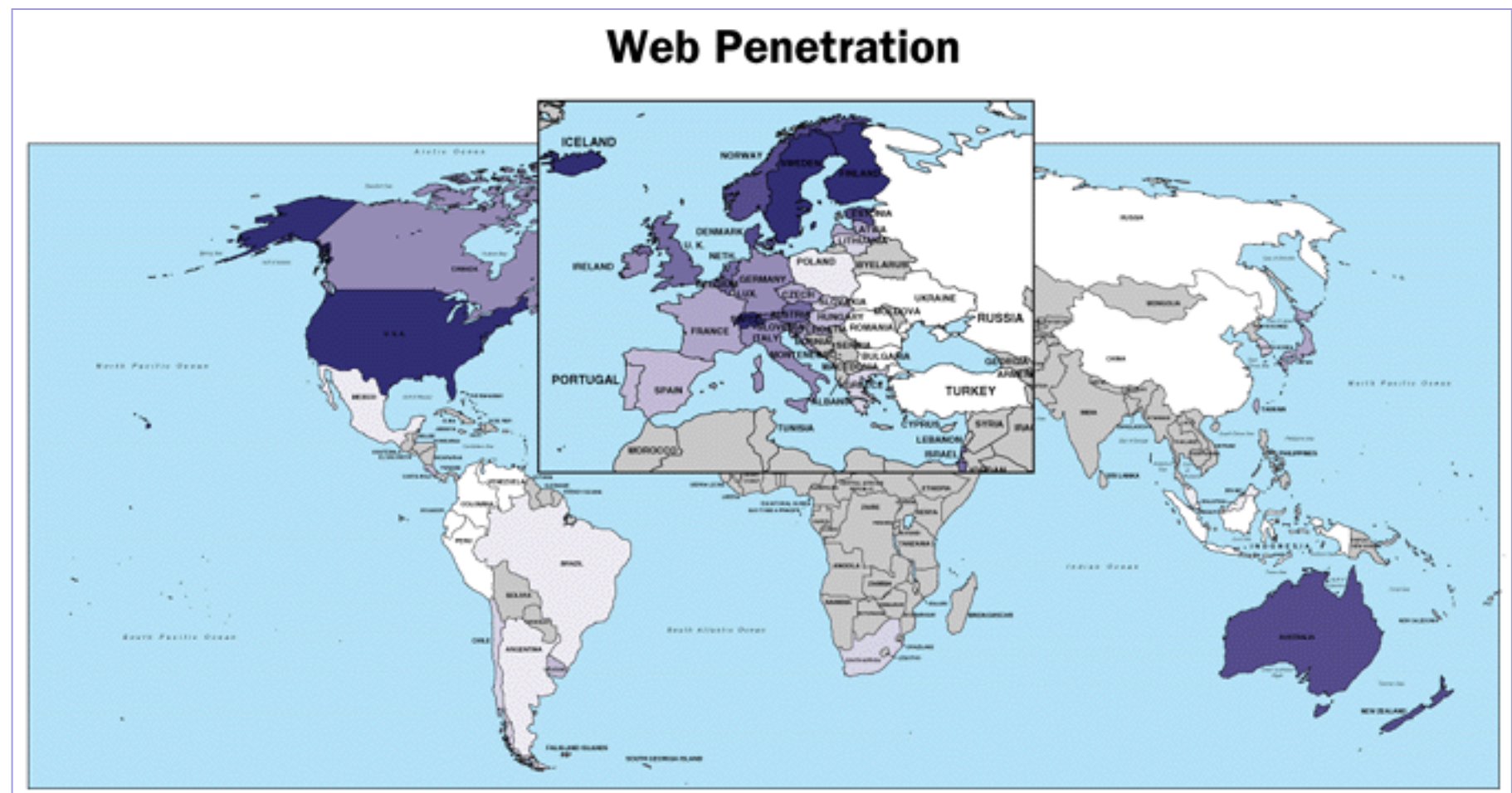
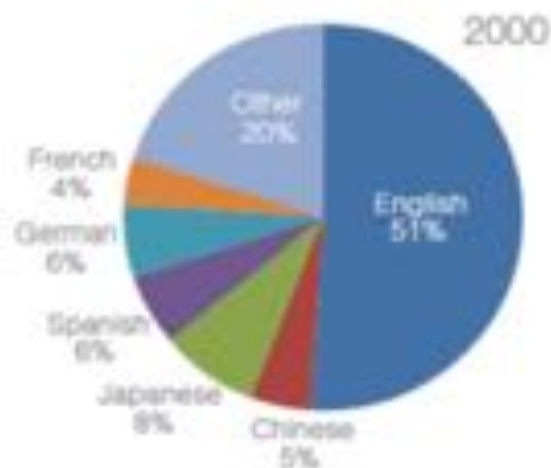




# The early spread of the Web

Relative size of Eng-speaking population in developed world

Cf. early Web penetration, 1997 (Nunberg & Schuetze)







# Fears of English Hegemony...

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“The Web is the ultimate act of intellectual colonialism.”  
Director of Russian ISP, 1999

“Nearly 70 per cent of the world's Web sites are in English, at times crowding out voices and views.” Kofi Annan, 12-Jan-04



# Why do they hate us?

The Internet is "a great force for the Anglification of the planet."  
Linguist on Linguist List

“[Thanks to the Internet,] English will be the native language of a majority of the world by some time in the next century.” Editor, *The Futurist*

"There is no retreat from English as the world language; no retreat from an English-speaking world." Sridath Ramphal, chairman of Commission on Global Governance, 1996

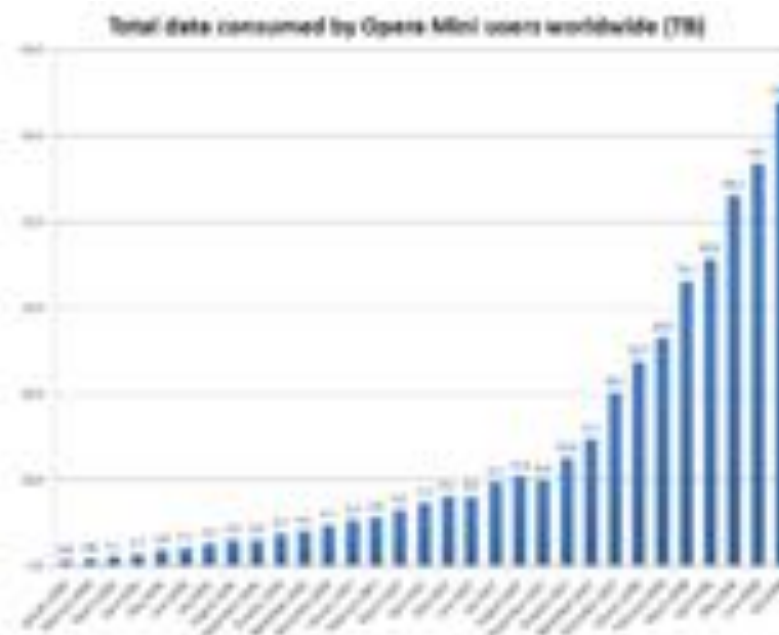
# Faster than we expected

## Cisco: mobile connections to hit 10 billion by 2016

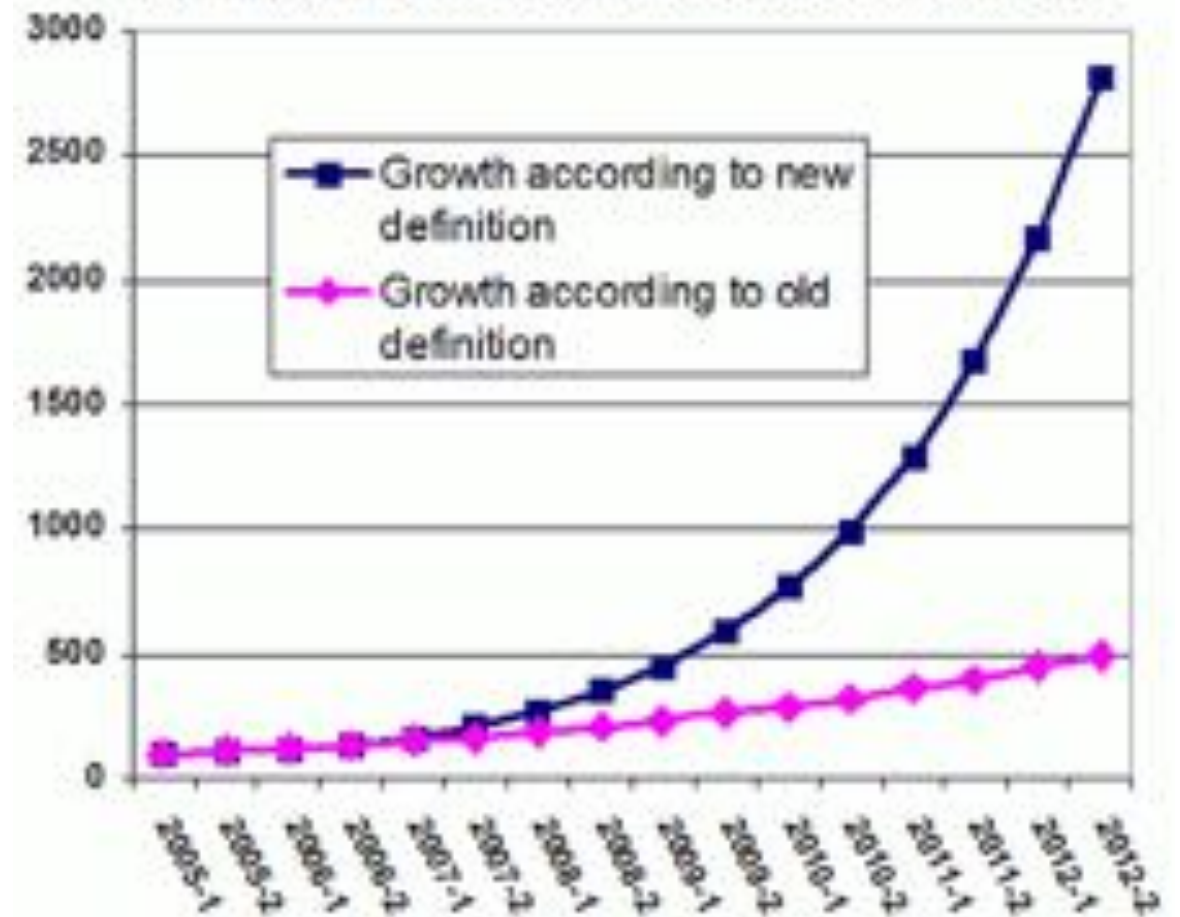
By: Dan Graziano | Feb 15th, 2012 at 12:30AM

Filed Under: Mobile

0 Comments



## Chinese Internet Users - 2 Growth Scenarios



**AMD: By 2015 half of world will have an Internet connection**

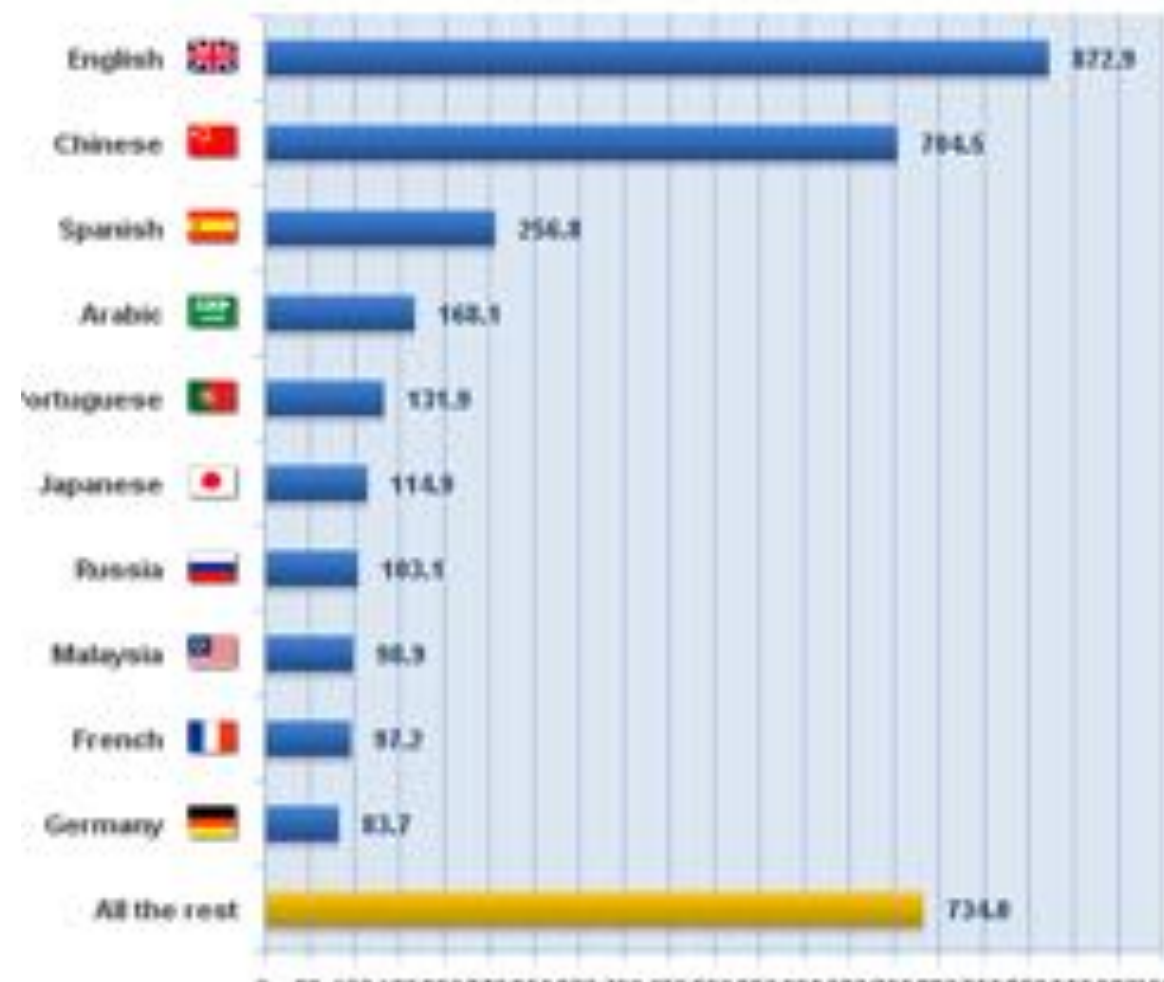




# Growth of Other Languages on the Web

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Top Ten Languages in the Internet  
in millions of users - November 2015





# Space for Smaller Languages

Web encourages the spread of English....  
*And* maintenance and spread of smaller national, regional, and ethnic languages



# How should we think of the Internet?

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# How should we think of the Internet?

---



## New shoes, old lasts

Broadcasting as common carrier (i.e., like phone service) with obligation to provide general access

Broadcasting as extension of press, exempt from control

Broadcasting as entertainment (like movies) subject to censorship/regulation



# The Internet as library

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"[T]he library of the future." — J.R. Licklider, 1965

"[T]he Internet...is a library." —Cairncross, *The Death of Distance*, 1997

"Library of libraries" —George Steiner, *Grammar of Creation*, 2001

"[T]he web is a global library produced by millions of people" — Yochai Benkler, *The Wealth of Networks*, 2006

"In the beginning, the Web was a library" — Abelson, &c., *Blown to Bits*, 2008

# The right model?

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"The Internet is a library with all the books on the floor." --*Librarian's Guide to Cyber Space*

“It's as if we've torn down the walls of the library, and now the reading room is full of street people.” A linguist





# Why it matters

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CHIP (Children's Internet Protection) Act, 2000:

Requires porn-filtering software to protect minors in all public libraries receiving subsidies under 1996 Telecommunications Act.  
(3d attempt to block porn from libraries)

Am. Lib. Association and ACLU sue: CHIP unconstitutional burden on free speech, since filters block protected speech...

At issue: degree of scrutiny required in allowing restrictions of 1st Amendment rights in govt interest.

Challenge wins in Court of Appeals, loses in Supreme Court 2003.

# Why it matters

---

“But we don’t have those books in libraries”

[Federal Internet subsidies] were intended to help public libraries fulfill their traditional role of obtaining material of requisite and appropriate quality for educational and informational purposes. Congress may certainly insist that these “public funds be spent for the purposes for which they were authorized.” Especially because public libraries have traditionally excluded pornographic material from their other collections, Congress could reasonably impose a parallel limitation on its Internet assistance programs

# In Sum

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Internet emerges through government initiative, in collaboration with universities and private sector.

With growth of internet, control is distributed among universities, private sector, and quasi-governmental bodies.

With unanticipated popularity of email & other functionalities, internet grows rapidly; browsers and WWW enhance utility for information, commerce, etc.

Spread of internet partially levels international playing field in diffusion of news & culture

Like models of radio, differing conceptions of the internet can shape policy and use



# Readings for April 11

## Storage and Search

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### *Required Reading*

Bush, Vannevar. 1945. As We May Think, *The Atlantic Monthly*. 176 (1): 101-108.

Döpfner, Matthias. 2014. "Why We Fear Google" *Frankfurter Allgemeine*, April 17

Schmidt, Eric. 2014. "A Chance for Growth." *Frankfurter Allgemeine*, April 4.

Zuboff, Shoshana. 2014. "Dark Google." *Frankfurter Allgemeine*, April 30.

# Assignment for April 11

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The debate over Google involves a European newspaper taking on an American technology leader. Are national differences driving the debate here. If so, how? If not, what are the main drivers?