

# Advent of the Internets

---

**Geoff Nunberg**

**il03 History of Information**

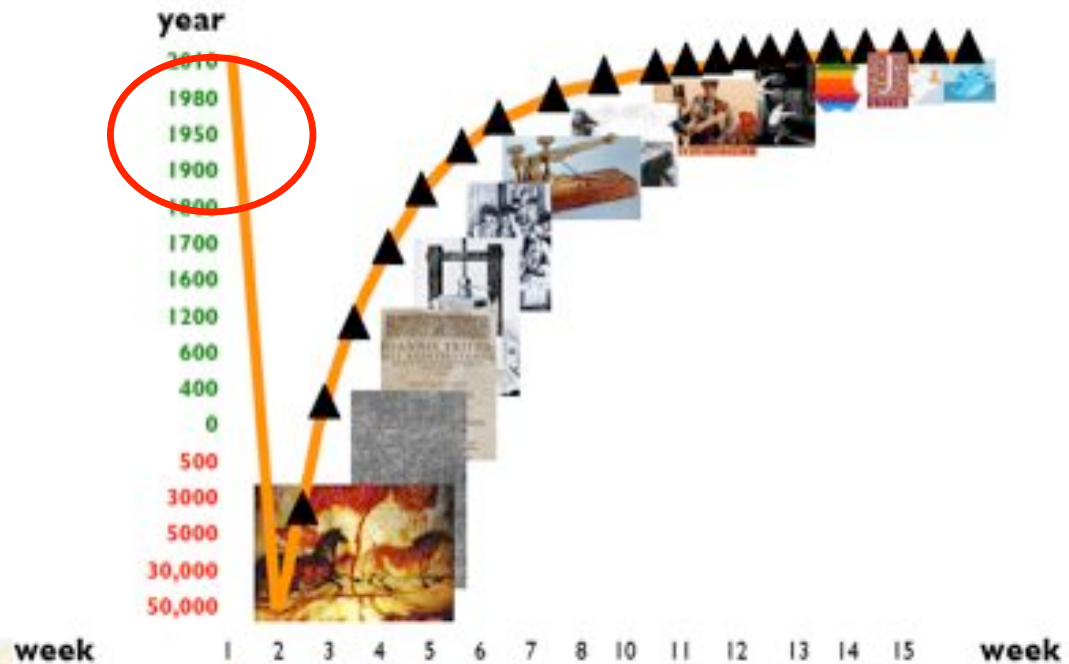
April 17, 2014



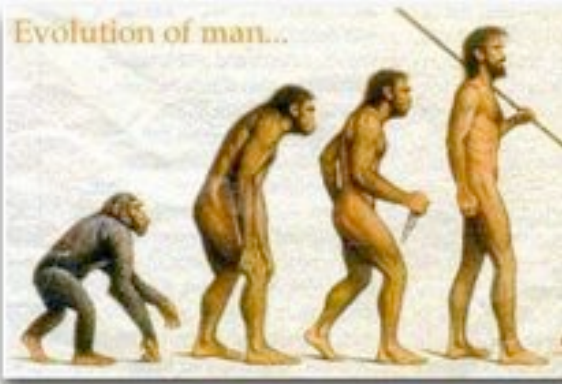


# Where We Are

The march  
of progress...



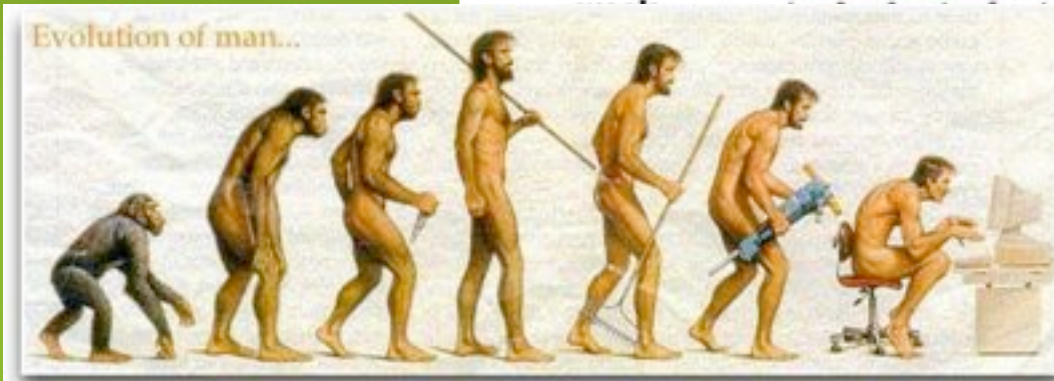
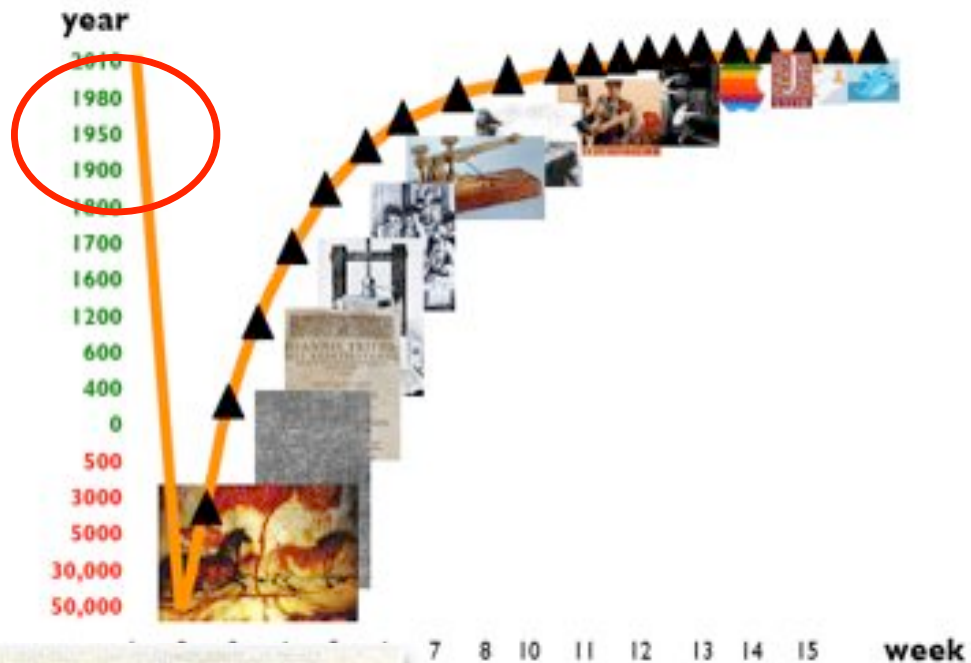
Evolution of man...





# Where We Are

The march  
of progress...(?)





# What Are We Talking About?

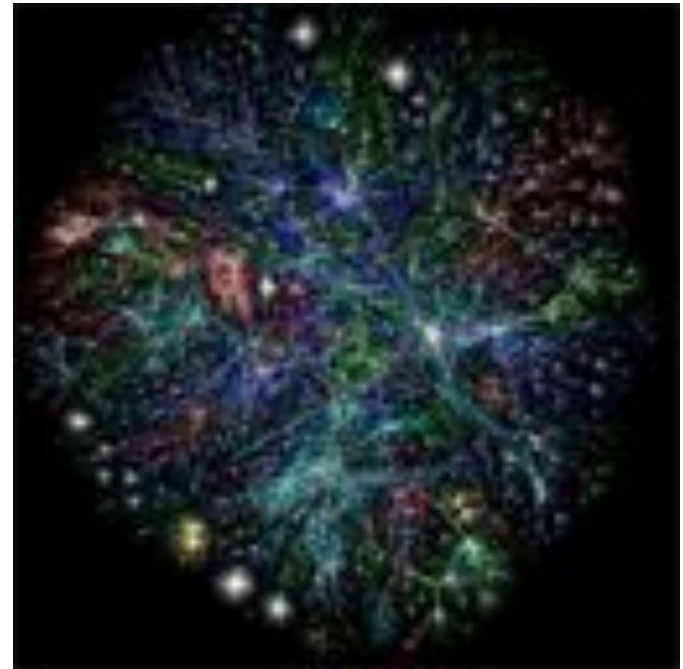
---

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 from Opte Project

Asia Europe/Africa

Latin America

North America

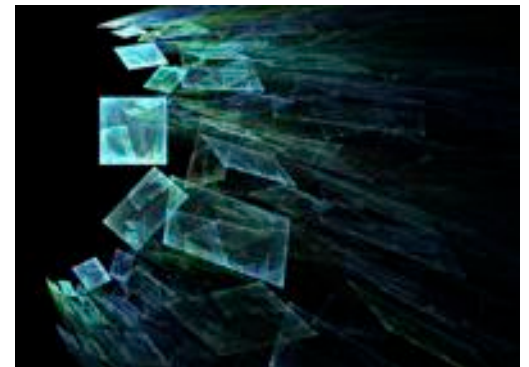
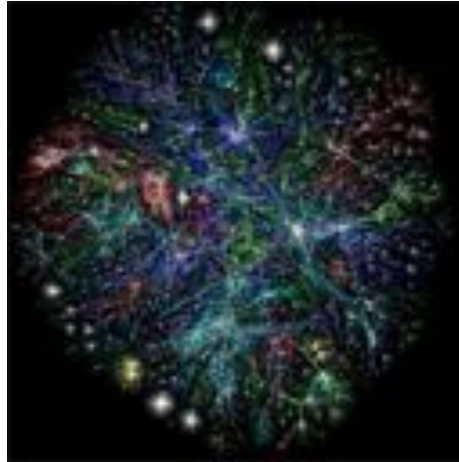
Private Networks (RFC1918)





# (Why is it always night in cyberspace?)

---



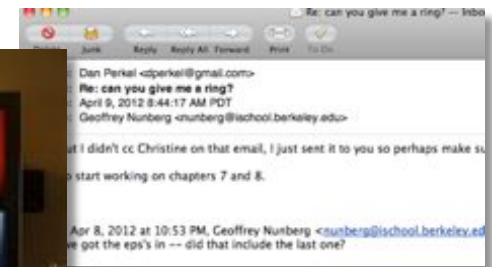


# What makes a "technology": Devices





# What makes for a "technology"?: Content



skype learn prices

My account

Geoff Nunberg





# Looking for the Internet: W was right!

---

The "internet": a technology, a channel, a medium, a "place," a set of applications...?

Contrast "radio," "television" etc.

a technology?

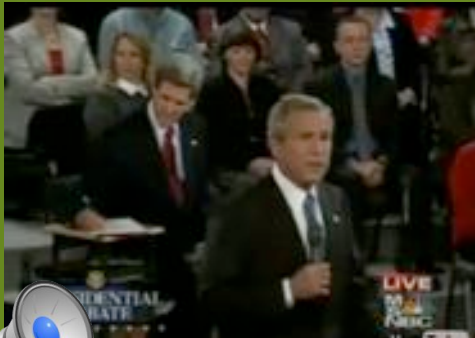
a network?

a set of applications?

a communications channel?

media?

a place?

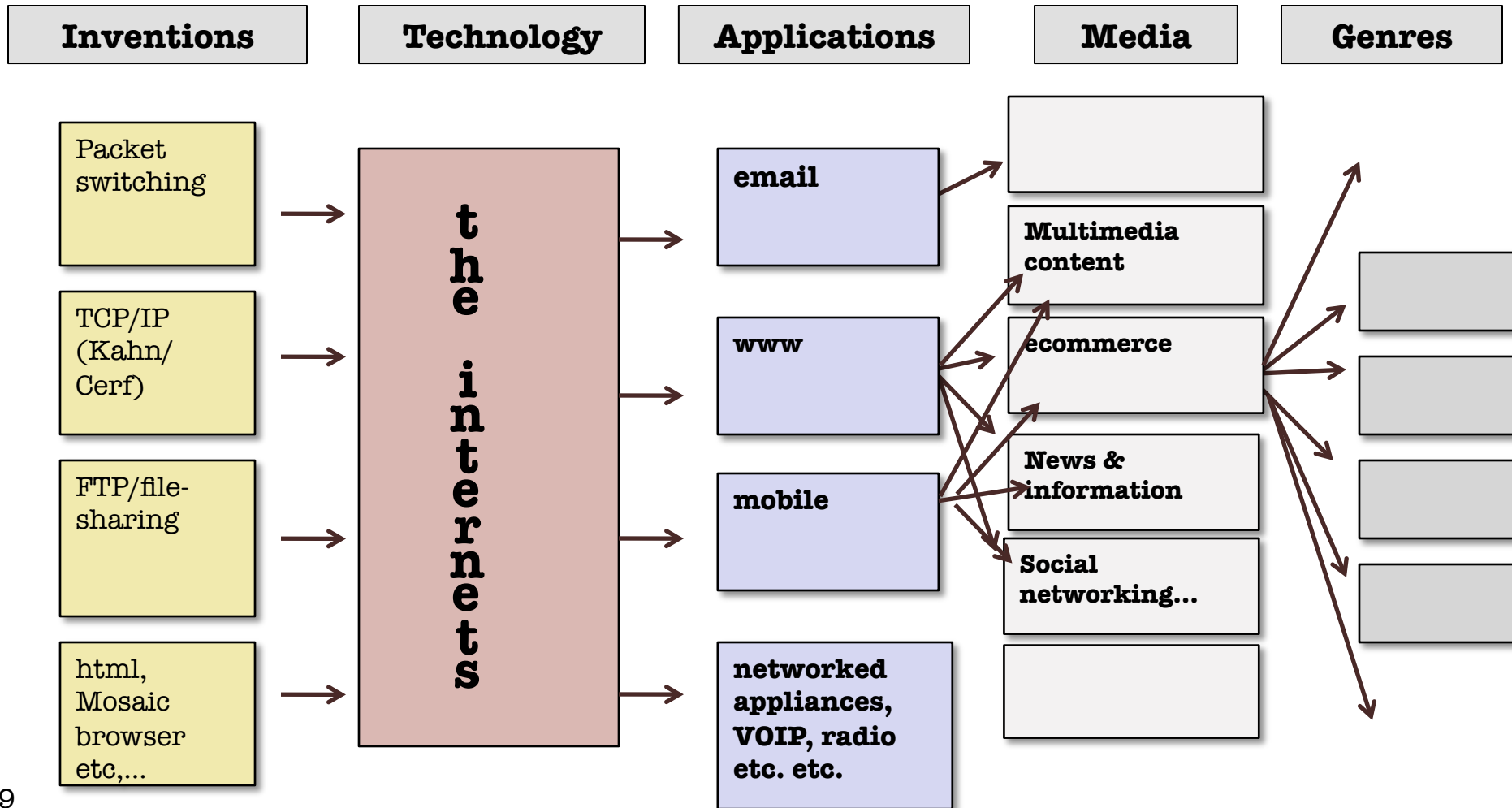


*"a vast unintended  
consequence"*



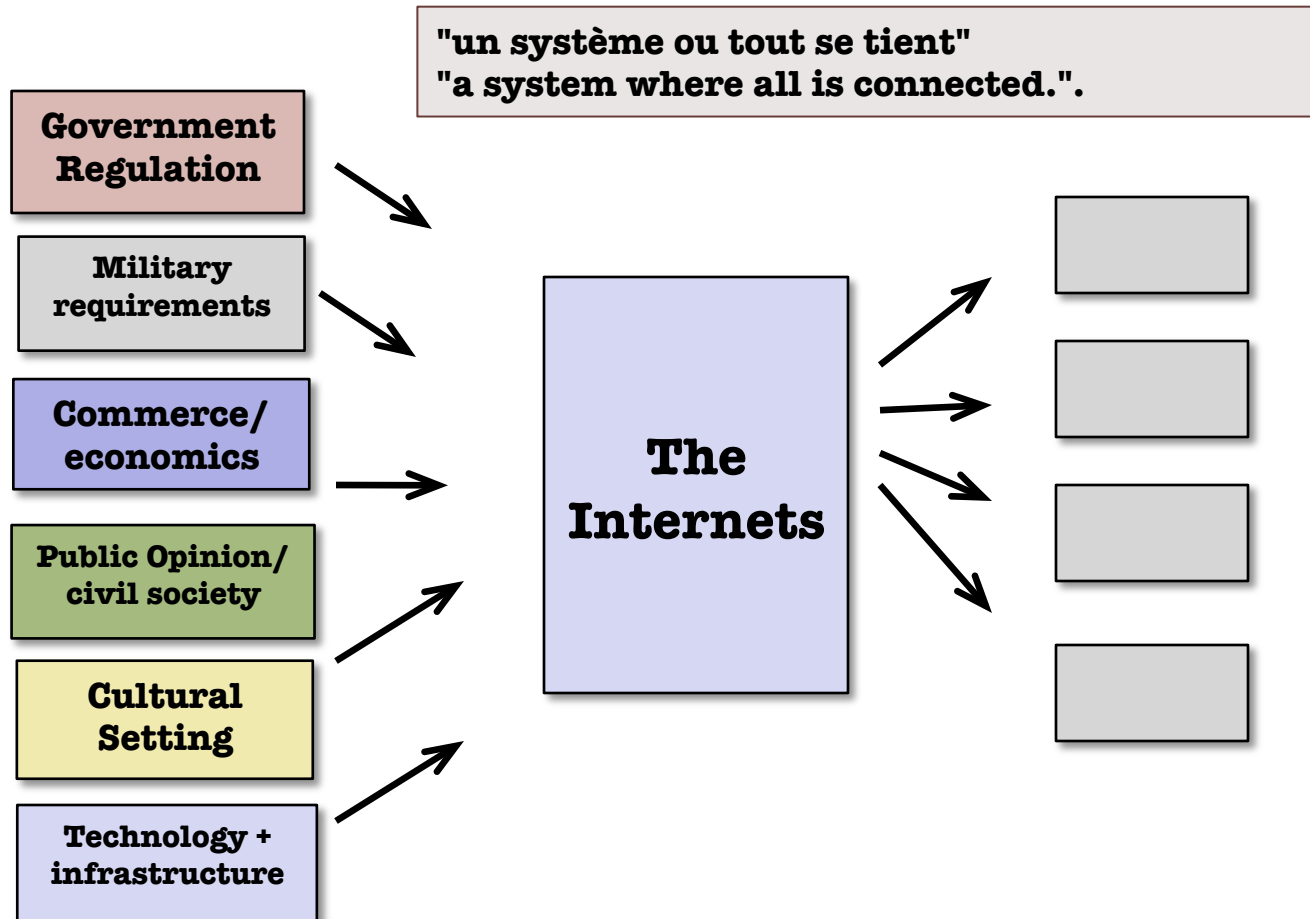


# Inventions, Technologies, Applications, Media: not an easy story to tell





# Multiple Influences





# Technological Bases of the Web

---



Communications protocols/Packet switching

Physical Networks

Addressing system

Hypertext transfer protocols

Browsers/ Graphical browsers

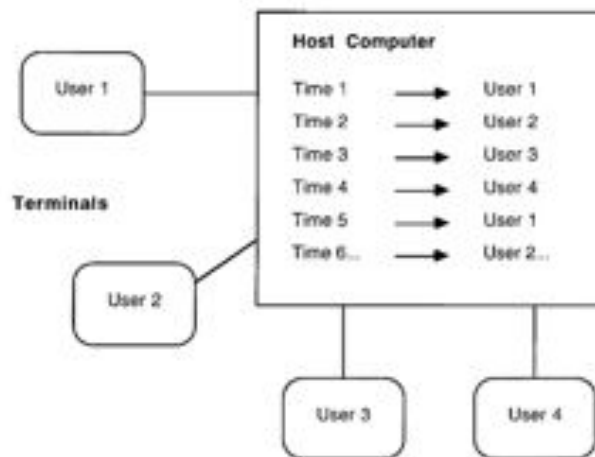
Indexing & search

Broadband



# Communicating

## intra-machine time-sharing





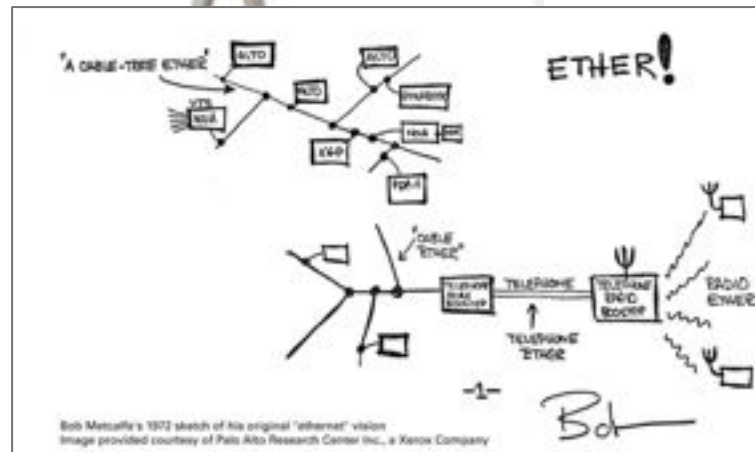
# Communicating

## different machines

computer to printer

[the stock ticker]

Ethernet: computer to printer



Hughes' telegraph,  
1855



Edison Stock Ticker,  
1869



Bob Metcalfe at Xerox  
PARC in 1973

# Communicating

## different machines

computer to printer

[the stock ticker]

Ethernet: computer to printer

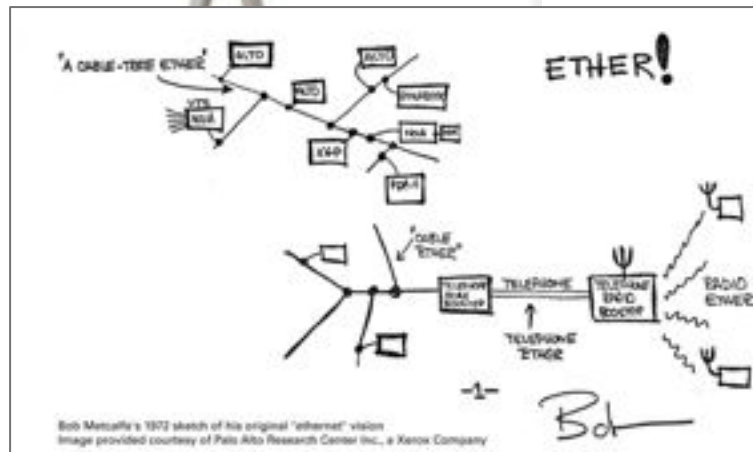
Hughes' tele  
1855



Edison Stock Ticker,  
1869



Bob Metcalfe at Xerox  
PARC in 1973





# The Sixties Setting



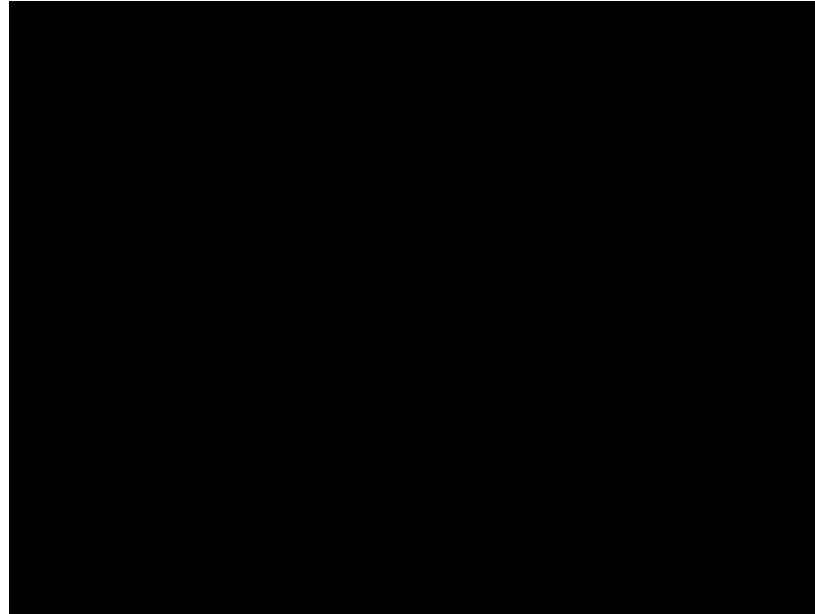
1962



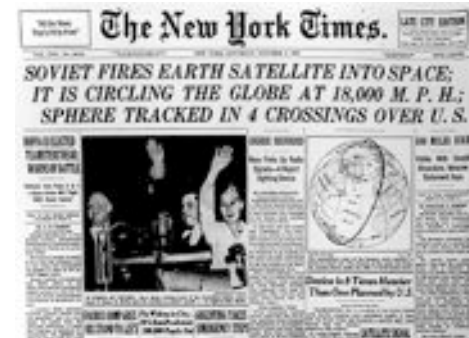
1961



1960



Doctor Strangelove (Stanley Kubrick), 1964

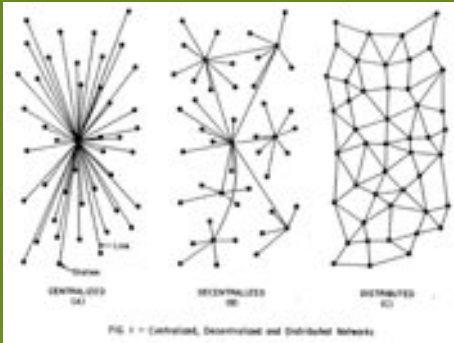


1957

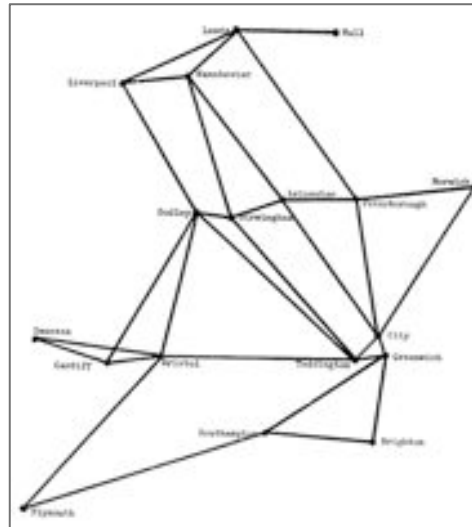


# Technological Beginnings: Packet Switching

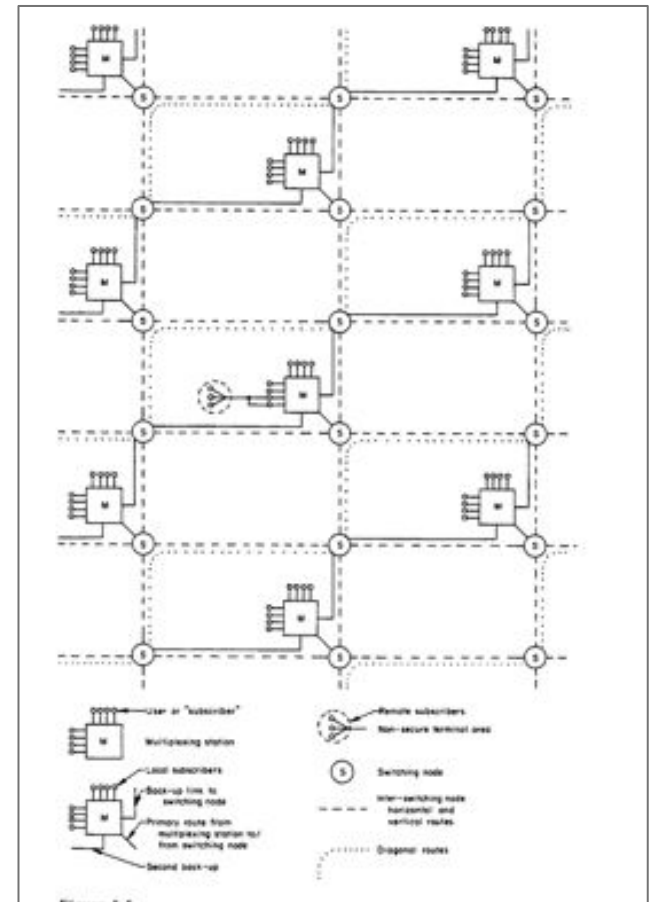
Switching also maximizes  
network efficiency...



Paul Baran, "On Distributed  
Communications,  
1964 RAND report



Donald Davies proposed  
UK network 1967







# 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.



*Arpanet 1971*



# Technological Beginnings: 60s & 70s

---



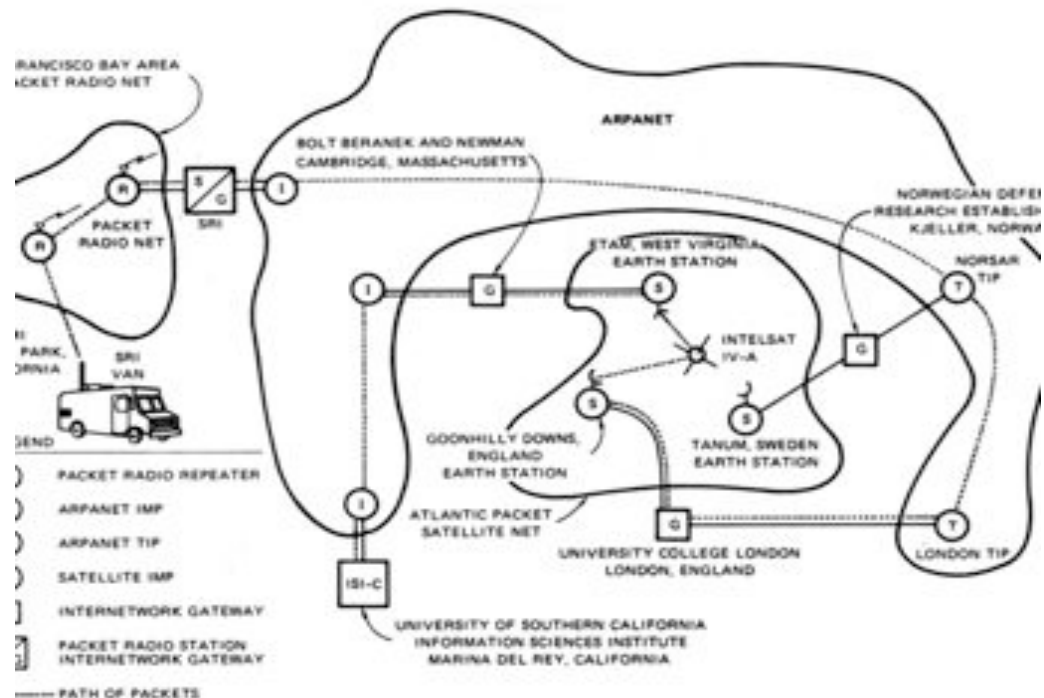
1971: File Transfer Protocol (FTP) permits easy exchange of files between sites.

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



# 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

---

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.

“symbolics.com” is first .com registrant

Late 1980's: First Internet Service Providers emerge

1990: ARPANET shuts down

1991: NSF removes all restrictions on commercial use of Internet





# Internet Development:80s

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

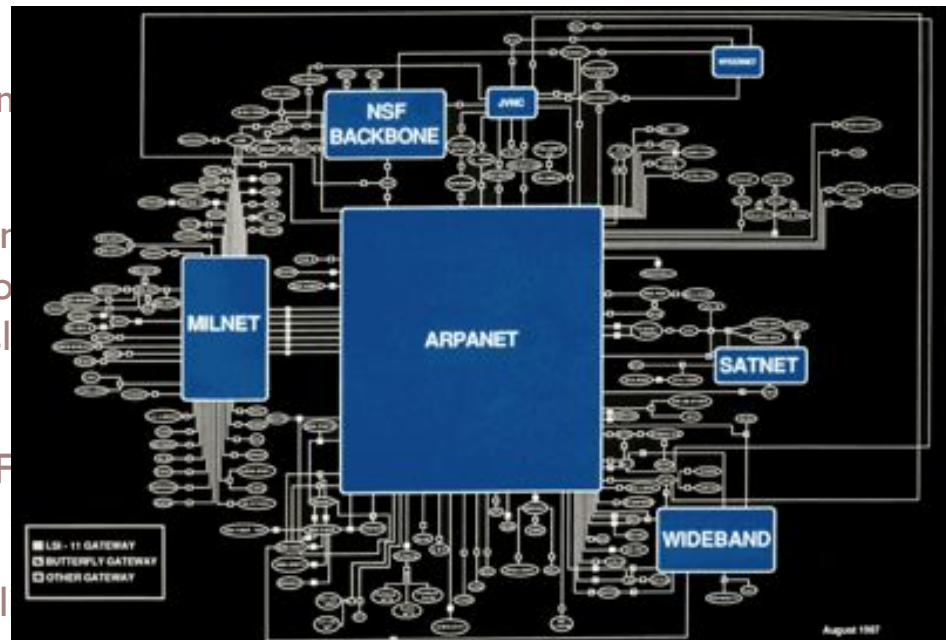
1980 Usenet established at UNC Chapel Hill as “the poor man’s ARPANET.” User groups classified as comp., news., rec., talk., etc.

1980's: Com

1983: Domain  
number of ho  
servers transl

Late 1980's: F

1989: Austral



Internet 1987



# The Origins of Email

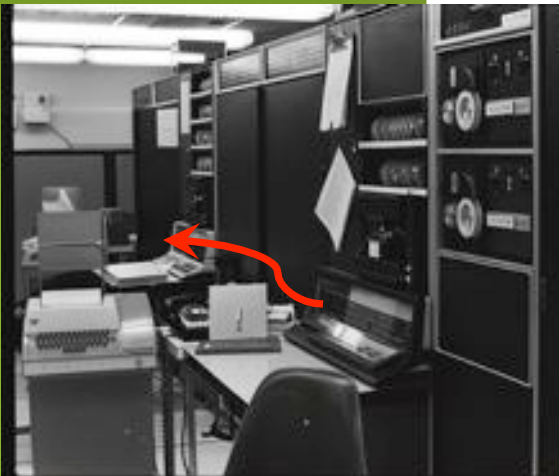
---

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

But public access to email doesn't begin until 1988, when MCI mail is linked to the Internet

1975: 1<sup>st</sup> email client MSG (permits "forward," "reply")

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



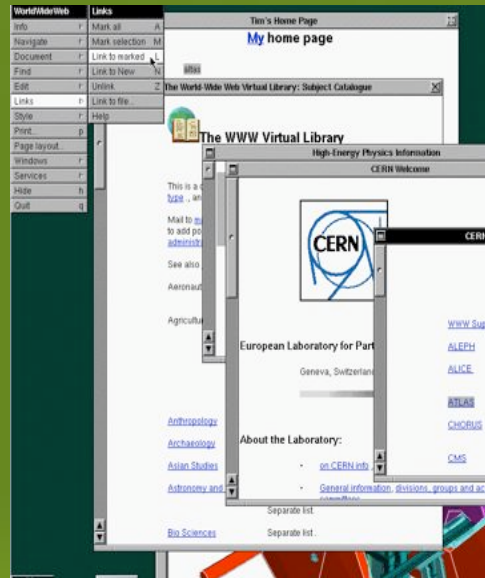


# The Emergence of the WWW

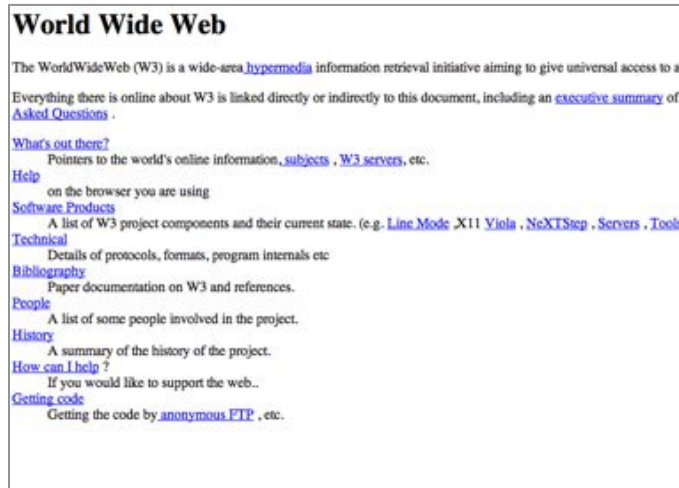
1945: Vannevar Bush writes "As We May Think" in *The Atlantic*; envisions Memex machine to follow links between documents on microfiche

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.



Sir Tim



The First Web Page

# 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.) to users unfamiliar with computers.

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

Hayes Smartmodem 1981



But analog modems still 90% of market





# The Emergence of the WWW

2000: AOL merges w/ Time-Warner

2005: gives away free email acc'ts

2009 spun off by Time-Warner

2010 eliminates chat rooms

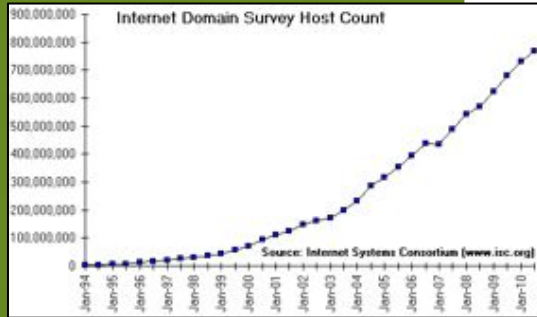
2011 acquires Huffington post

**AOL subscribers, 2001-2009**





# The Growth of the WWW



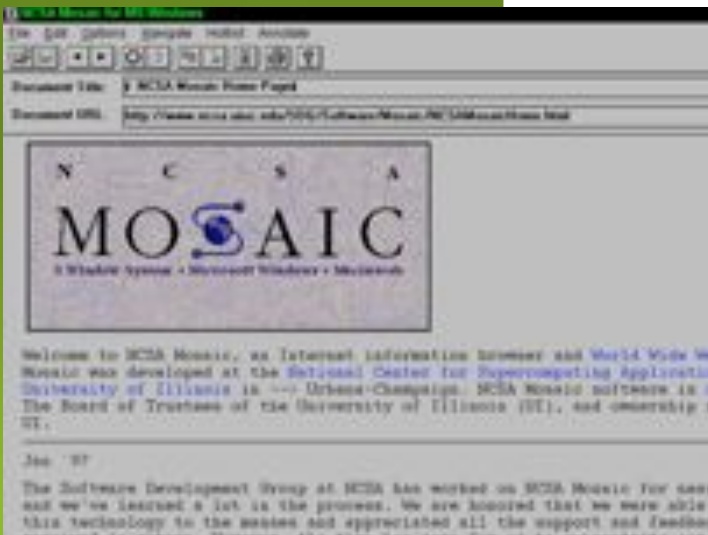
1993: Mark Andreessen's Mosaic browser released by NCSA, which runs on Windows and permits easy integration of graphics in Web pages.

CERN announces that W3 technology will be available free to everyone.

1994: Andreessen, now in private sector, releases Netscape Navigator browser.

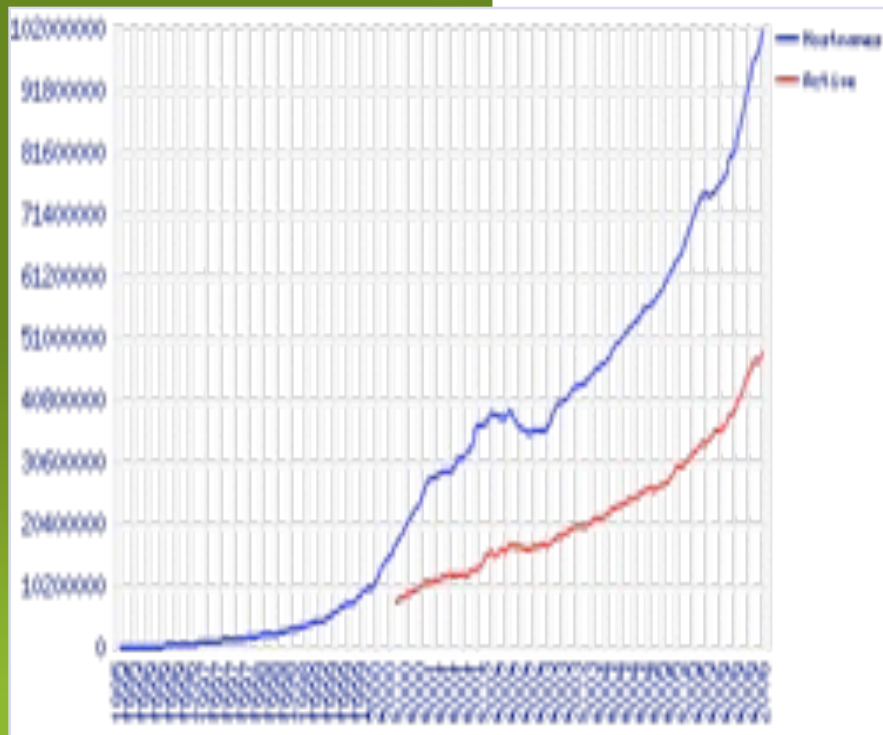
1995: Microsoft releases Internet Explorer bundled with Windows 95 to compete with Netscape.

1995 AOL makes Internet available to all subscribers





# The Web Takes Off



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

---

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.



Jon Postel



## PRICEY DOMAIN NAMES

VacationRentals.com 2007  
\$35m

Insure.com 2009 \$16m

Sex.com 2010 \$13m

Fb.com 2010  
by Facebook \$8.5m

Diamond.com 2006 \$7.5m

Beer.com 2004 \$7m

Casino.com 2003 \$5m

Slots.com 2003 \$5m

Yp.com 2008 2.8m by Yellow  
Pages

## Dot.comania

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.



Jon Postel

TOP STORIES IN OPINION

1 of 12

2 of 12



Coalition of the Disappointed



The Spending Bender Also Known as the '...

OPINION

## America's Internet Surrender

By unilaterally retreating from online oversight, the White House

By L. GORDON CROVITZ

March 18, 2014 6:56 p.m. ET

The Internet is often described as a miracle of self-regulation, which is almost



Jay Nordlinger - Blown Out, Part II

The Editors - Ukraine and the Crisis of the West

Kevin D. Williams - Case for a Little

MARCH 26, 2014 4:00 AM

## Don't Globalize ICANN

By The Editors

Archive Latest RSS Send

## FOX NEWS

Search foxnews.com

Flash

Opinion Home Todd Starnes Judith Miller Juan Williams KT McFarland Dr. Keith Ablow Karl Rove Ric Grenell

TECH

## ICANN debate: Team Obama must reverse decision on Internet control

By Erik Telford · Published April 09, 2014 · FoxNews.com

f 162 t 50 g+ 7



# Politics of ICANN

## NEW REPUBLIC

POLITICS | CULTURE | THE MAGAZINE

search...

SUBSCRIBE NOW



## What happens to the internet after the U.S. hands off ICANN to others?

BY LEE HAINIE | 6 COMMENTS



A screen shows a rolling feed of new Generic Top-Level Domain Names (gTLDs). (Andrew Cowie/AFP/GettyImages)

This weekend, hundreds of people from dozens of countries will gather in Singapore to



TOP STORIES IN OPINION

1 of 12



Coalition of the Disappointed



The Spending Bender Also Known as the '...

2 of 12

OPINION

## America's Internet Surrender

By unilaterally retreating from online oversight, the White House

By L. GORDON CROVITZ

March 18, 2014 6:56 p.m. ET

The Internet is often described as a miracle of self-regulation, which is almost



Jay Nordlinger - Blown Out, Part



The Editors - Ukraine and



Kevin D. William

ICANN may be opened up to the influence of nations that do not boast traditions of individual liberty and protected expression. *Nat. Review*

## FOX NEWS

Search foxnews.co

Flash

Opinion Home Todd Starnes Judith Miller Juan Williams KT McFarland Dr. Keith Ablow Karl Rove Ric Grenell

TECH

ICA  
reve

By Erik Telfo

This is the Obama equivalent of Carter's decision to give away the Panama Canal —only with possibly much worse consequences.” A former Bush official

# Politics of ICANN

## NEW REPUBLIC

POLITICS | CULTURE | THE MAGAZINE

Search

SUBSCRIBE NOW

TECHNOLOGY

MARCH 24, 2014

**No, Barack Obama Isn't Handing Control of the Internet Over to China**  
The misguided freakout over ICANN

What happened  
U.S. hands o

BY LEE RAINIE | 10 COMMENTS



A screen shows a rolling feed of new

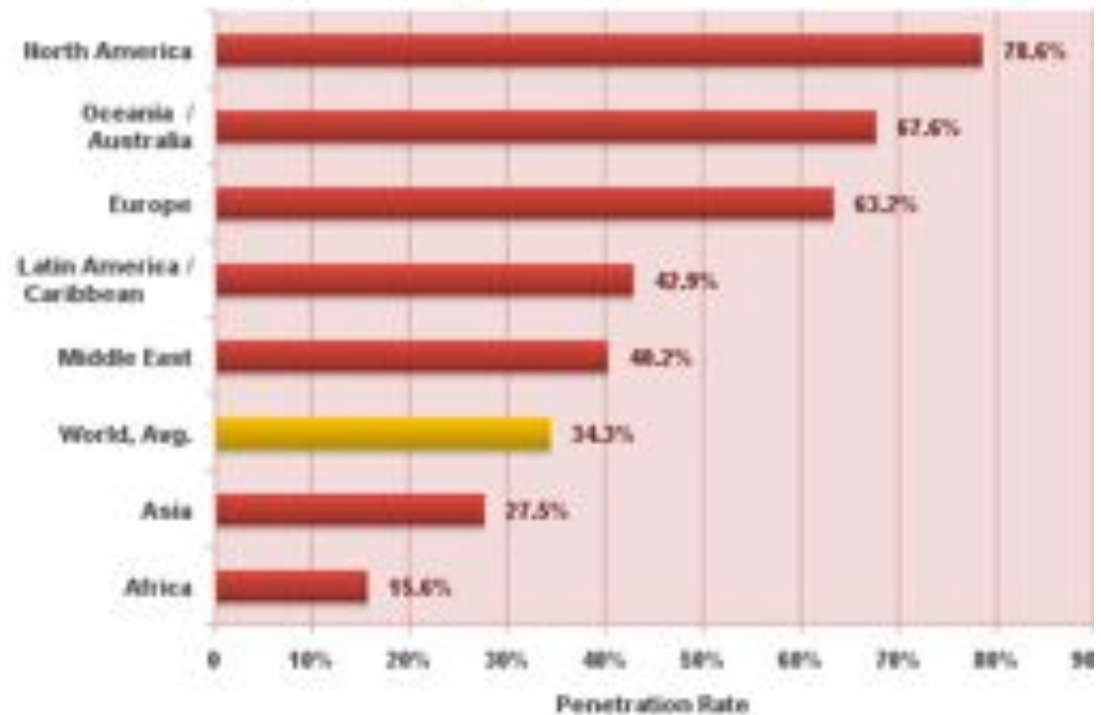
You may be reading this article at newrepublic.com, and if you are, you're here because your ISP, your operating system vendor, your browser maker and you are agreeing to map that name to this online place. Any could change it, notwithstanding actions of governments and institutions like ICANN. ...last week's news is simply about symbolism. Jonathan Zittrain, *The New Republic*

This weekend, hundreds of people from dozens of countries will gather in Singapore to



# Disparities

**World Internet Penetration Rates  
by Geographic Regions - 2012 Q2**





# The Wired World





## ...but not so fast

---

But in much of world, desire for connectivity creates preference for fixed connections



Internet Café,  
Accra, Ghana



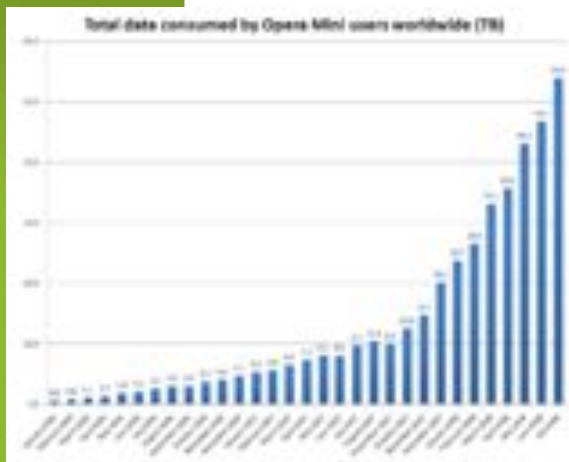
# Faster than we expected

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

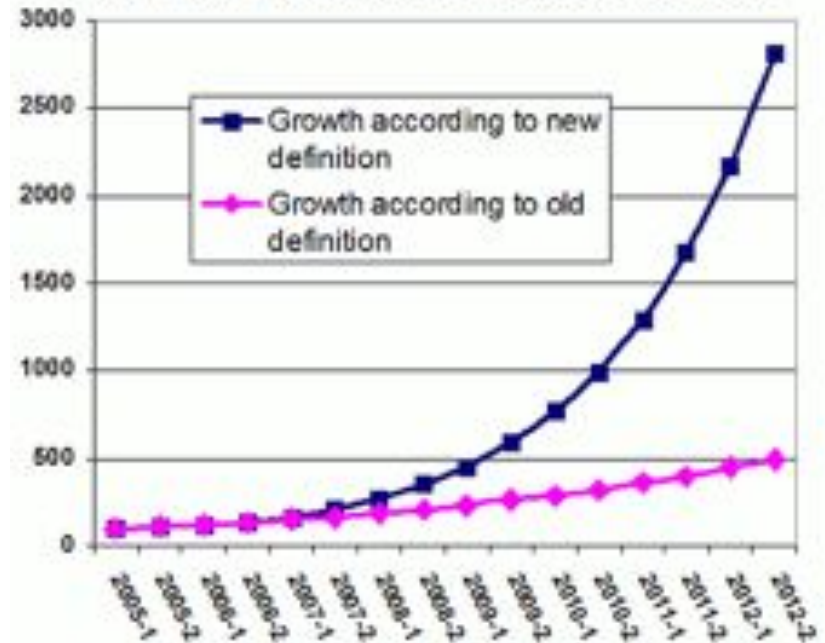
By: Dan Grazier | Feb 15th, 2012 at 12:30AM

0 Comments

Filed Under: Mobile



## Chinese Internet Users - 2 Growth Scenarios



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



# The Internationalization of the Web

---

Initial prevalence of English on the Web

1997 -- Nunberg & Schuetze survey of 2.3 million pages from Web crawl: 85 percent of content is in English, including about 35 percent of content in non-English speaking domains.

Eng. Most common in N. Europe, less-developed nations

2000: Jack Xu Excite@Home; survey of around 600 million pages: 72% are in English



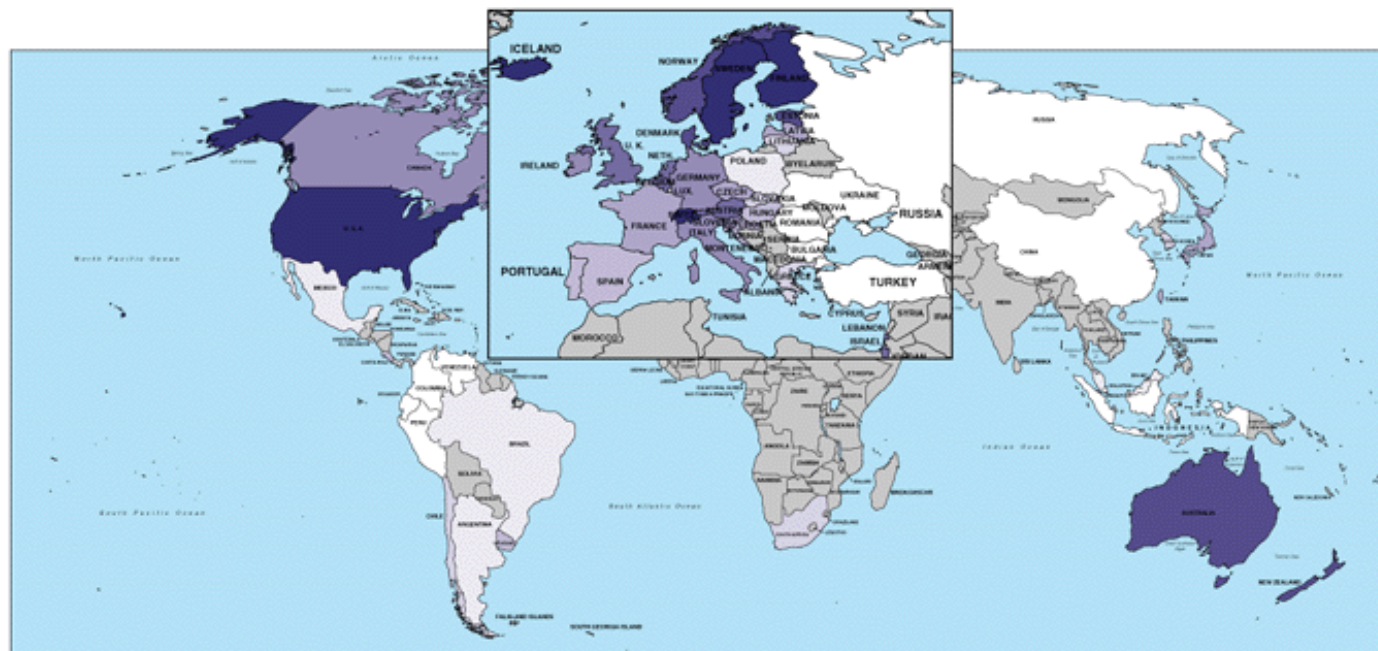


# The Internationalization of the Web

Relative size of Eng-speaking population in developed world

Cf. Web penetration, 1997

**Web Penetration**





## Fears of English Hegemony...

---

“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



## And Anglophone Triumphalism...

---

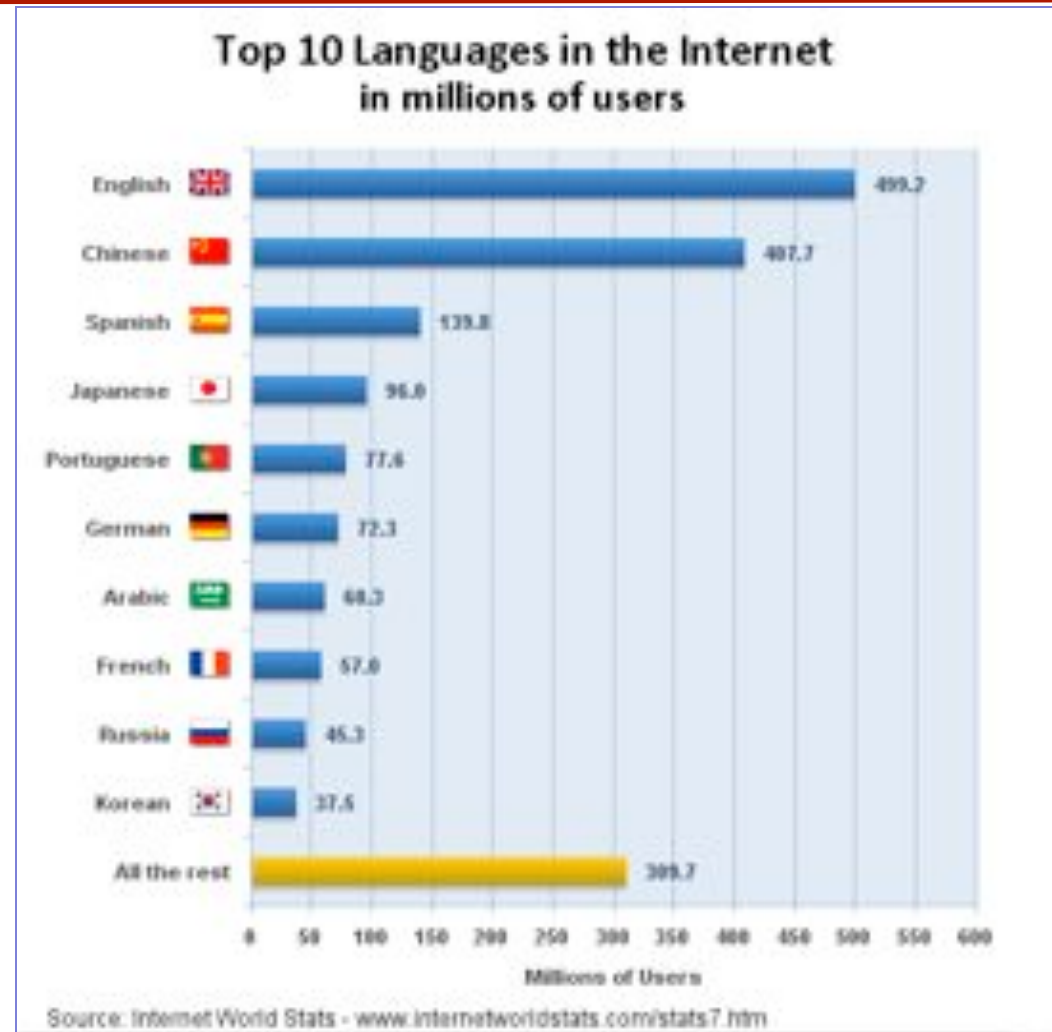
The Internet is "a great force for the Anglification of the planet."

“[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 and English-speaking world." Sridath Ramphal, chairman of Commission on Global Governance, 1996



# Growth of Other Languages on the Web





# Internet Penetration Moves toward Equalization...

Penetration increases most sharply in Africa, Middle East, Latin America...

WORLD INTERNET USAGE AND POPULATION STATISTICS						
World Regions	Population ( 2009 Est.)	Internet Users Dec. 31, 2009	Internet Users Latest Data	Penetration (% Population)	Growth 2000-2009	Users % of Table
Africa	991,002,342	4,514,400	86,217,900	8.7 %	1,809.8 %	4.8 %
Asia	3,808,070,503	114,304,000	764,435,900	20.1 %	568.8 %	42.4 %
Europe	803,850,858	105,096,093	425,773,571	53.0 %	305.1 %	23.6 %
Middle East	202,687,005	3,284,800	58,309,546	28.8 %	1,675.1 %	3.2 %
North America	340,831,831	108,096,800	259,561,000	76.2 %	140.1 %	14.4 %
Latin America/Caribbean	586,662,468	18,068,919	186,922,050	31.9 %	934.5 %	10.4 %
Oceania / Australia	34,700,201	7,620,480	21,110,490	60.8 %	177.0 %	1.2 %
<b>WORLD TOTAL</b>	<b>6,767,805,208</b>	<b>360,985,492</b>	<b>1,802,330,457</b>	<b>26.6 %</b>	<b>399.3 %</b>	<b>100.0 %</b>



# Internet Penetration Moves toward Equalization...

Web page content more heavily English



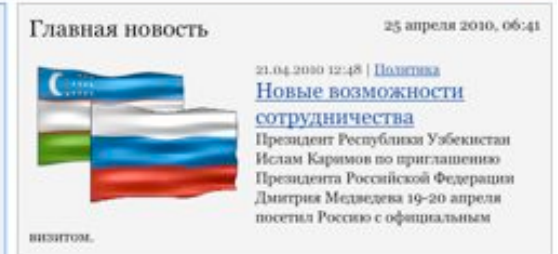
Proportion of languages used on home pages, top 10m websites





# Space for Smaller Languages

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





# **The growth of broadband**

---

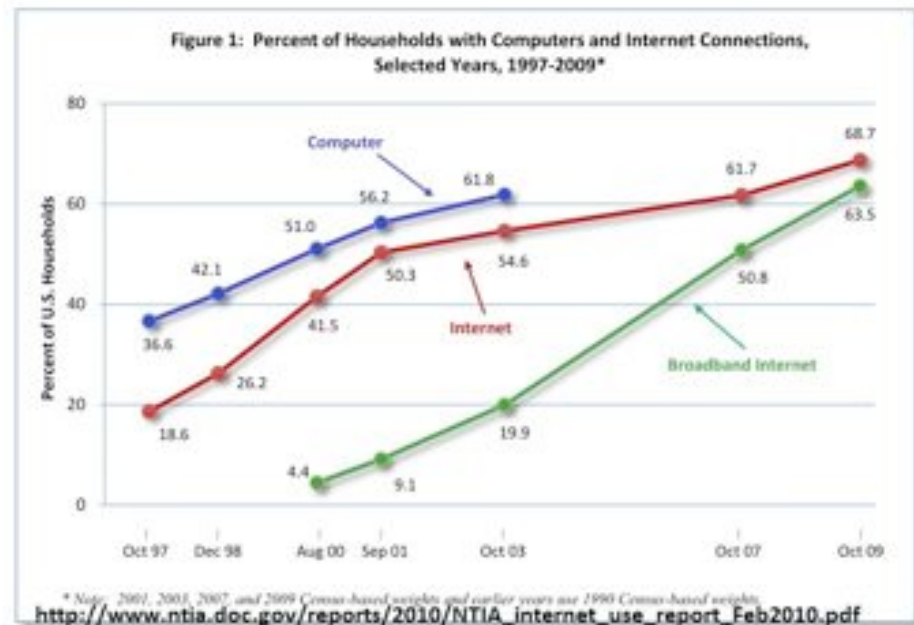
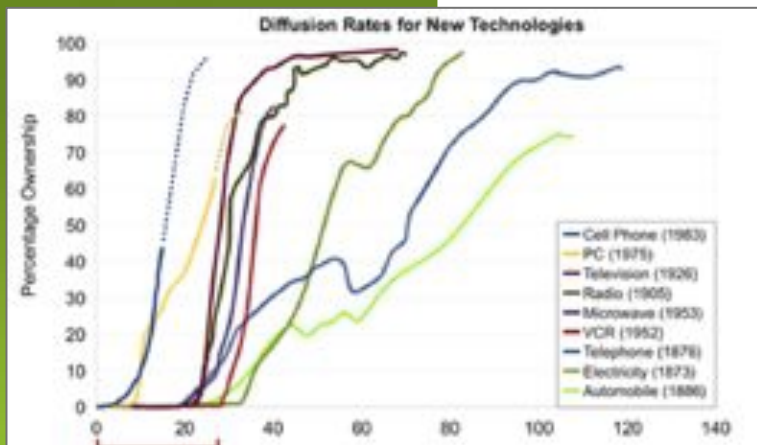


# The growth of broadband

US population w/ broadband access:

2000: 3%

2010: 66%



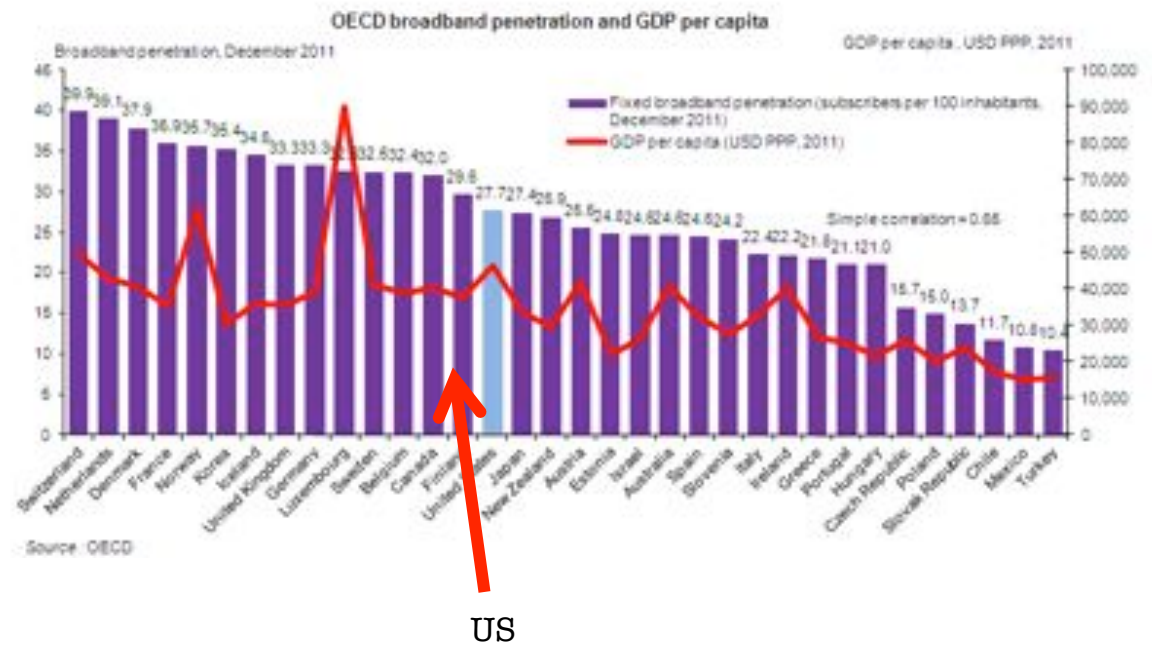


# The growth of broadband

But US lags other developed nations...

Country	91-12 Avg. Mbps	6-Mo Change	Yr-1 Change
— Global	2.6	14%	25%
1 South Korea	15.7	-1.5%	9.4%
2 Japan	10.9	21%	35%
3 Hong Kong	9.3	5.4%	1.3%
4 Netherlands	8.8	6.5%	38%
5 Latvia	8.8	18%	38%
6 Switzerland	8.1	11%	30%
7 Ireland	7.3	3.4%	30%
8 Czech Republic	7.1	6.2%	9.1%
9 Belgium	7.1	13%	16%
10 Finland	6.9	16%	39%
...			
12 United States	6.7	17%	28%

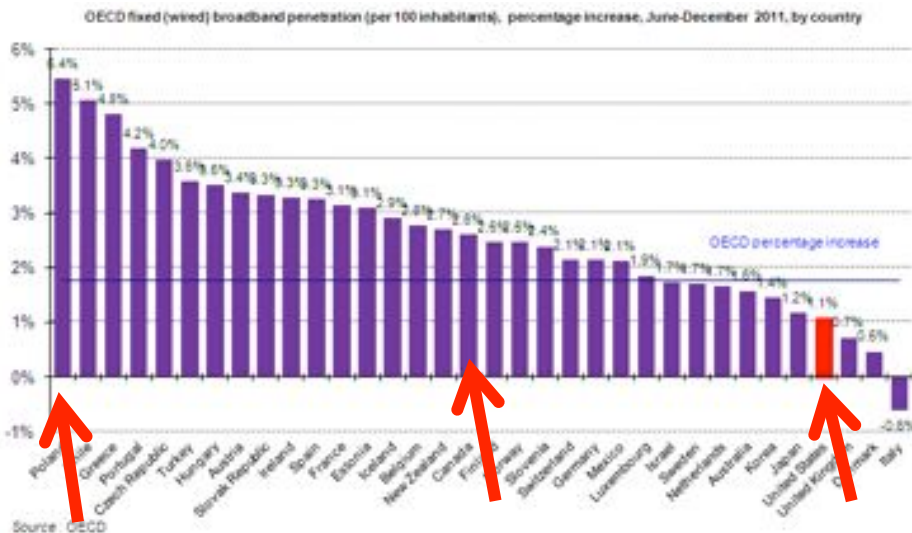
Figure 7: Average Measured Connection Speed by Country





# Slowing broadband growth

## Rate of growth in broadband



Poland

Canada

US

at&t / comcast / verizon

US broadband growth slows to a trickle with only 260,000 new connections

by Om Malik AUG. 14, 2012 - 8:11 AM PDT

CNET | News | Internet & Media | Broadband growth slows in U.S.

## Broadband growth slows in U.S.

Following years of double-digit gains, broadband adoption has slowed with 66 percent of Americans using a high-speed connection at home, says Pew Internet.

## Broadband and Dial-up Adoption, 2000-2010

% of American adults who access the internet via dial-up or broadband, over time







# Is broadband a public utility?



Types of broadband access:

Copper wire (DSL, phone lines)

Cable

Fiber optic

Wifi

(satellite)

...while “blazing fast” broadband might be important for some users, broadband speeds in the US are plenty fast enough to satisfy most users.  
Forbes

TIME

TECH POLICY

## Is Broadband Internet Access a Public Utility?

By Sam Gustin @samgustin · Jan. 09, 2013 · 33 Comments

Share Like 1.5k Tweet 642 +1 90 LinkedIn Share 126 Print

Read Later

Should broadband Internet service be treated as a basic utility in the United States, like electricity, water, and traditional telephone service? That's the question at the heart of an important and provocative new book by Susan Crawford, a tech policy expert and professor at Cardozo Law School. In *Captive Audience: The Telecom Industry and Monopoly in the New Gilded Age*, released Tuesday by Yale University Press, Crawford argues



Courtesy of Yale University Press

Forbes

## 10 Reasons To Be More Optimistic About Broadband Than Susan Crawford Is

Geoffrey Manne, Subscriber





# Is broadband a public utility?



“In Seoul, when you move into an apartment, you have a choice of three or four providers selling you symmetric fiber access for \$30 per month, and installation happens in one day,” Susan Crawford

The wireless industry claims that there is extensive competition in the U.S., including four nationwide operators and seven providers..., but that’s like claiming that the New York Giants and the Tappan Zee High School team both play football.

TIME

TECH POLICY

## Is Broadband Internet Access a Public Utility?

By Sam Gustin @samgustin · Jan. 09, 2013 · 33 Comments

Share Like 1.5k Tweet 642 +1 90 LinkedIn Share 126 Print

Read Later

Should broadband Internet service be treated as a basic utility in the United States, like electricity, water, and traditional telephone service? That's the question at the heart of an important and provocative new book by Susan Crawford, a tech policy expert and professor at Cardozo Law School. In *Captive Audience: The Telecom Industry and Monopoly in the New Gilded Age*, released Tuesday by Yale University Press, Crawford argues



Courtesy of Yale University Press



# Is broadband a public utility?

---

**Forbes**

3/10/2013 @ 4:40PM | 7,490 views

**10 Reasons To Be More Optimistic About Broadband Than Susan Crawford Is**

**Geoffrey Manne**, Subscriber

...given the entrenched influence of these companies in Washington, D.C., many — if not most — of her policy prescriptions seem a tad far-fetched. Is the U.S. government about to mandate low-cost broadband Internet access for all Americans? It's not likely any time soon. Time.

...while “blazing fast” broadband might be important for some users, broadband speeds in the US are plenty fast enough to satisfy most users.  
Forbes

**THE WALL STREET JOURNAL.**

**The Joys Of Oligopoly**



## Readings for April 20

---

Marshall, Alfred. 1920. “Industrial Organization, Continued. The Concentration of Industries in Particular Localities,” book IV chapter X (section iv.x.1-15), in *Principles of Economics*. London, Macmillan & Co. (link on Canvas)

Knox, Vicemus. On the Original Intention of Universities vol 2, pp. 149-154 in *Liberal Education* (1789) Read: pp 149-154 (Google Books, link on Canvas)

“The Revolution Begins at Last,” *Economist*, 1995, Sept 30. (reader)



## Assignment for 4/22

---

After discussing the “localization of industry,” Marshall writes “Every cheapening of the means of communication ... alters the action of the forces which tend to localize industries.” Many people read this as predicting the end of industrial “clusters.” Knox also suggests that developing technology may bring about the end of the university. Choose one of these predictions and show how and why it has or has not held up.