UC Berkeley School of Information

Advent of the Internets

Geoff Nunberg

i103 History of Information

April 9, 2015

UC Berkeley School of Information

Where We Are

year

2015
1980
1950
1900
1800
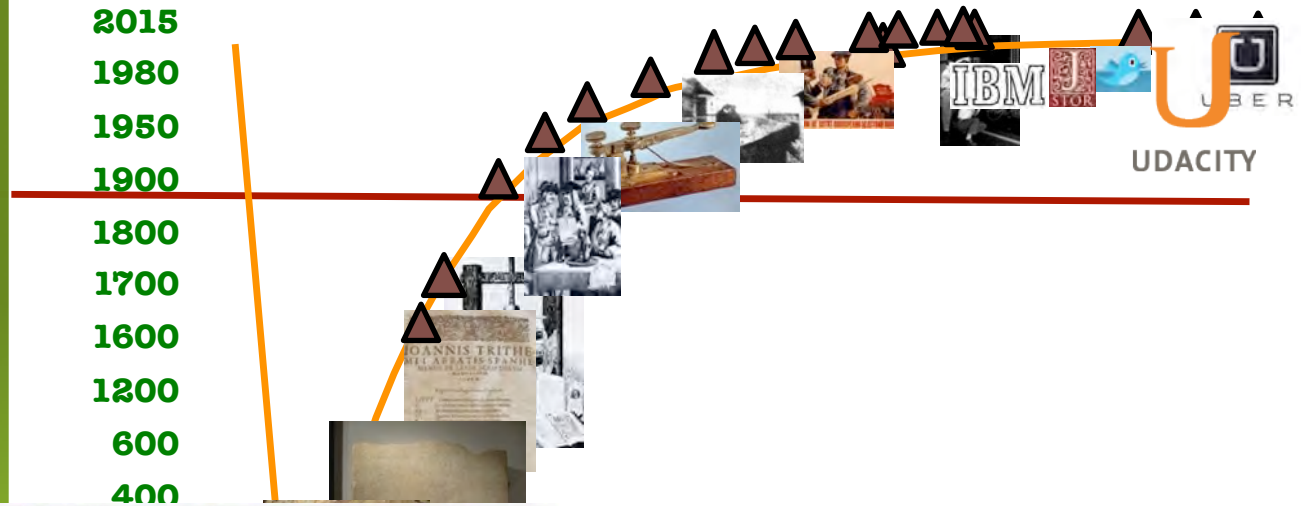1700
1600
1200
600
400

4   5   6   7   8   10   11   12   13
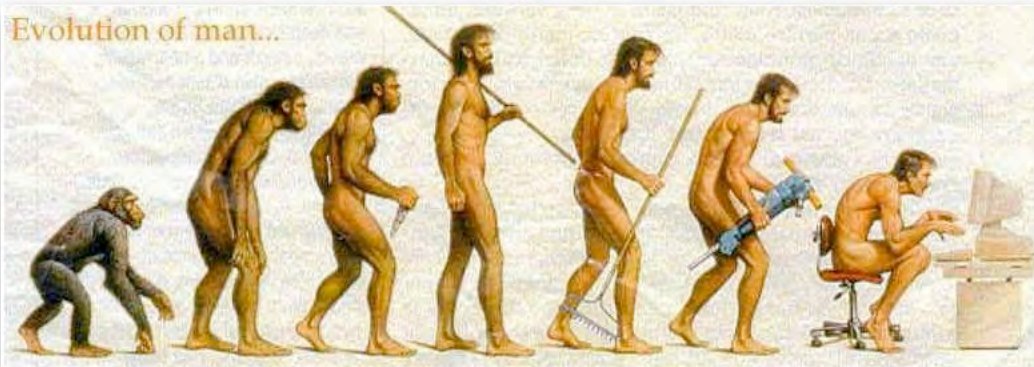
Evolution of man...

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
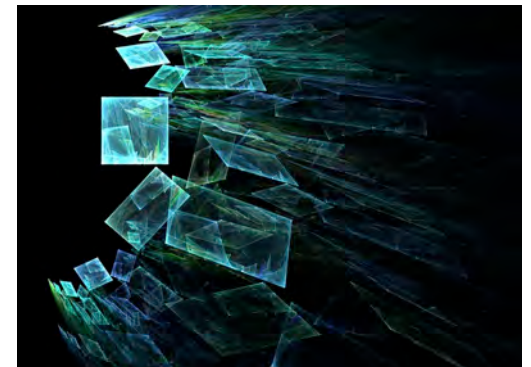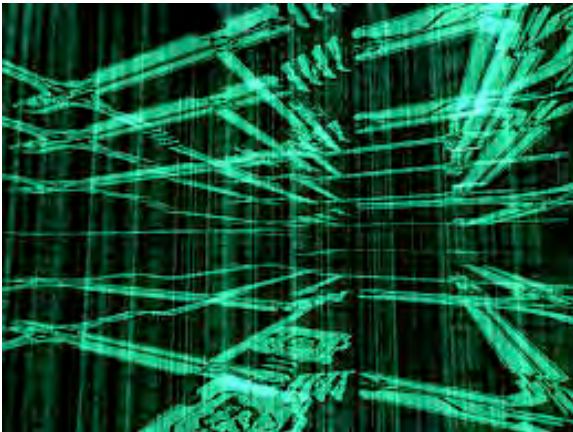Asia Europe/Africa
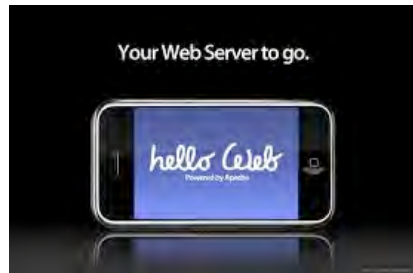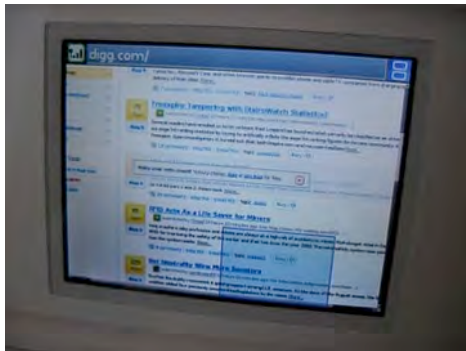Latin America
North America
Private Networks (RFC1918)

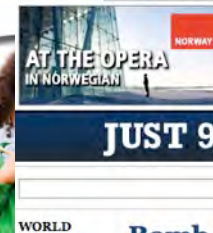# (Why is it always night in cyberspace?)

What makes a "technology": Devices

What makes for a "technology"?: Content
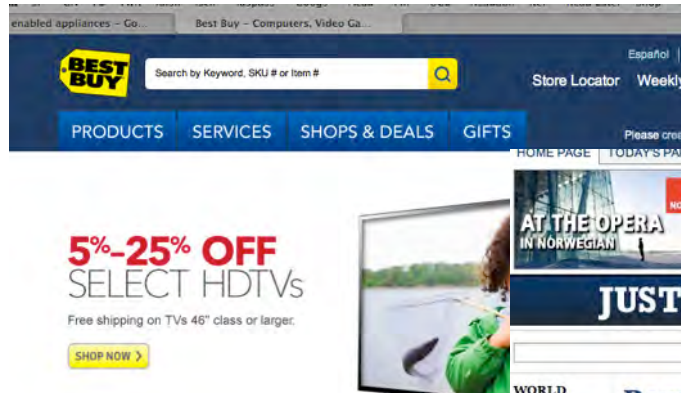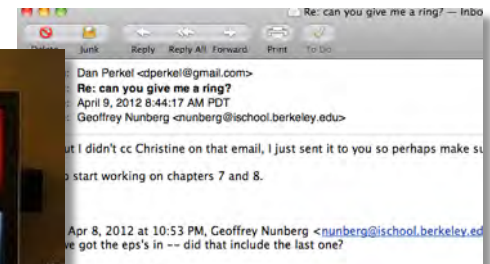
Looking for the Internet: W was right!
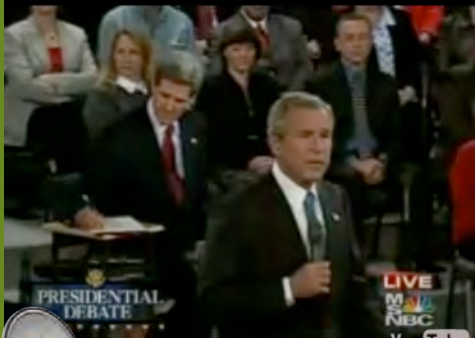
Is the "internet":

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

Inventions	Technology	Applications	Media	Genres

Inventions:
- Packet switching
- TCP/IP (Kahn/Cerf)
- FTP/file-sharing
- html, Mosaic browser etc,...

Technology: the internets

Applications:
- email
- www
- mobile
- networked appliances, VOIP, radio etc. etc.

Media:
- Multimedia content
- ecommerce
- News & information
- Social networking...

Multiple Influences

"un système ou tout se tient"
"a system where all is connected.".

Government policy

Military requirements

Commerce/ economics

Public Opinion/ civil society

Cultural Setting

Technology + infrastructure

The Internets

"a vast unintended consequence"

(some) Technological Bases of the Web

Packet switching/communications protocols

Physical Networks

Addressing system

Hypertext transfer protocols

Browsers/ Graphical browsers

Indexing & search

Broadband

Chestertown 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 Accomodation of Passengers. Merchandife, Produce, &c. carried on the lowest Terms. From experience they can assuredly fay, that the Packet is safe, and fails remarkably well --Will regularly leave Chestertown, 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 proprietors, will use all possible Diligence to accommodate Passengers, as well as be careful to execute, with punctuality, every truft committed to his charge.
JOHN CONSTABLE,
JAMES PIPER.

Chestertown, May, 17, 1793.

Communicating

intra-machine

time-sharing

Communicating

Hughes' tele[graph] 1855

Edison Stock Ticker, 1869
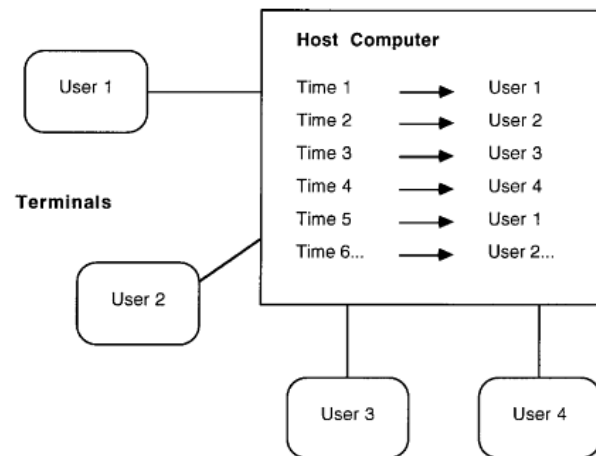
Bob Metcalfe at Xerox PARC in 1973

different machines

Ethernet: computer to printer

Bob Metcalfe's 1972 sketch of his original "ethernet" vision
Image provided courtesy of Palo Alto Research Center Inc., a Xerox Company
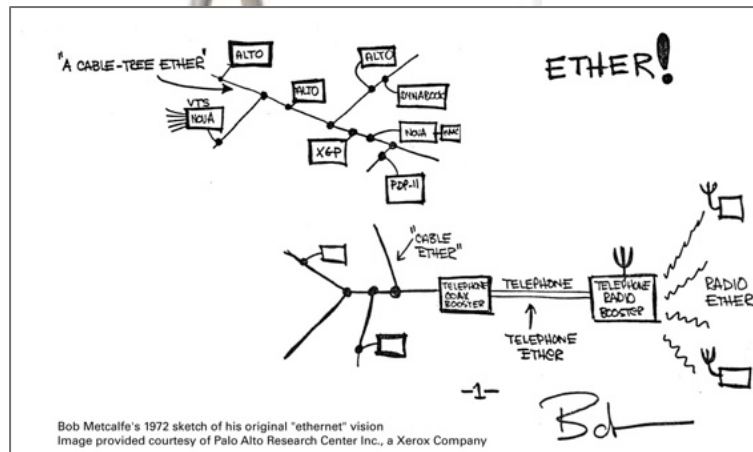
The Sixties Setting

1962

1961

1960

Doctor Strangelove (Stanley Kubrick), 1963

1957

Technological Foundations: Packet Switching

Switching ensures "survivabity" but also maximizes network efficiency…
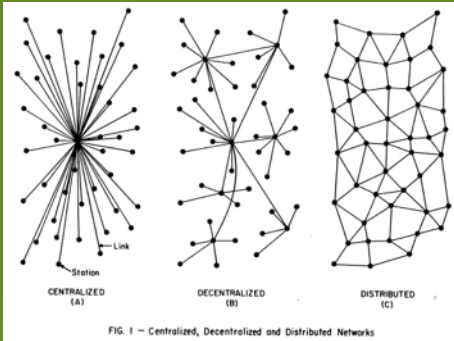
Paul Baran, "On Distributed Communications, 1964 RAND report
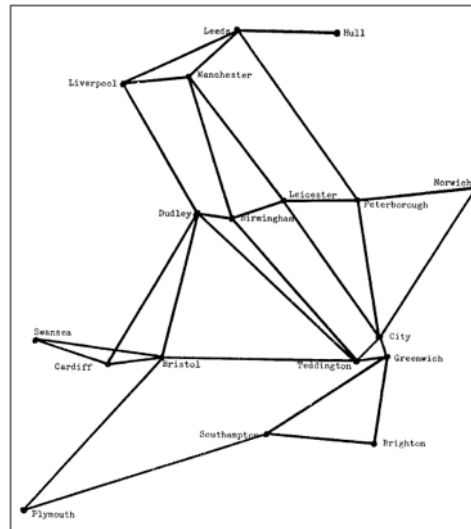
Donald Davies proposed UK network 1967
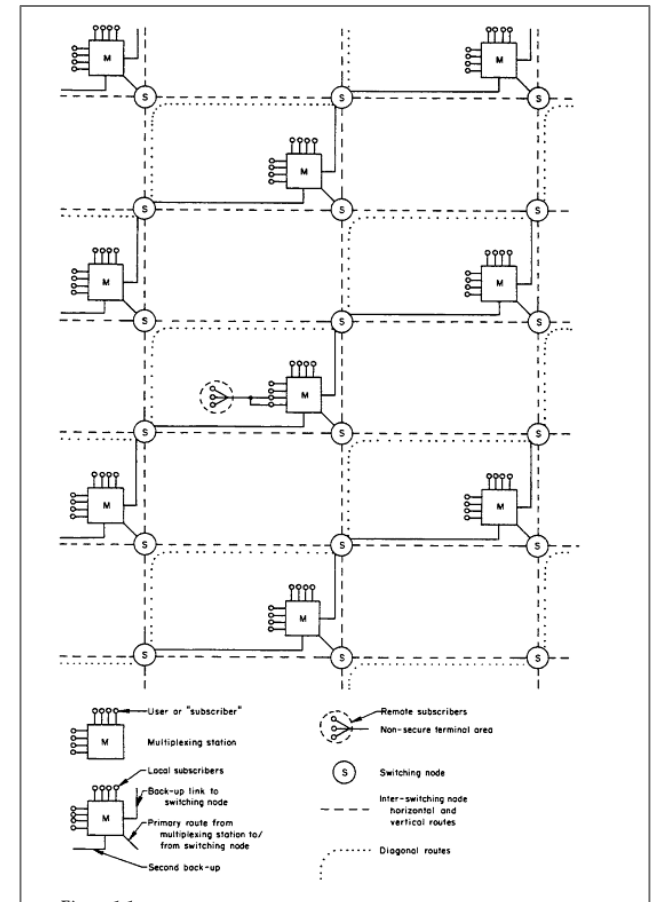
Technological Beginnings: 60s & 70s

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.)

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).
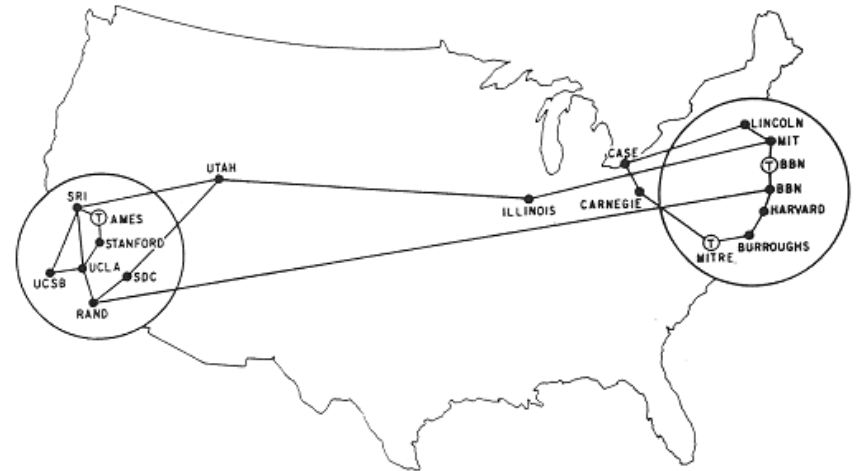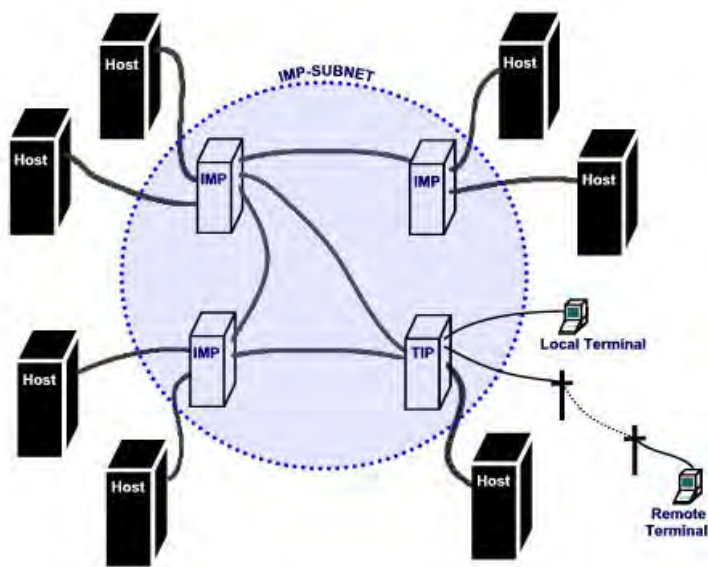
MAP 4   September 1971

Arpanet 1971

Arpanet for Russkies

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
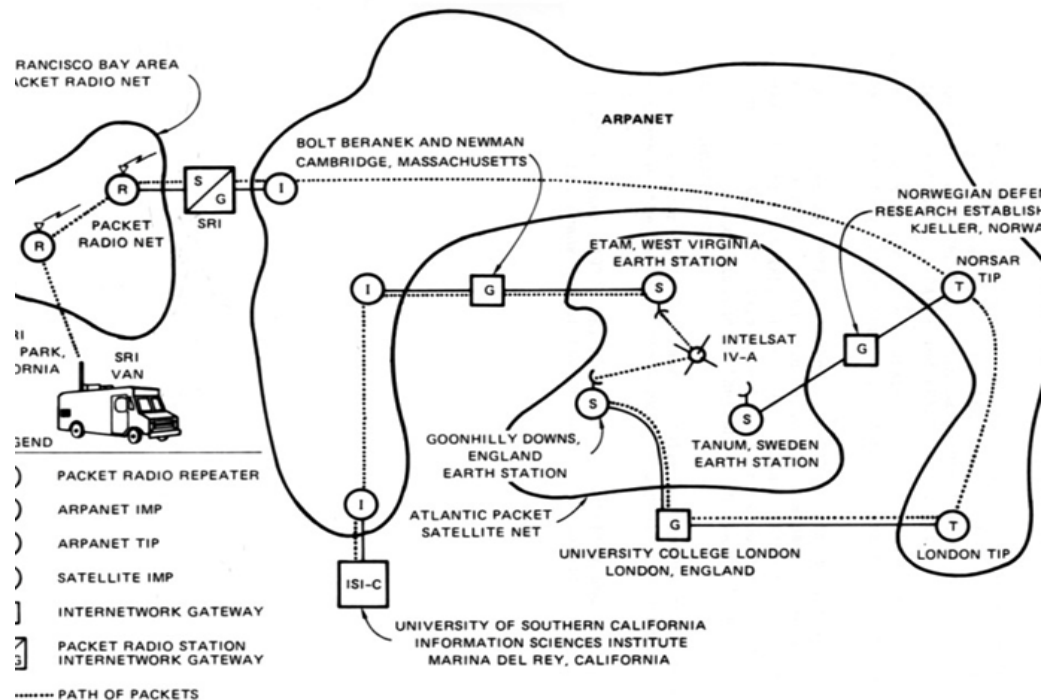
Internet Development:80s

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: Comm

1983: Domai   wing
number of ho   c./ name
servers transl

Late 1980's: F

1989: Austral

Internet 1987

21
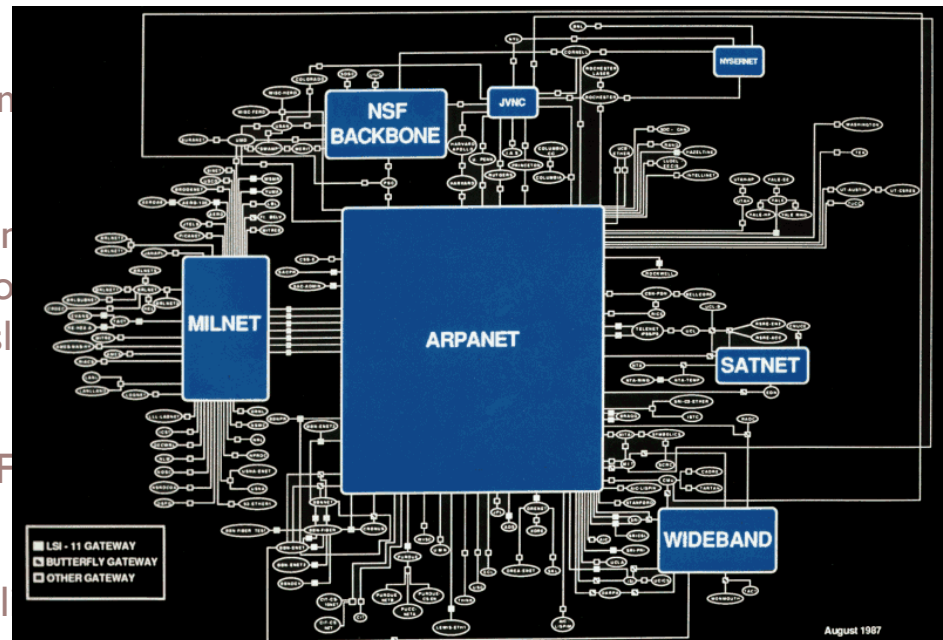
The Origins of Email

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

1975: 1st email client MSG (permits "forward," "reply")

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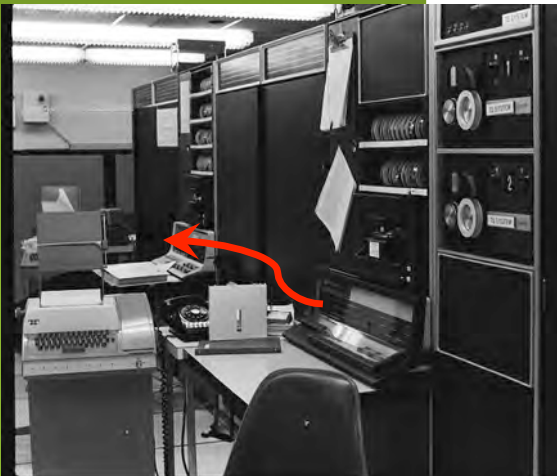
Meanwhile....

changing perceptions

killer apps

Bravo, 1974

Visicalc, 1978

Lotus 1-2-3, 1983

Excel (for Mac), 1984

Editable Formatted Text
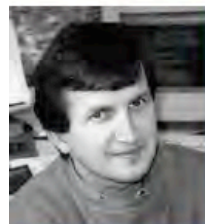
Charles Simonyi
Xerox PARC

Dan Briklin &
Bob Frankston
HBS

21-Hofl15-Computer-PD.4.7 60

Meanwhile….
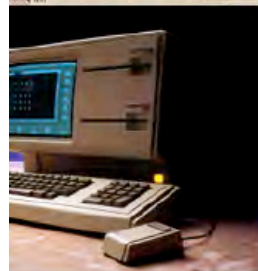
culture clash

home brew, fone freaks

1975 Altair

1976 Apple 1

1983 Lisa

1984 Macintosh
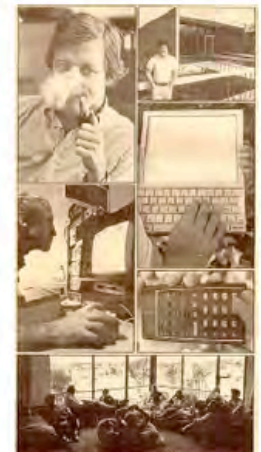
Stewart Brand, "Fanatic Life
and Symbolic Death Among
the Computer Bums"
--*Rolling Stone*,
7 December, 1972

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.
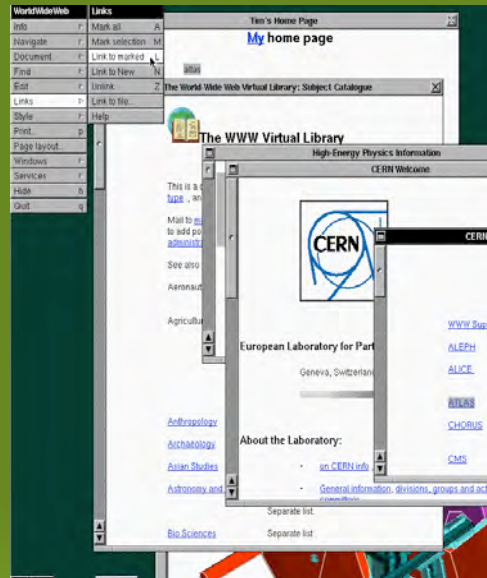
Sir Tim

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 th 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

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

CNET | News · Personal Tech
December 1, 1998 4:00 AM PST

Cable modems double in 1998

By Stephanie Miles
Staff Writer, CNET News

Related Stories

Taking digital services to the masses

November 30, 1998

Worldwide shipments of cable modems skyrocketed in the first half of 1998, due in large part to strong sales in North America, according to a report released today.

Driven by increasing PC sales to North American consumers, worldwide sales of high-speed cable modems shot up 130 percent in 1998 to 492,000 units.

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

Browsers!

Internet Domain Survey Host Count
Source: Internet Systems Consortium (www.isc.org)
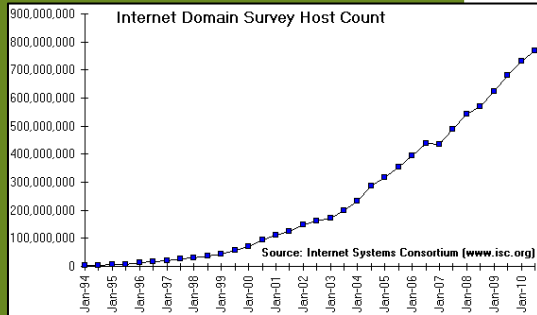
1993: Marc Andreessen's Mosaic browser released by NCSA, which runs on Windows and permits easy integration of graphics in Web pages.

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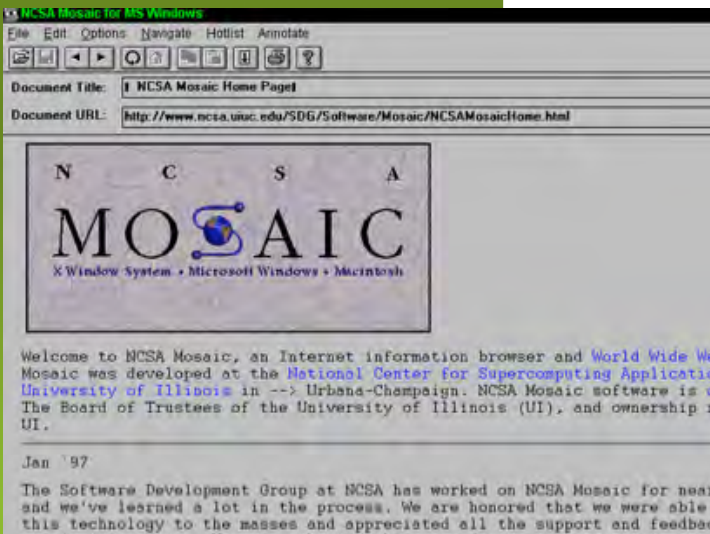
The Web Takes Off
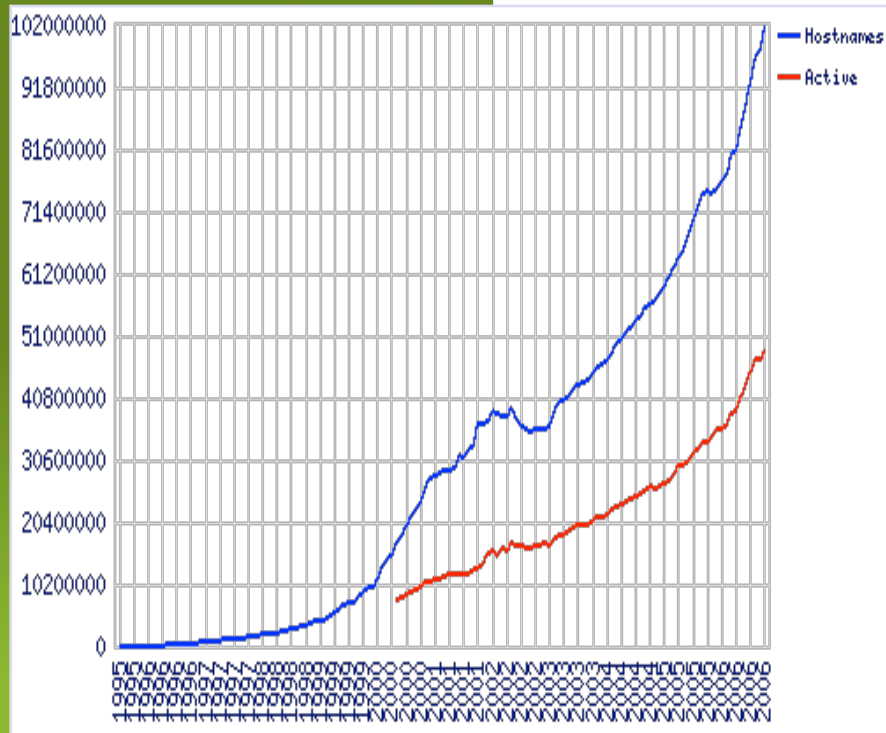
1994-2005: Internet use increases rapidly, driven by email, E-commerce, news & information, pornography & gambling. By 2005 there are an estimated 100m Web sites.

~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

Politics of ICANN

TOP STORIES IN OPINION

1 of 12
Coalition of the Disappointed

2 of 12
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

NR

Jay Nordlinger - Blown Out, Part II

The Editors - Ukraine and the Crisis of the West

Kevin D. Willia Case for a Little

MARCH 26, 2014 4:00 AM

Don't Globalize ICANN

By The Editors

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TECH

ICANN debate: Team Obama must reverse decision on Internet control

By Erik Telford · Published April 09, 2014 · FoxNews.com   f 162 🐦 59 g+ 7

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TECHNOLOGY   MARCH 24, 2014

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

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

BY LEE RAINIE | 💬 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

31

Politics of ICANN

THE WALL STREET JOURNAL. ☰ OPINION

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TECHNOLOGY MARCH 24, 2014

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

Jay Nordlinger - Blown Out, Part   The Editors - Ukraine and   Kevin D. Willia

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

What happe
U.S. hands o

BY LEE RAINIE   💬 6 COMMENTS

> 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*

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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

A screen shows a rolling feed of new

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

The Wired World
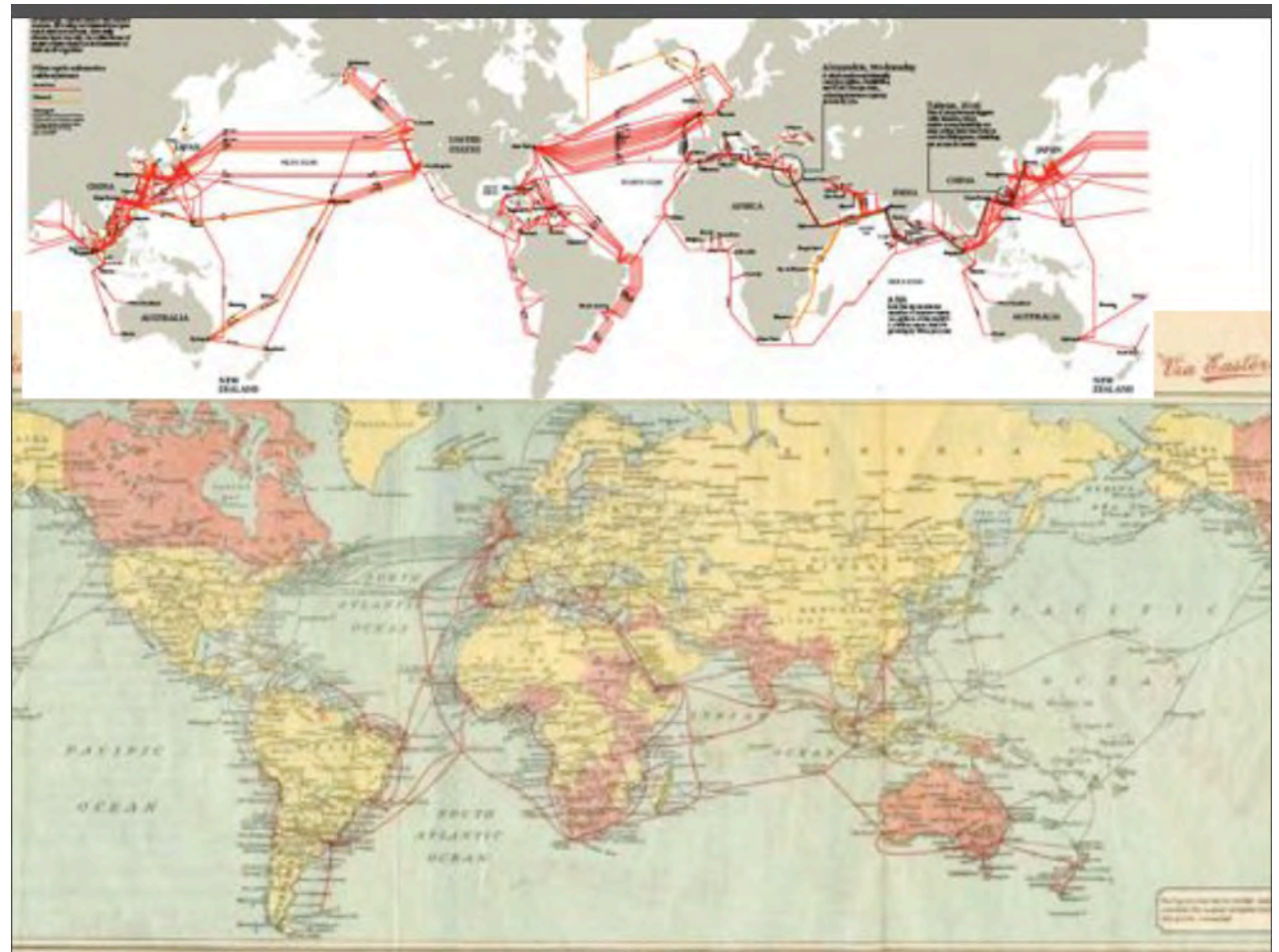
Disparaties

World Internet Penetration Rates
by Geographic Regions - 2012 Q2

Region	Penetration Rate
North America	78.6%
Oceania / Australia	67.6%
Europe	63.2%
Latin America / Caribbean	42.9%
Middle East	40.2%
World, Avg.	34.3%
Asia	27.5%
Africa	15.6%

Penetration Rate
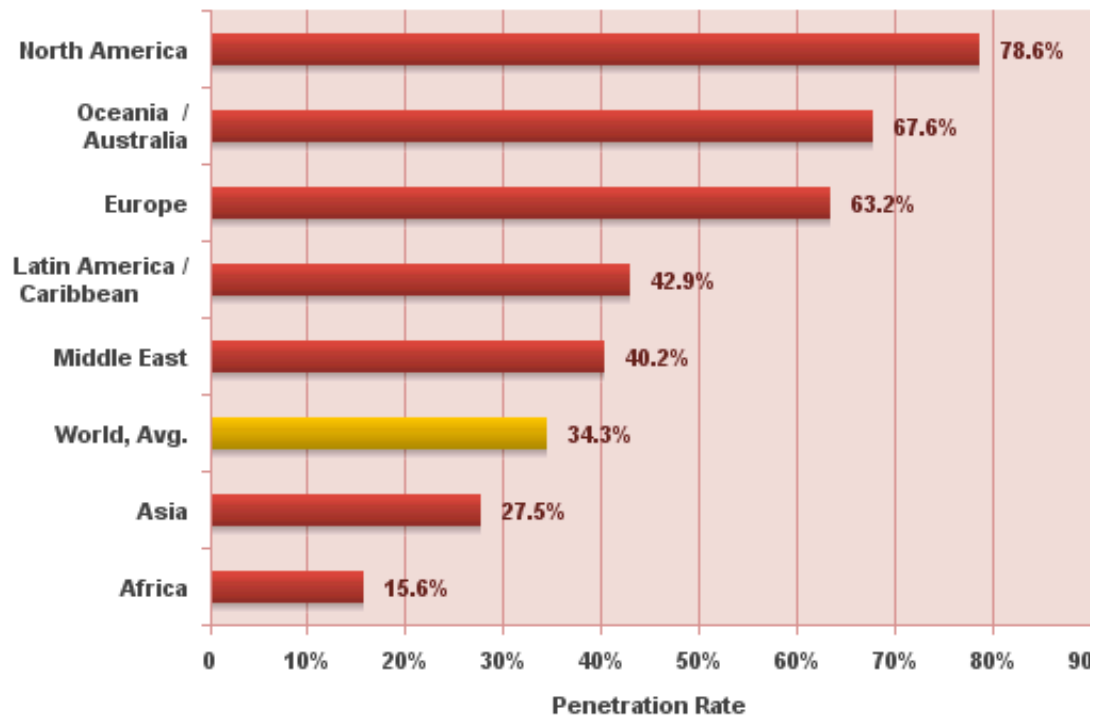
...but not so fast

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

Filed Under: Mobile

0 Comments
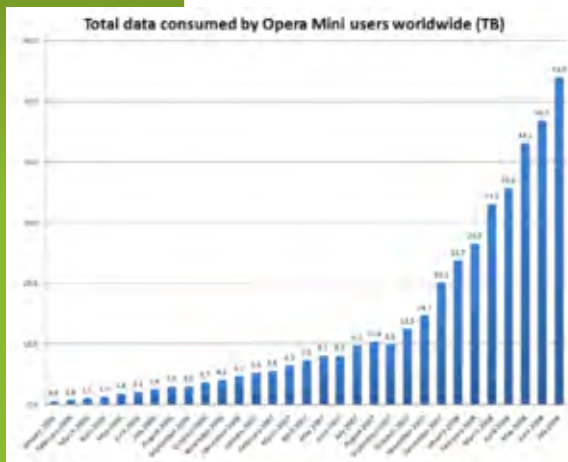
Chinese Internet Users - 2 Growth Scenarios

- Growth according to new definition
- Growth according to old definition

Total data consumed by Opera Mini users worldwide (TB)
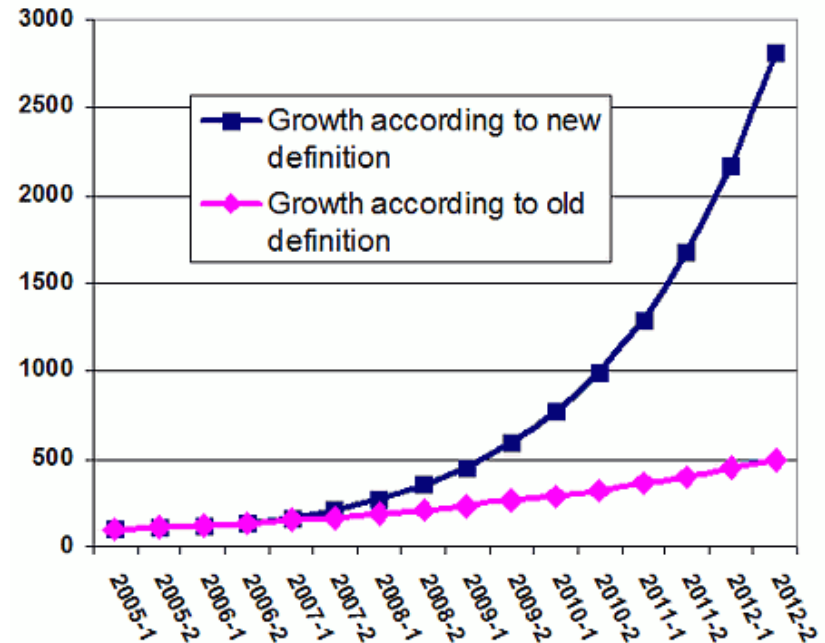
AMD: By 2015 half of world will have an Internet connection

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
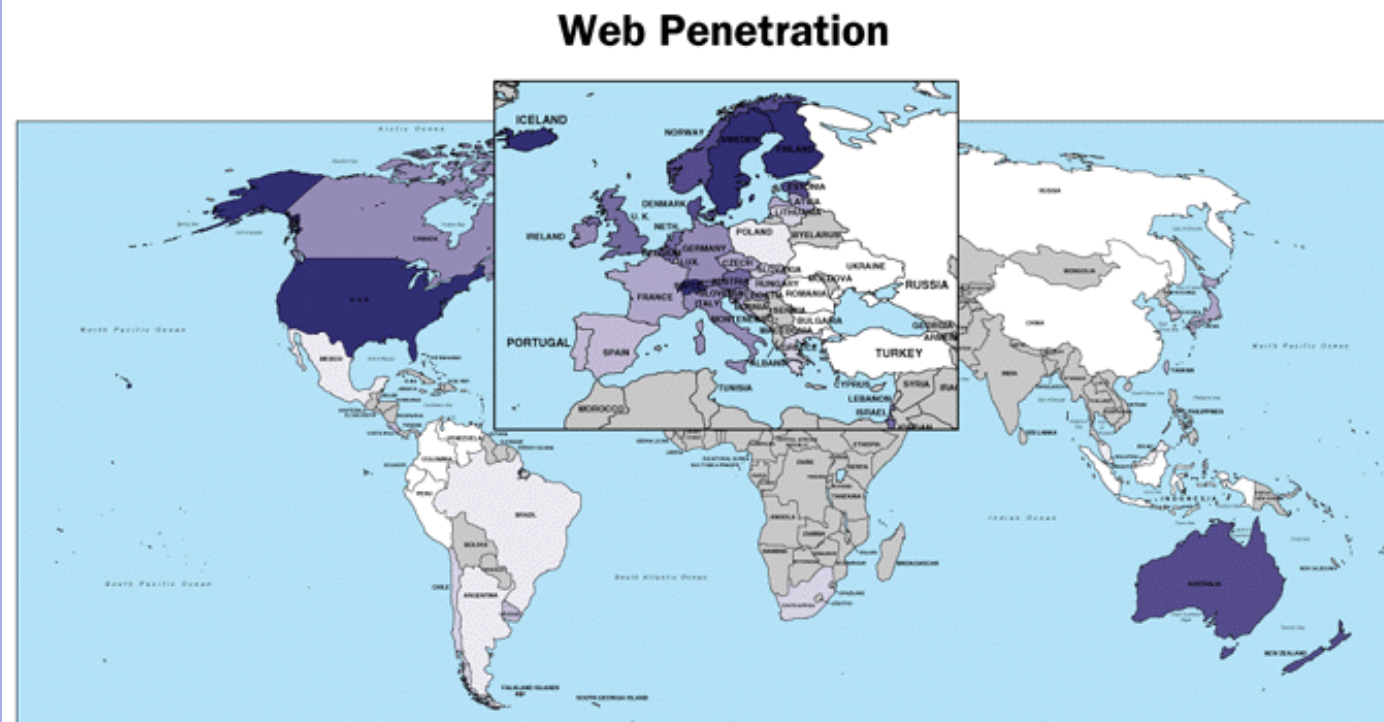
Fears of English Hegemony...

"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 Users by Language

Language	Users
English	565,004,126
Chinese	509,965,013
Spanish	164,968,742
Japanese	99,182,000
Portuguese	82,586,600
German	75,422,674
Arabic	65,365,400
French	59,779,525
Russian	59,700,000
Korean	39,440,000
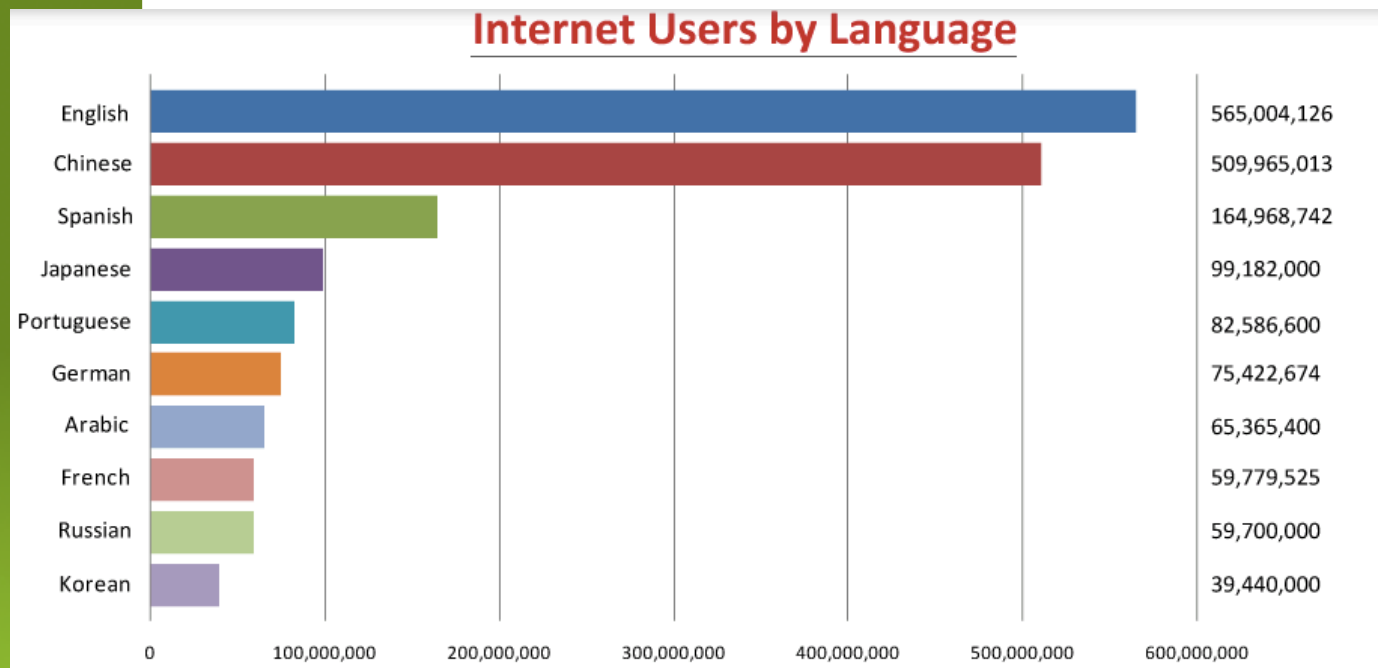
Internet Penetration Moves toward Equalization…

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

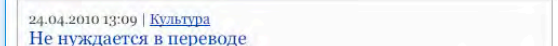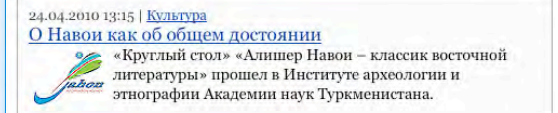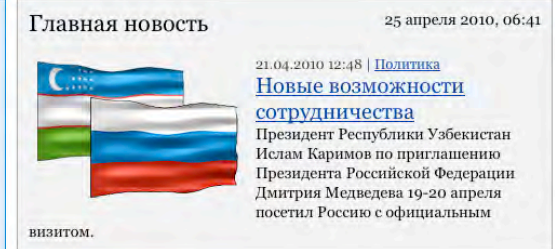| WORLD INTERNET USAGE AND POPULATION STATISTICS JUNE 30, 2014 - Mid-Year Update						
World Regions	**Population (2014 Est.)**	**Internet Users Dec. 31, 2000**	**Internet Users Latest Data**	**Penetration (% Population)**	**Growth 2000-2014**	**Users % of Table**
Africa	1,125,721,038	4,514,400	297,885,898	26.5 %	6,498.6 %	9.8 %
Asia	3,996,408,007	114,304,000	1,386,188,112	34.7 %	1,112.7 %	45.7 %
Europe	825,824,883	105,096,093	582,441,059	70.5 %	454.2 %	19.2 %
Middle East	231,588,580	3,284,800	111,809,510	48.3 %	3,303.8 %	3.7 %
North America	353,860,227	108,096,800	310,322,257	87.7 %	187.1 %	10.2 %
Latin America / Caribbean	612,279,181	18,068,919	320,312,562	52.3 %	1,672.7 %	10.5 %
Oceania / Australia	36,724,649	7,620,480	26,789,942	72.9 %	251.6 %	0.9 %
WORLD TOTAL	7,182,406,565	360,985,492	3,035,749,340	42.3 %	741.0 %	100.0 %

Space for Smaller Languages

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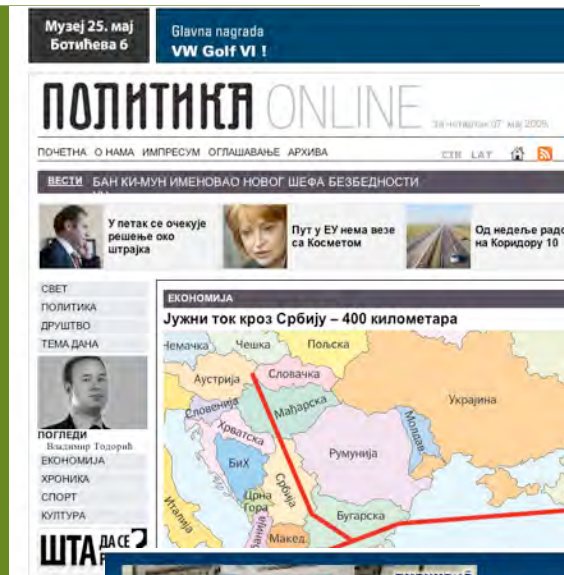
The growth of broadband

The growth of broadband

US population w/ broadband access:

2000: 3%

2010: 66%

Diffusion Rates for New Technologies

Figure 1: Percent of Households with Computers and Internet Connections, Selected Years, 1997-2009*

* Note: 2001, 2003, 2007, and 2009 Census-based weights and earlier years use 1990 Census-based weights.

http://www.ntia.doc.gov/reports/2010/NTIA_internet_use_report_Feb2010.pdf
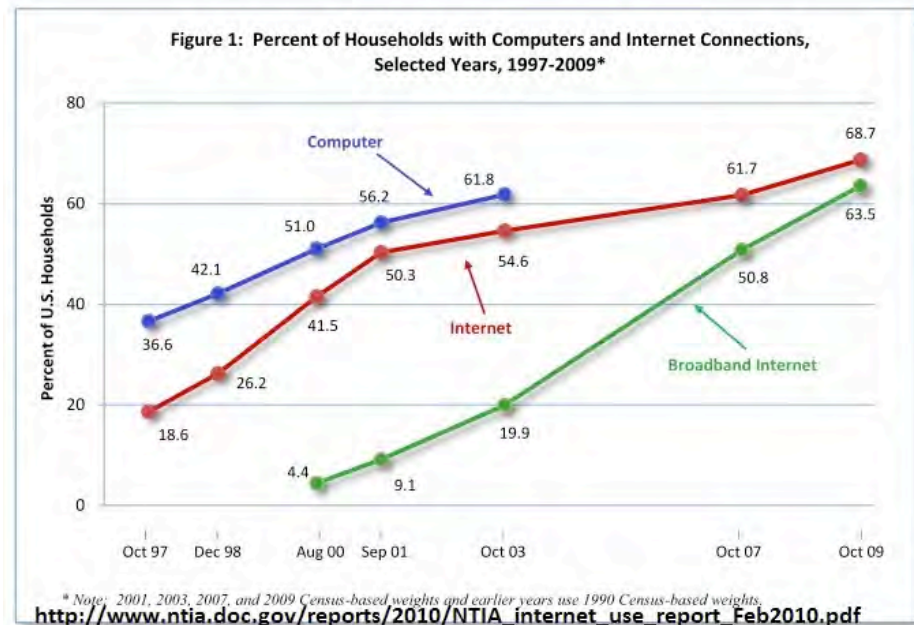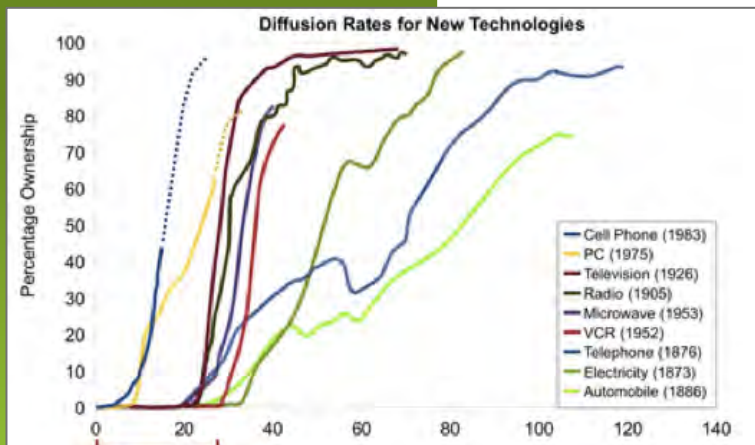
The growth of broadband

But US lags other developed nations…

	Country	Q1 '12 Avg. Mbps	QoQ Change	YoY 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%	18%
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%	9.7%
9	Belgium	7.1	13%	16%
10	Finland	6.9	16%	39%
…				
12	United States	6.7	17%	29%

Figure 7: Average Measured Connection Speed by Country

The growth of broadband

OECD broadband penetration and GDP per capita

Broadband penetration, December 2011

GDP per capita , USD PPP, 2011

Fixed broadband penetration (subscribers per 100 inhabitants, December 2011)

GDP per capita (USD PPP, 2011)

Simple correlation = 0.65

Source : OECD

US

47
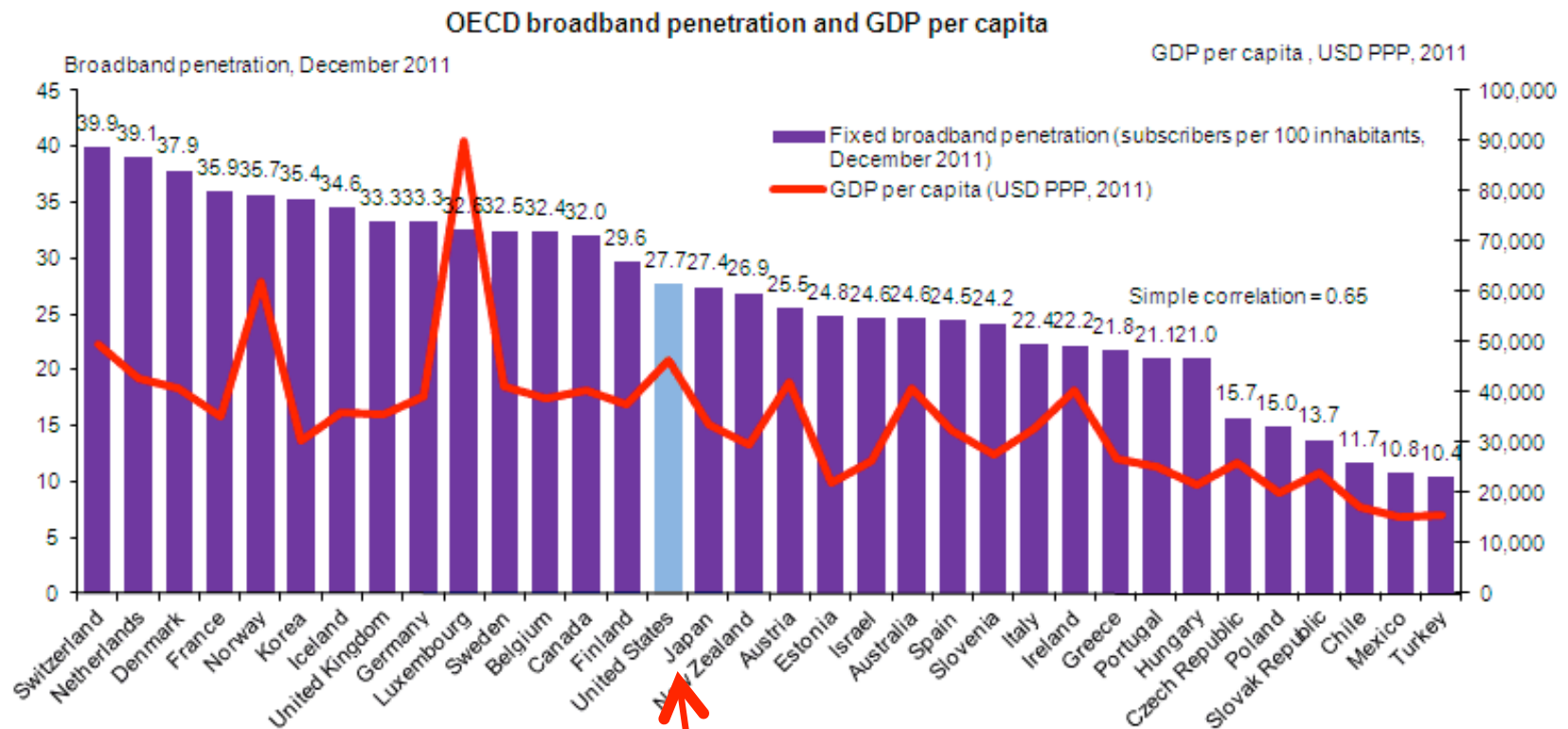
Slowing broadband growth

Rate of growth in broadband

OECD fixed (wired) broadband penetration (per 100 inhabitants), percentage increase, June-December 2011, by country
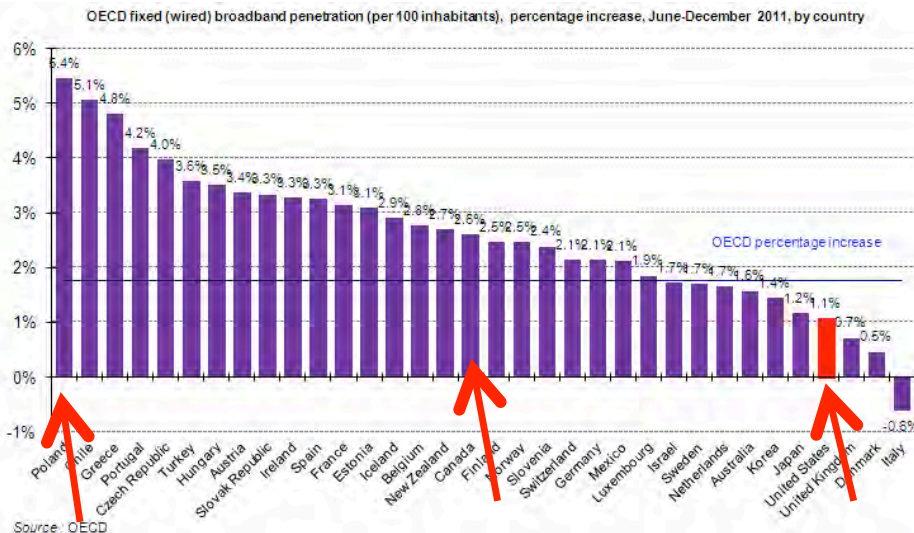
Poland   Canada   US

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

by Om Malik   AUG. 14, 2012 - 8:11 AM PDT
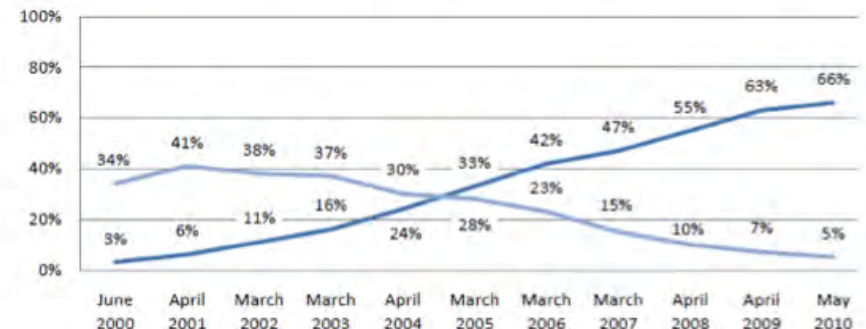
CNET › News › Internet & Media › Broadband growth slows in U.S.

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, 2000-1010

% 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

SUSAN CRAWFORD

Captive Audience

The Telecom Industry and Monopoly Power in the New Gilded Age

TIME

TECH POLICY
Is Broadband Internet Access a Public Utility?

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

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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.

SUSAN CRAWFORD

Captive Audience

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Courtesy of Yale University Press

Is broadband a public utility?

…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
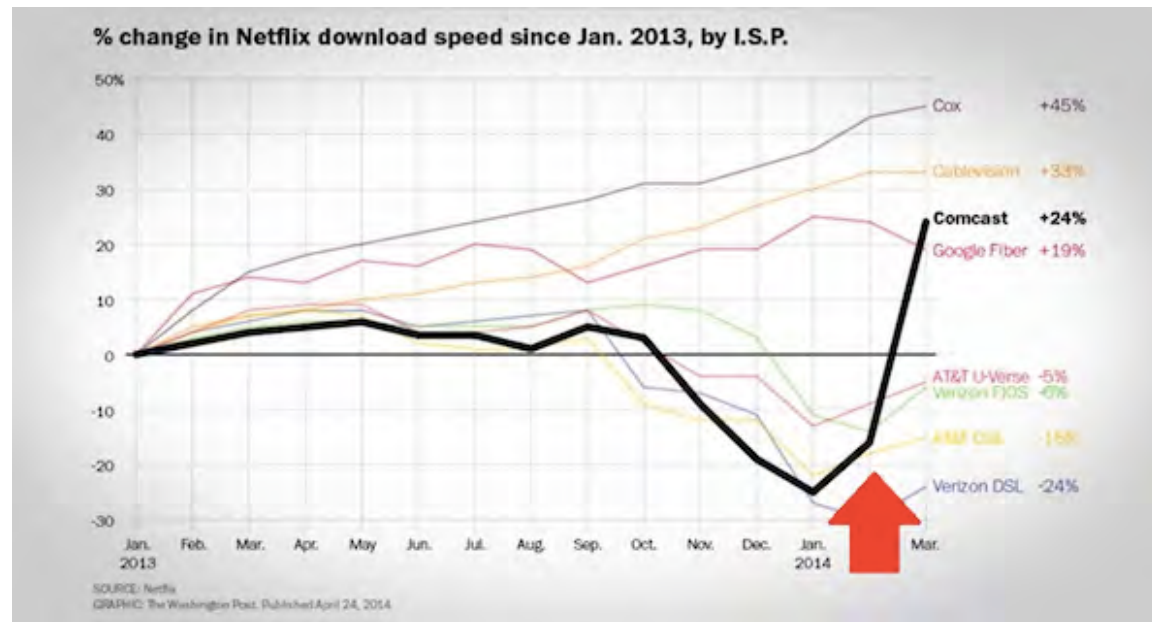
The Net Neutrality Kerfuffle

Fast lanes and slow?

% change in Netflix download speed since Jan. 2013, by I.S.P.

The Internet Fights Back

Obama statement

Court decision

Reports of coming FCC draft rules

FCC draft rules released

Internet slowdown day

White House & FCC respond

Oliver video

1st deadline for comments to FCC

Netflix blogpost

Stories
Tweets
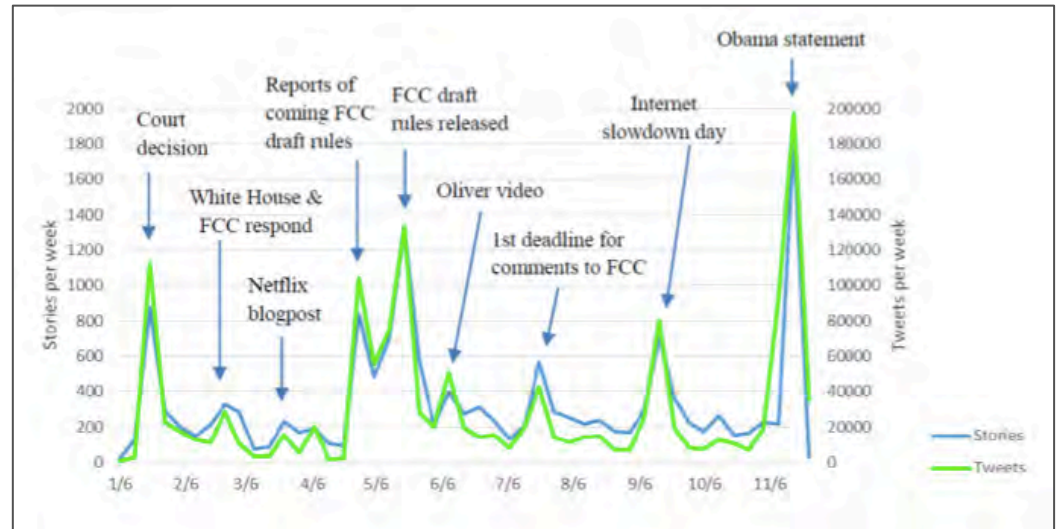
BATTLEFORTHENET   WHAT   INFOGRAPHIC   SITES   APPS   EVERYONE   WHY   LETTER

Fork me on GitHub

Sept. 10ᵗʰ is the Internet Slowdown

Cable companies want to slow down (and break!) your favorite sites, for profit. To fight back, let's cover the web with symbolic "loading" icons, to remind everyone what an Internet without net neutrality would look like, and drive record numbers of emails and calls to lawmakers.
Look what we just did together. Are you in?

Loading
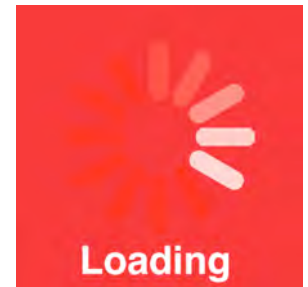
The battle joined

Carly Fiorina: Obama's net neutrality failure

By Carly Fiorina
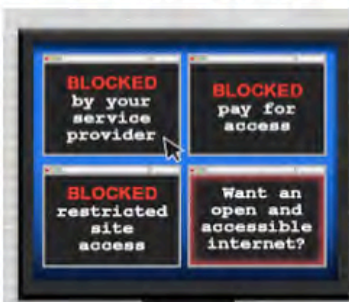Updated 8:45 AM ET, Tue April 7, 2015

Net neutrality proponents did a masterful job of marketing it with the help of late-night hosts and political spin, arguing that it would level the Internet playing field. The truth, however, is that it will insert Washington bureaucracy and control into the 21st century's greatest success story.

Net Neutrality
President Obama's Plan for a Free and Open Internet

The ACLU Answers the Key Questions

BLOCKED by your service provider
BLOCKED pay for access
BLOCKED restricted site access
Want an open and accessible internet?

Protect your right to access what you want and how you want it on the Internet

The Internet has become so much a part of the lives of most Americans that it is easy to imagine that it will always remain the free and open medium it is now. We'd like to believe it will remain a place where you can always access any lawful content you want, and where the folks delivering that content can't play favorites because they disagree with the message being delivered or want to charge more money for faster delivery.

But there are no such guarantees.

The FCC Rules

Open Internet

Maintaining a Fast, Fair, and Open Internet.

An Open Internet means consumers can go where they want, when they want. This principle is often referred to as Net Neutrality. It means innovators can develop products

Readings for April 14

Auletta, Ken. 2010. "Publish or Perish." *The New Yorker,* April 26.

Hughes, Evan. 2013. "Book Publishers Scramble to Rewrite Their Future. *Wired*, March 19.

Carr, Nicholas, 2014. "The ebook equilibrium," Rough Type blog post, June 6.

Additional:

Carr, Nicholas. 2013. "The flattening of ebook sales." Rough Type blog post, Aug. 5

Darnton, Robert. 2009. "Google and the Future of Books," *The New York Review of Books*, Feb. 12, 2009. (See also letters in response.)

Required Reading

Jones, Feminista. 2013. "Is Twitter the underground railroad of activism?" *Salon*. July 17.

Kaba, Mariame and Smith, Andrea. 2014. "Interlopers on social media: feminism, women of color and oppression," *Truth Out*. February 1.

Lenzo, Brian. 2013. "Will the revolution be tweeted?" ISR. July 17. Read: From "Facebook revolution or Wall Street hype?" to the end.

Loza, Susana. 2014. "Hashtag Feminism, #SolidarityIsForWhiteWomen, and the Other #FemFuture," *Ada: A Journal of Gender, New Media, and Technology*. July 21.

McKenzie, Mia. 2014. "On Ferguson Protests, the Destruction of Things, and What Violence Really Is (And Isn't)," Black Girl Dangerous. November 26.

> Reflect back on your responses and class discussion around "Black Lives Matter" demonstrations and how media portrayals of "riots" and "violence" are racialized

Readings for April 16, 2

Additional readings:

Watch "Asmaa Mahfouz & the YouTube Video that Helped Spark the Egyptian Uprising," February 8, 2011.

Read: StudentNation (various students). 2015. "From Selma to Madison, a Generation Demands Justice," March 16.

Assignment for April 16

The readings from Jones, Kaba and Smith, and Loza focus on social media technology as a powerful social change resource for marginalized groups (whether based on race, gender, sexuality, ability, citizenship, and/or class). Whilst readings from McKenzie and Lenzo suggest that social media technology uses the same racialized portrayals ("Ferguson protesters are violent rioters") and over-simplified narratives ("Facebook=revolution") as mainstream media. Referencing both perspectives, use specific examples to show whose argument is more convincing. What implications might these arguments have for social issues that you care about?