

INTERNET TECHNOLOGY, ECONOMICS AND POLICY

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<http://www.cs.columbia.edu/~hgs/teaching/itep/>

Fall 2017

CLASS OVERVIEW

Big questions

- How does the Internet work, technically?
- How come your Internet bill is so high (or low)?
- What's hard about extending the Internet to rural areas?
- Is the Internet local, national or international?
- What does it mean for the Internet to be “open” or “neutral”?
- Do Google and Facebook differ from Comcast and AT&T?
Should any of them be able to ban offensive speech on their platform?
- How can we make the Internet useful for public safety & people with disabilities?
- Why do carriers pay billions of dollars for spectrum?
- What makes “cyber security” hard?

What's on the syllabus?

- Technology
 - Overview of Internet technology (how does the Internet work)
 - Protocol and architecture standardization (IETF, 3GPP, OMA, ...)
 - Wireless communications
 - From AM radio to cellular
 - Spectrum: properties, allocation and co-existence
- Economics
 - Review of basic principles of micro-economics
 - The economics of networks
 - building networks, natural monopolies, ...
- Law & policy
 - How does the law work?
 - A bit of communication history
 - The role of communication policy and regulation
 - Telecom Act, FCC overview
 - Common carriage, public utilities, significant market power and other regulatory frameworks

What's on the syllabus?

- Network neutrality and the Open Internet
- Peering, transit and traffic exchange
- Names, numbers and addresses
- *Internet security challenges*
 - Basic principles of network security
 - “Cybersecurity”
 - Unwanted communication
 - Privacy and surveillance
- *Communication for all*
 - Enabling technologies for people with disabilities (relay services, accessibility, CVAA, ...)
- Internet governance
 - ICANN, ITU and other actors

What should you be able to do after taking the class?

- Elevator pitch
 - “What is spectrum and why is it hard to find” – in 2 minutes
- In-depth survey
 - “The economics of Internet adoption in rural and urban areas”
- Research
 - Know sources and approaches
 - engineering models vs. economic models vs. legal analysis
 - Appreciate need to consider
 - technical feasibility
 - economic factors
 - policy enablers and constraints

Materials

- No formal text book, but draws from
 - “Telecommunications Law & Policy” (S. Benjamin, Shelanski, Speta, Weiser), 2012.
 - “The Master Switch” (T. Wu).
 - “Computer Networking: A Top-Down Approach” (J. Kurose, K. Ross), 6th edition, Addison-Wesley, 2013.
- Other materials:
 - Technical papers (IEEE, ACM, tech reports, ...)
 - Law review articles (*Federal Communications Law Journal*)
 - SSRN
 - White papers
 - Industry analysis reports (analysts, OECD, Census, ...)
 - Regulatory filings (FCC, Ofcom, BEREC, ...)
 - Laws & regulations (US, mostly)

How to benefit from this class

- Be prepared (e.g., read assigned materials)
- Expand your mental horizon beyond your discipline
- Understand positions you may not “like”
- Participate in class discussion
- Pick an interesting project
 - “big data”
 - apps & software for public-good applications
 - system modeling

How not to benefit

- Catch up on Facebook
- Cat videos!
- Transcribe the class into your notebook
- Flip through the slides
- Voice only popular opinions
 - or opinions you read in the NY Times, WSJ or Breitbart
- Believe that the instructor is always right
 - on facts or interpretation

Mechanics

- Homework assignments
 - may allow options to accommodate different backgrounds
- Semester (group) paper
 - start early – may need to be defined & refined by iteration
 - outcome: research paper
 - may be review, quantitative analysis or experiment (not just software)
- Pop quizzes, occasionally
- Guest (video) lectures
 - colleagues from Washington, DC
- Possibly, field trip

Semester project

- Pick topic and team by 9/15
 - including goals and tools
 - responsibilities (who will do what)
 - observable milestones (every two weeks) create project page
 - submit via CourseWorks
- Bi-weekly progress reports for each team
- End-of-semester presentation
- Report suitable as technical report, i.e.,
 - proper citations (IEEE format, etc.)
 - useful abstract
 - standard paper conventions, including format and style
 - not just a bunch of bullet points or graphs

Semester project



See ITEP
project page

- Student chosen, with guidance
 - encourage cross-disciplinary teams
 - teams of 1-3 students
- Data analysis
 - *Measuring Broadband America, ATLAS*
 - other data sources (FCC, Ofcom, OECD, ITU)
 - own data gathering
- Measurements
 - Open Internet measurements
 - 911 services: (indoor) location accuracy, non-traditional emergency coordination (Harvey)
 - Services for people with disabilities: closed captioning; speech-to-text
 - Spectrum measurements
- Analysis
 - Network economics (e.g., spectrum usage, pricing or universal service)

Field trip?

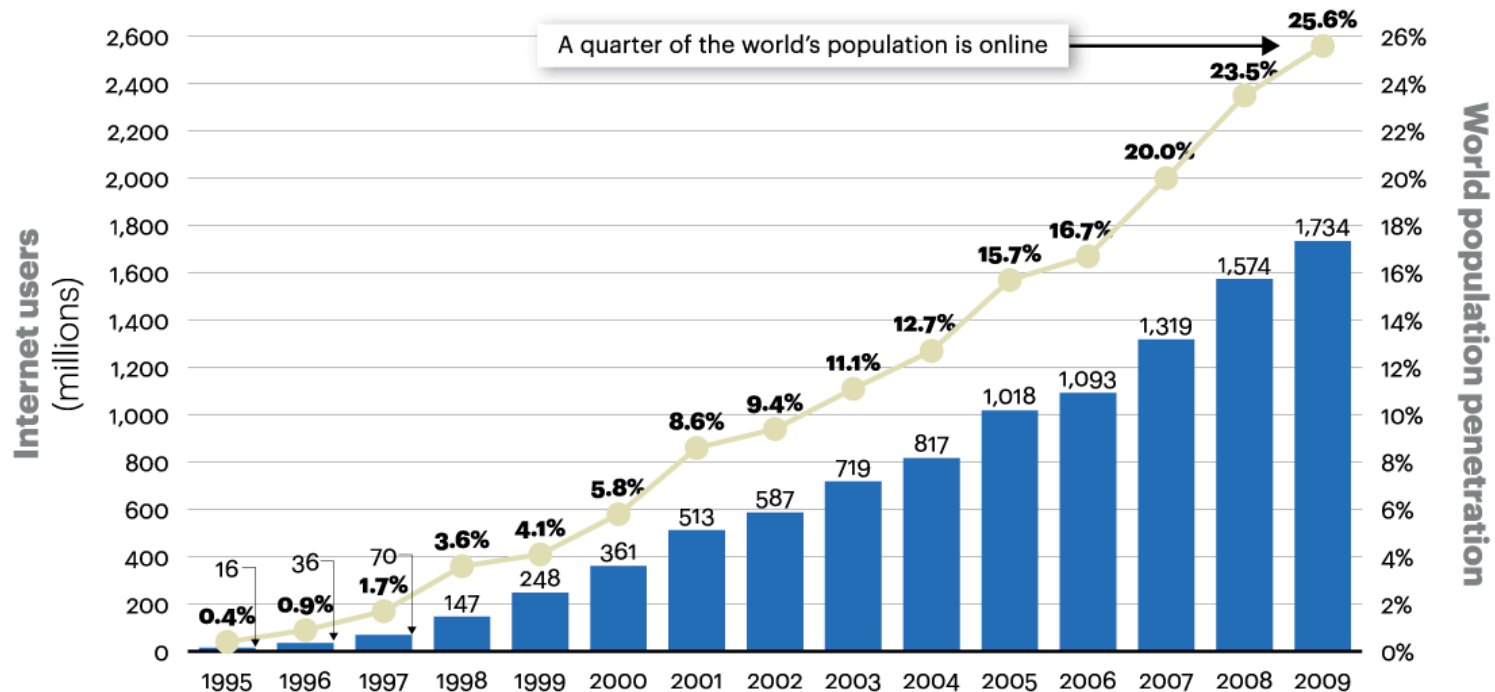
- Possible field trip to Washington, DC
 - FCC
 - NTIA
- Interest & logistics

PEOPLE & MONEY

Internet growth – classical view (1995-2009)

Figure 1

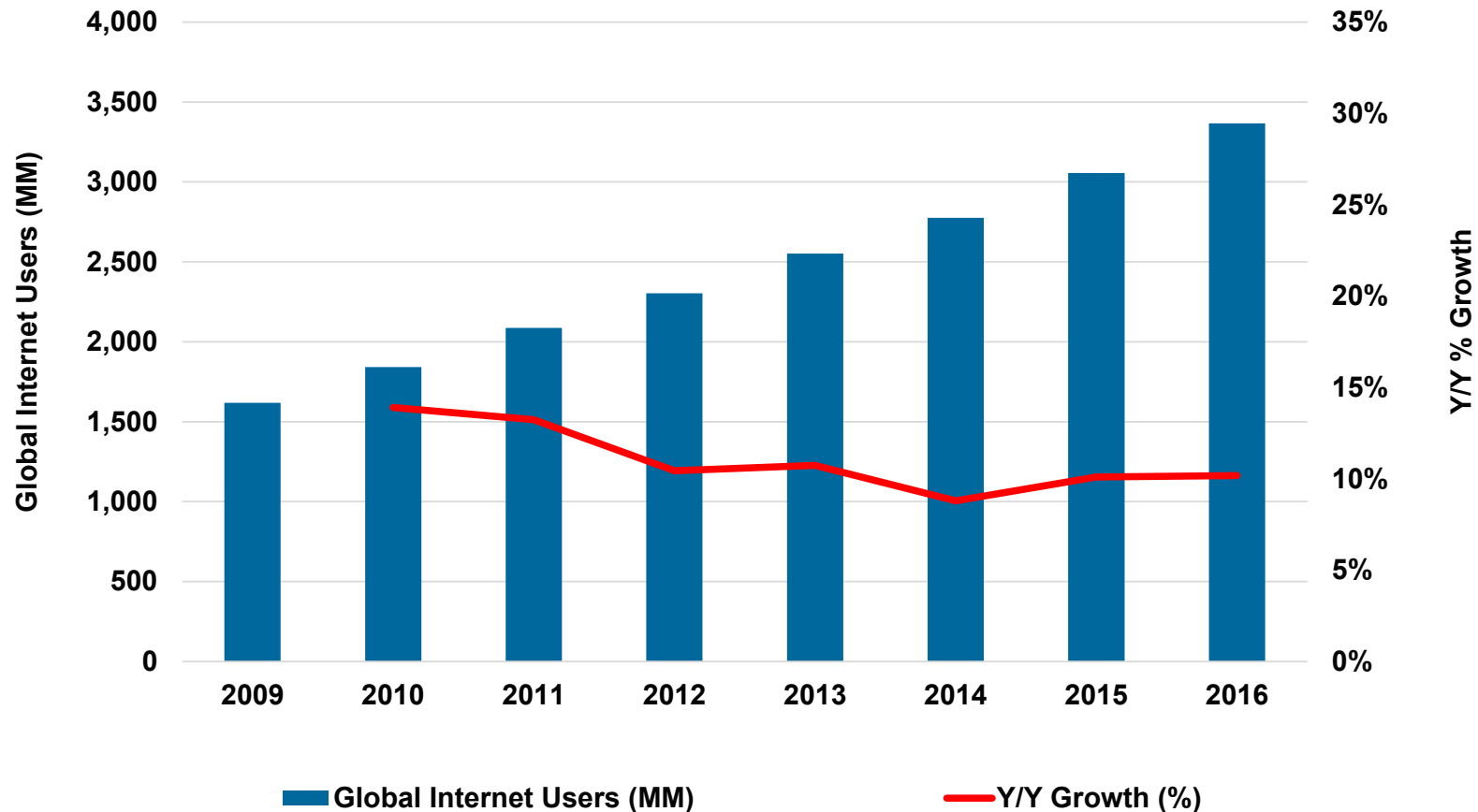
Global Internet users and penetration rate (1995-2009)



Sources: Nielsen, ITU; A.T. Kearney analysis

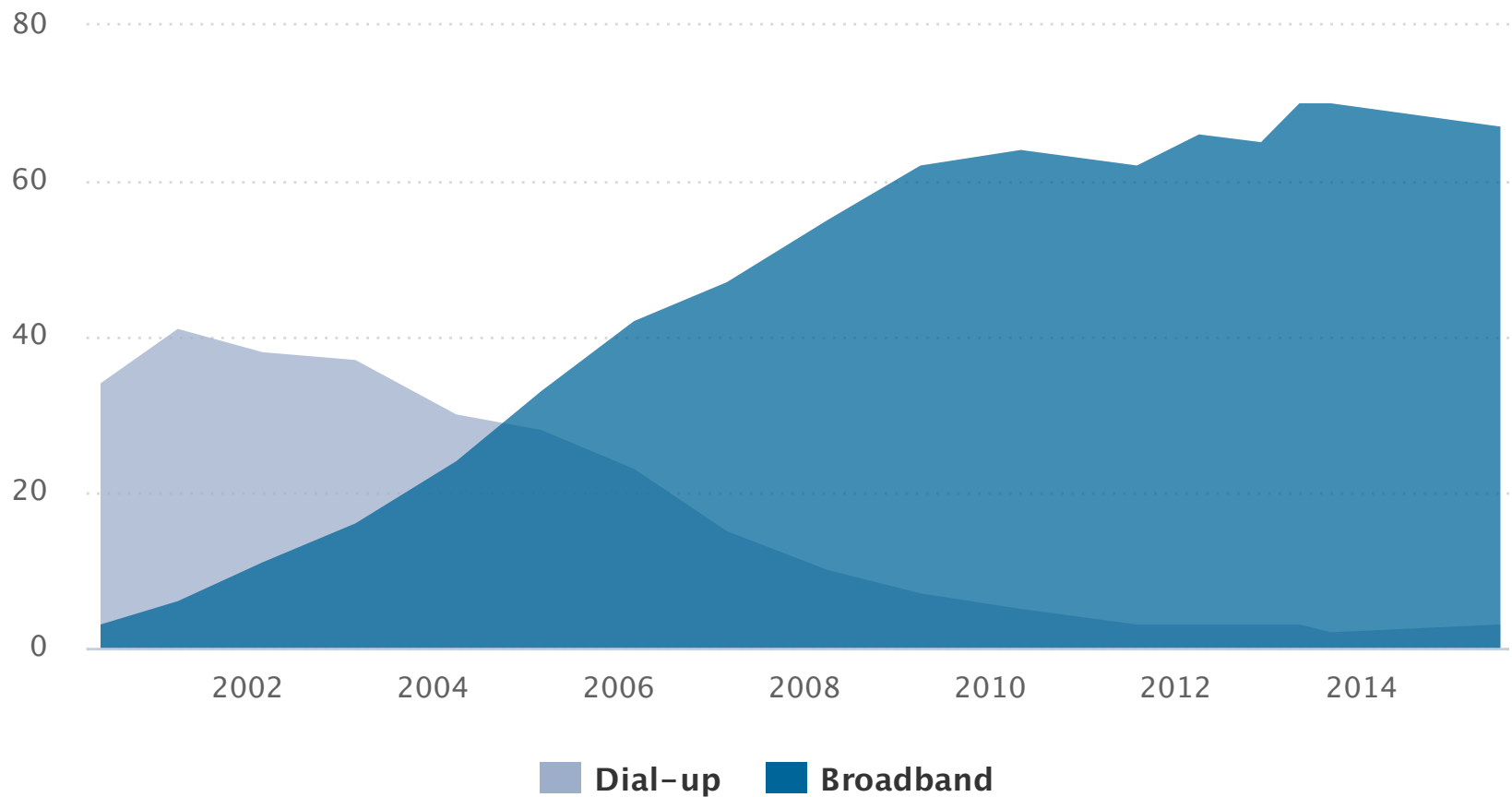
Internet growth – 2009–2016

Global Internet Users (MM), 2009 – 2016



US Internet access

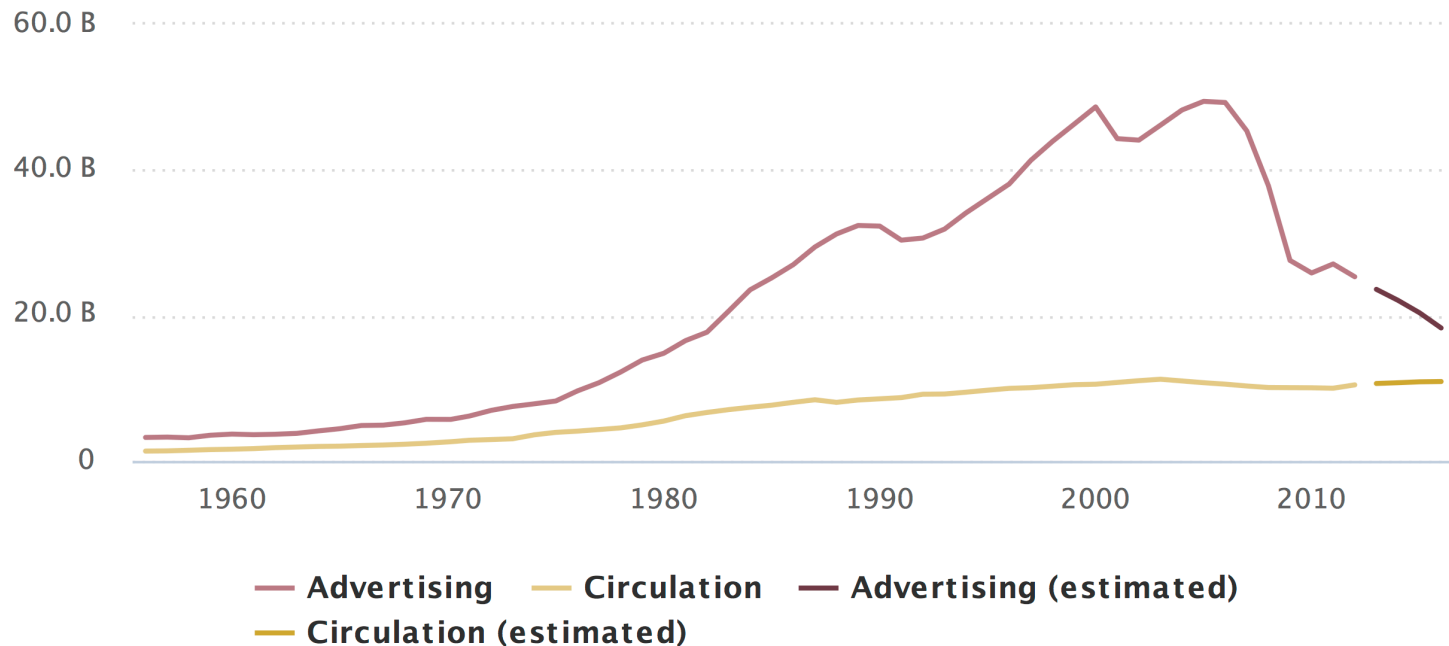
% of adults who have internet access at home



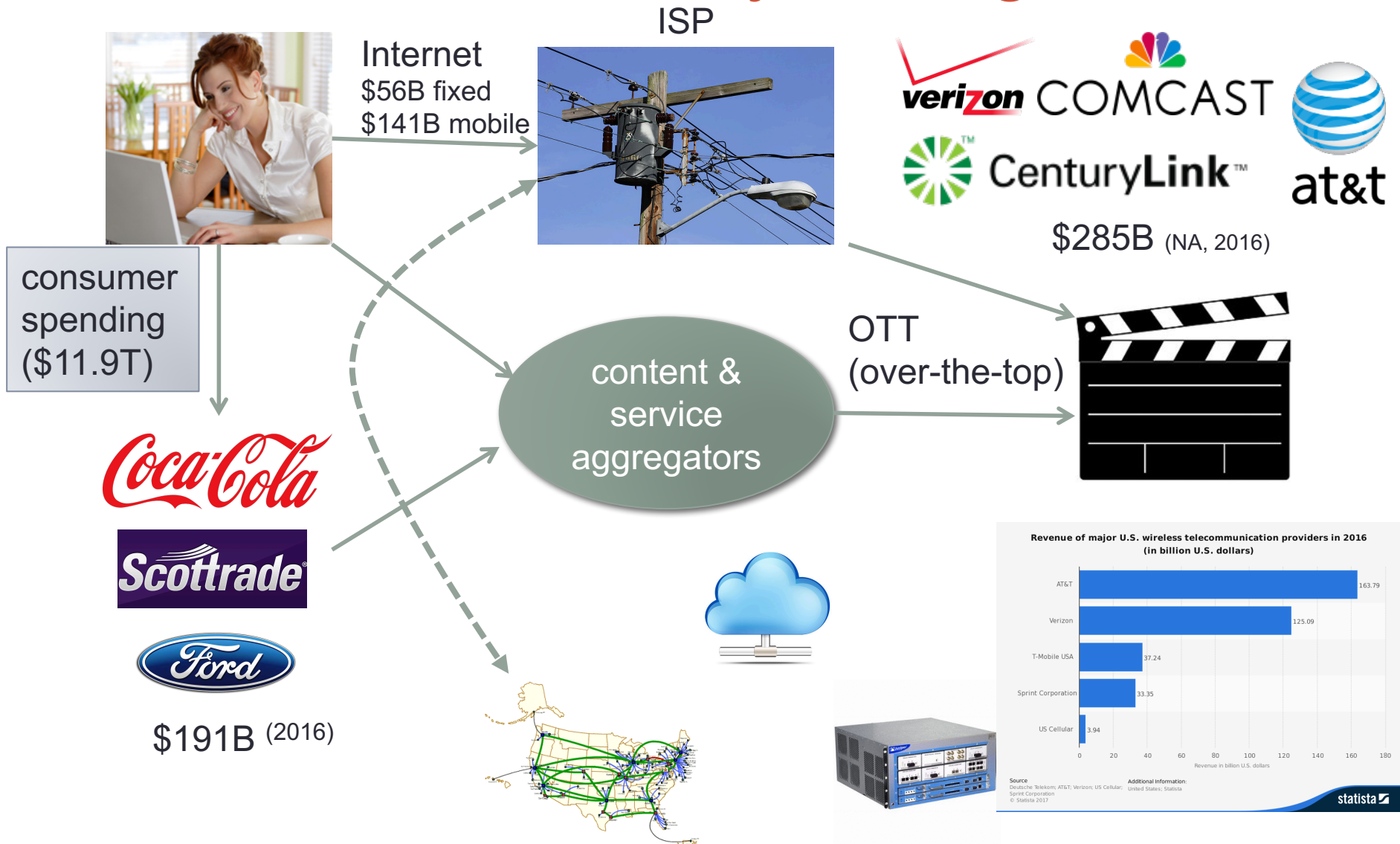
But not all are happy about this...

Newspaper industry estimated advertising and circulation revenue

Total revenue for U.S. newspapers (in U.S. dollars)



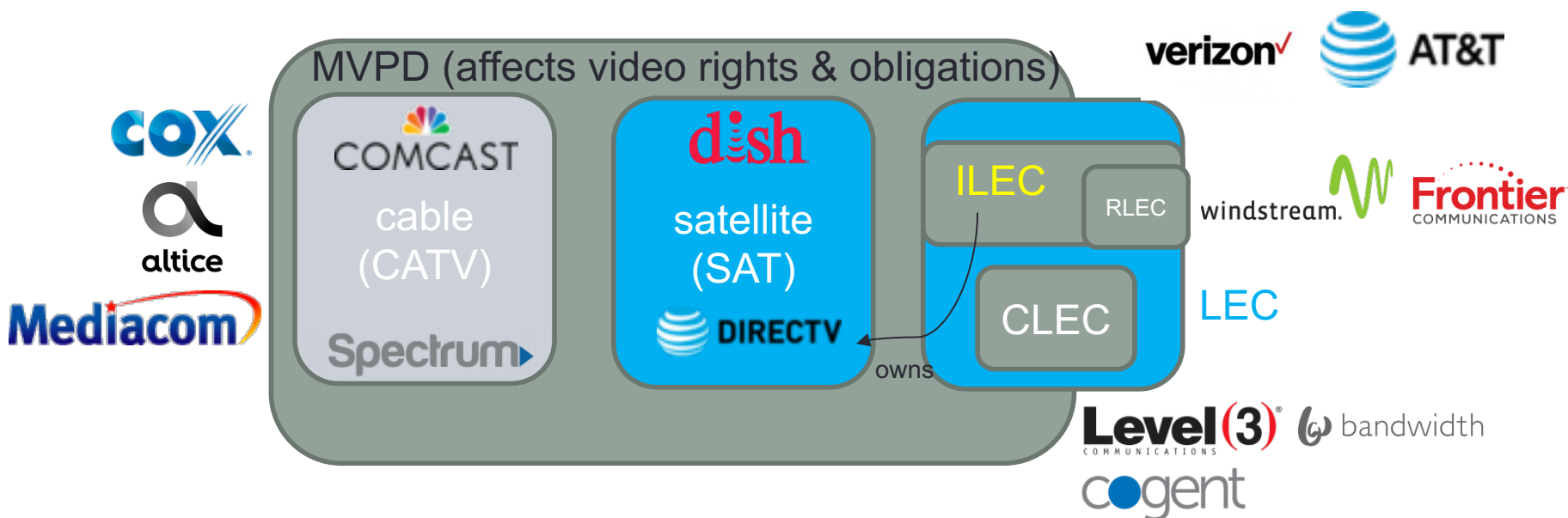
Basic Internet money routing



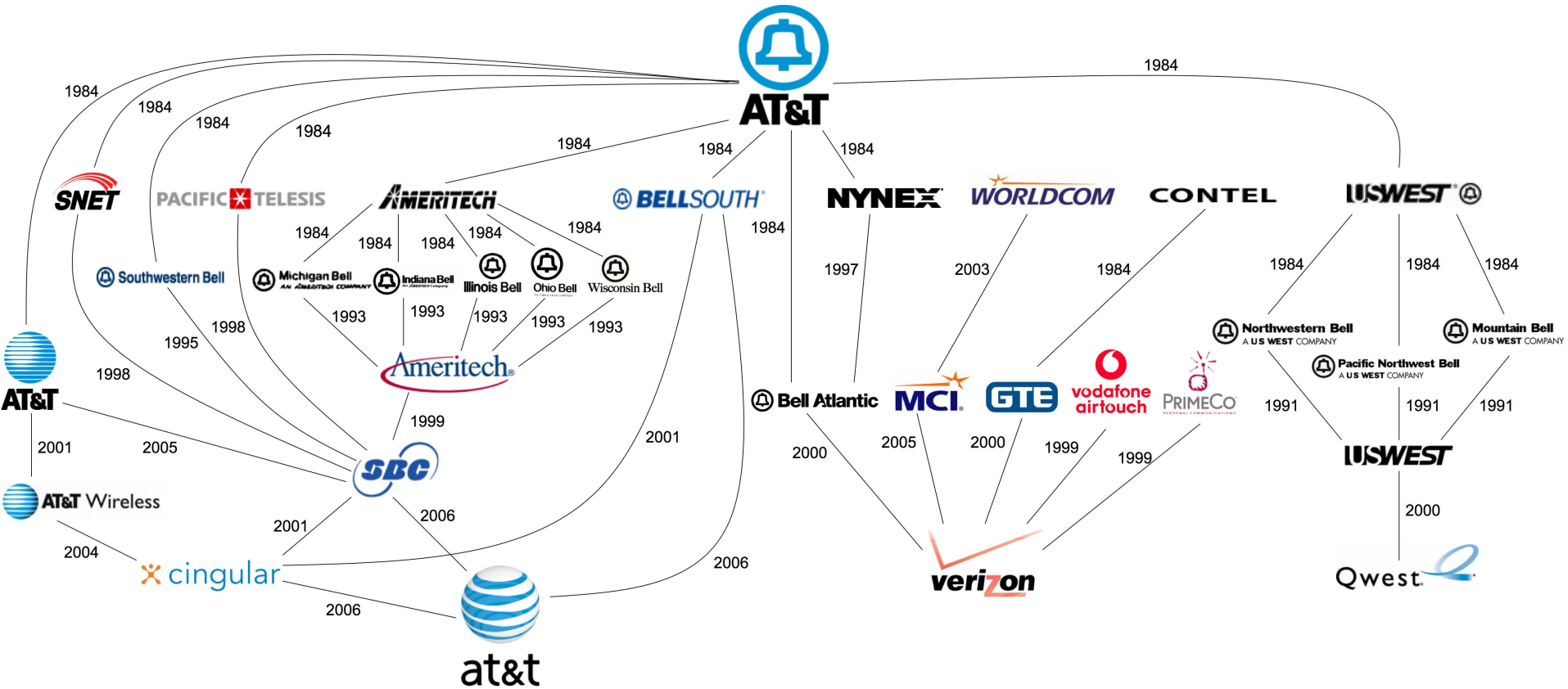
Internet service providers (by age)

- "phone companies"
 - 1880s
 - (incumbent) Local Exchange Carrier (LEC) & Rural LEC
 - large ILECs: AT&T, Verizon
 - large RLECs ("independents"): CenturyLink, Frontier, Windstream
 - thousands of small RLECs
- "cable companies"
 - 1960s
 - all are MVPDs, but phone companies can also be MVPDs
 - Comcast, Charter, Cox, Altice, Mediacom
- "cellular providers"
 - 1980s
 - AT&T, Verizon, T-Mobile, Sprint
- Internet backbone & "dark fiber"
 - 1990s
 - Level3, Cogent, Zayo

The industry is complicated

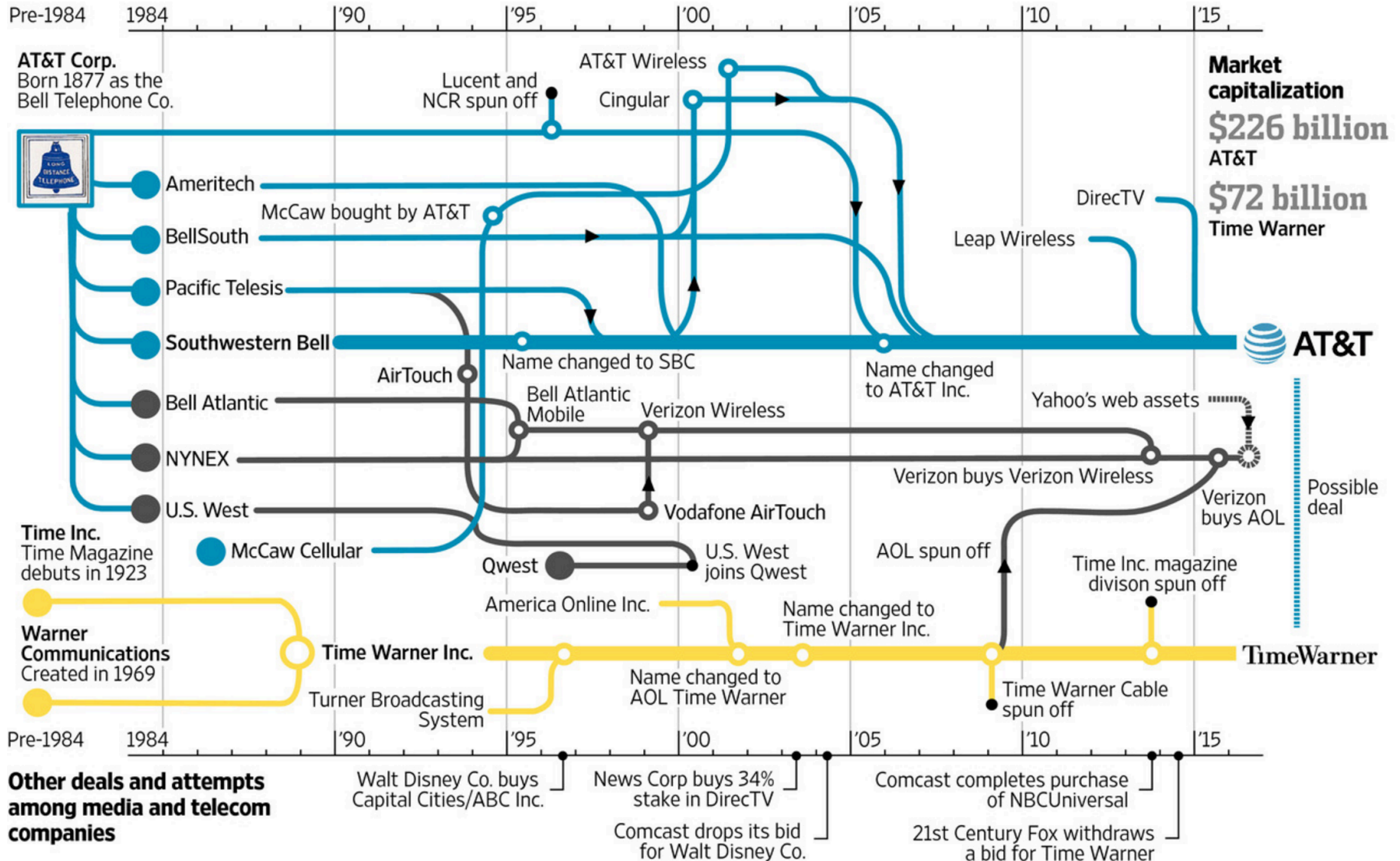


- all entities can serve as a *Broadband Internet Access Service* (BIAS), commonly known as *ISP*
- almost all "TV" distributors are MVPDs, but not all MVPDs are ISPs (e.g., satellite)
- AT&T, as an ILEC, owns a satellite MVPD (DirecTV)
- Same company can be ILEC in one state & CLEC in another (rare)



Converging Destinies

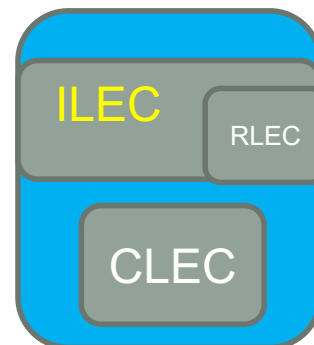
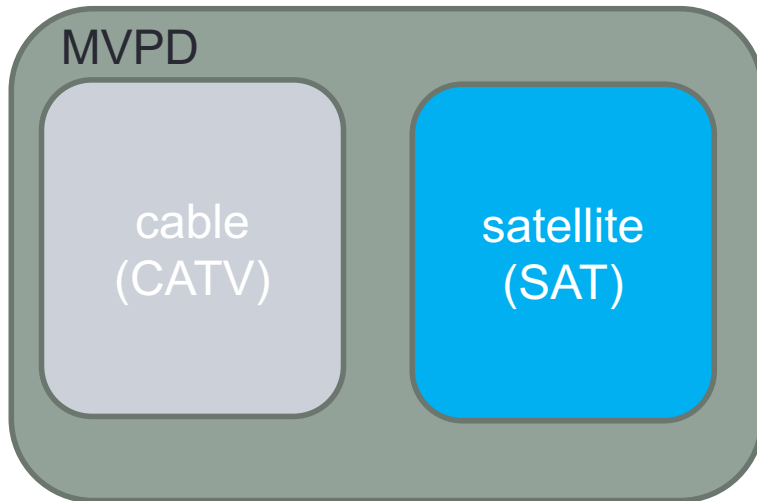
AT&T and Time Warner have reached an agreement to merge after decades of consolidation and deals in the telecommunication and media industries.



Source: staff and news reports

THE WALL STREET JOURNAL.

It used to be simple (ca. 1990)



LEC



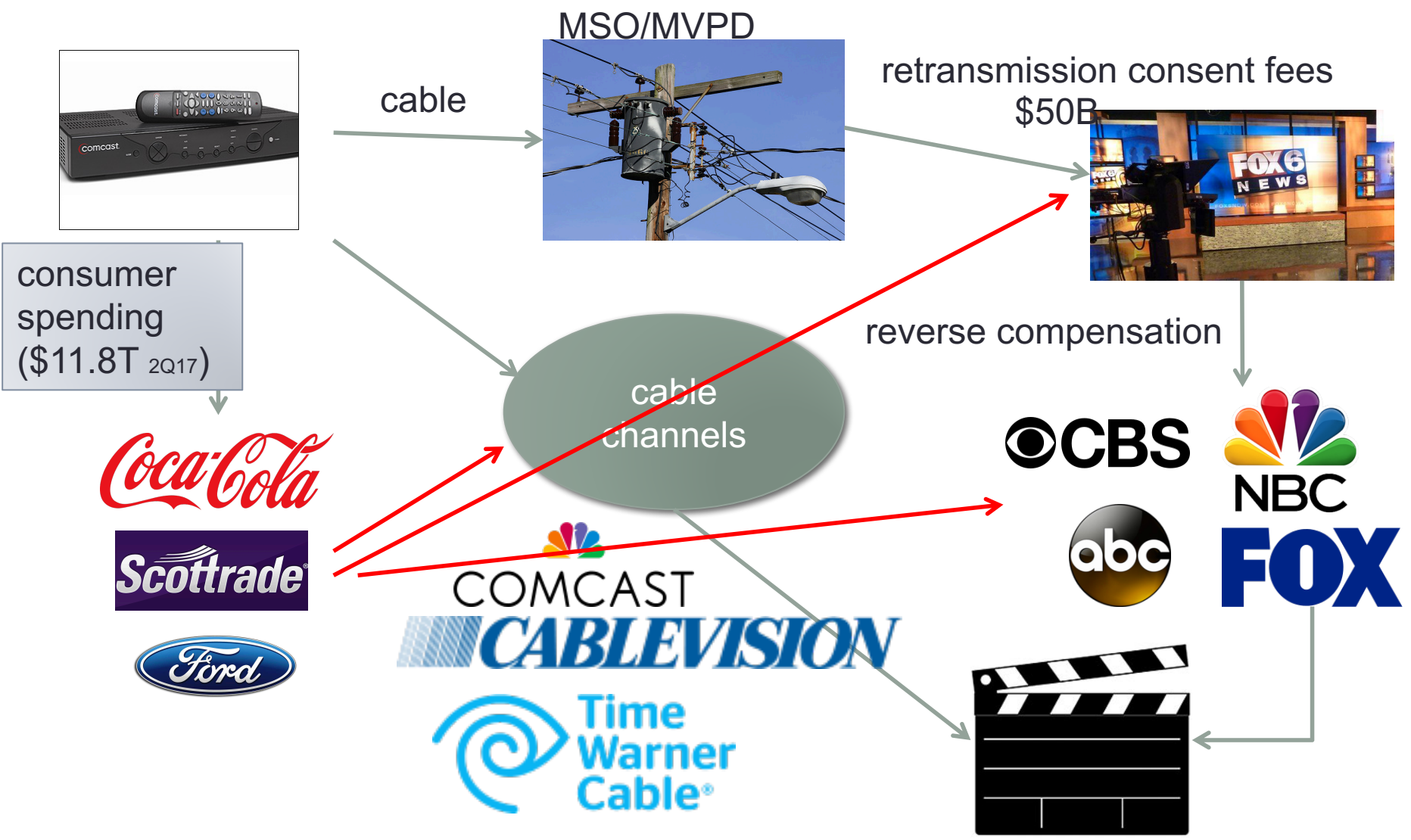
OTT, VOD, SVOD, ...

- OTT = delivery of services (interactive voice, entertainment video) over the Internet without subscribing to traditional cable or telephone service
 - Video: Netflix, Hulu, HBO Go, YouTube, Vimeo, Go90
 - Voice: Skype, Vonage, FaceTime, ...
- OVD = online video distribution (linear, scheduled [not VOD])
- SVOD = streaming/subscription video on demand
- AVOD = ad-supported video-on-demand
- TVOD = transactional; “pay TV”
- MVPD = multi-channel video programming distributor
 - typically, linear = “live TV” → can be cable (all cable systems are MVPDs), satellite (also) or fiber!
- TV Everywhere = cable service over IP (same bundle)

OTT, SVOD, ...

Service	Linear vs. on-demand	bundle or individual	payment	example
OVD	both	any	any	
MVPD	linear (may offer VOD)	bundles	monthly	cable TV, satellite
TV Everywhere	linear	subset of TV bundle	monthly	Comcast, TWC
SVOD	on demand	bundle	monthly	Netflix, HBO Go, Hulu Plus
TVOD		movie	movie	Amazon Instant Video
AVOD		short form content, movie	ad-supported	YouTube, Vimeo, Hulu

Basic video money routing

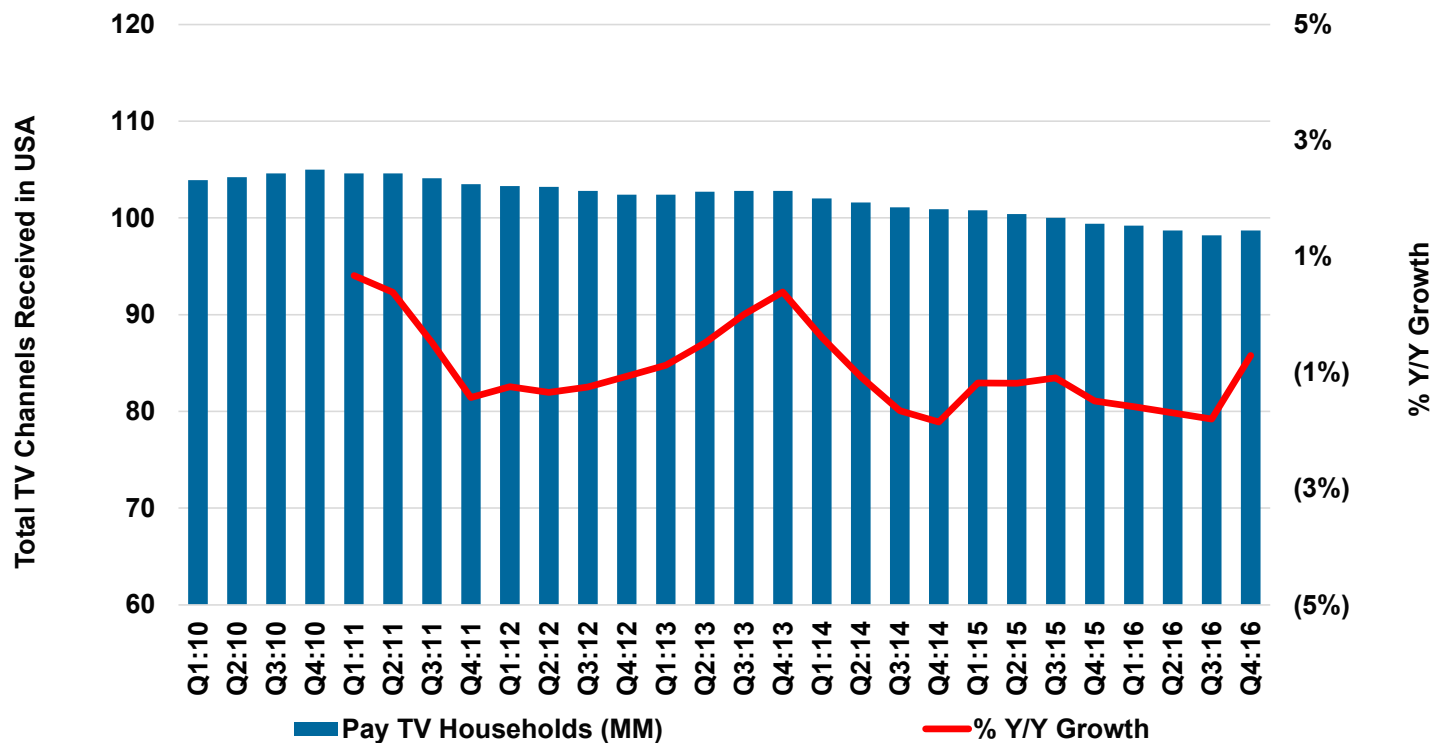


More industry revenues

Company or sector	US domestic revenue, 2016
Netflix (US)	\$5.1B
Cisco (Americas)	\$28.4B
US subscription TV (cable, SAT)	\$101.8B
US film (box office)	\$9.9B
US music (incl. concerts)	\$15.5B
US games (software & ads)	\$17.6B
US wireless telecom (services)	\$188.5B
Google (worldwide)	\$89.5B (56% international)

Cable TV subscriptions

Pay TV Households (MM), USA, 2010-2016



Source: Nielsen Total Audience / Cross Platform Reports, US Census Bureau, St. Louis Federal Reserve FRED Database
 Note: Pay TV households represented by Nielsen "Cable Plus" metric, which includes households who receive television via Wired Cable (No Telco), Telco, or Satellite. "Programming Costs" includes total program and production costs for Cable and Other Subscription Programming firms, 2006-2015, as per US Census Services Annual Survey for Employer Firms (\$25B in 2015, up from \$12B in 2006).

News revenue

- 2016: \$29B for 1,331 US dailies
 - 62% (\$18B) from advertising
 - ¼ (\$11B) digital & print circulation
 - rest: events, commercial printing, e-commerce, ...
- 12 cable news channels, 3 broadcast networks news, 800 news-producing local TV stations
 - \$16.4B revenue
 - total of about 2,192 TV stations
 - 3 news networks: \$691M average
- Non-commercial sector: \$1.9B
 - includes 1,000 local public radio stations
 - 393 public TV stations (PBS)

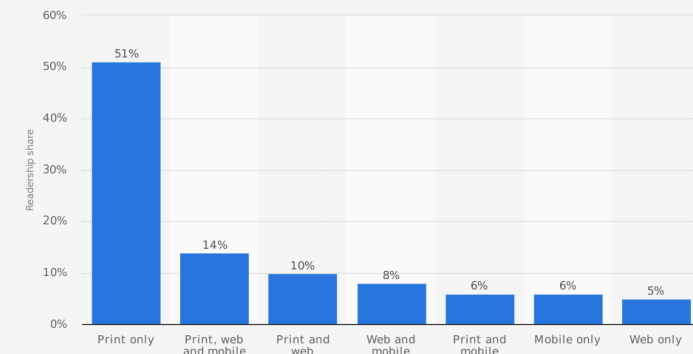
Revenue Estimates for Selected Digital News Properties

Annual revenue estimates for select digital news outlets, in millions

Outlet	Annual revenue	Year	Source
Huffington Post Media Group	\$100	2013	Citigroup Research
The Blaze	\$35-\$45	2012	Fortune
BuzzFeed	\$60	2013	BuzzFeed
Drudge Report	\$15-\$20	2012	Business Insider
Gawker	\$15-\$20	2010	The New Yorker

PEW RESEARCH CENTER

Distribution of newspaper media audience in the United States in January 2017, by platform



Source
Nielsen; MarketingCharts
© Statista 2017

Additional information:
United States; Nielsen; came Sunday any newspaper, came daily any newspaper, came Saturday any newspaper, any newspaper website past 30 days, used mobile devices to read news

2015-2020 U.S. Advertising

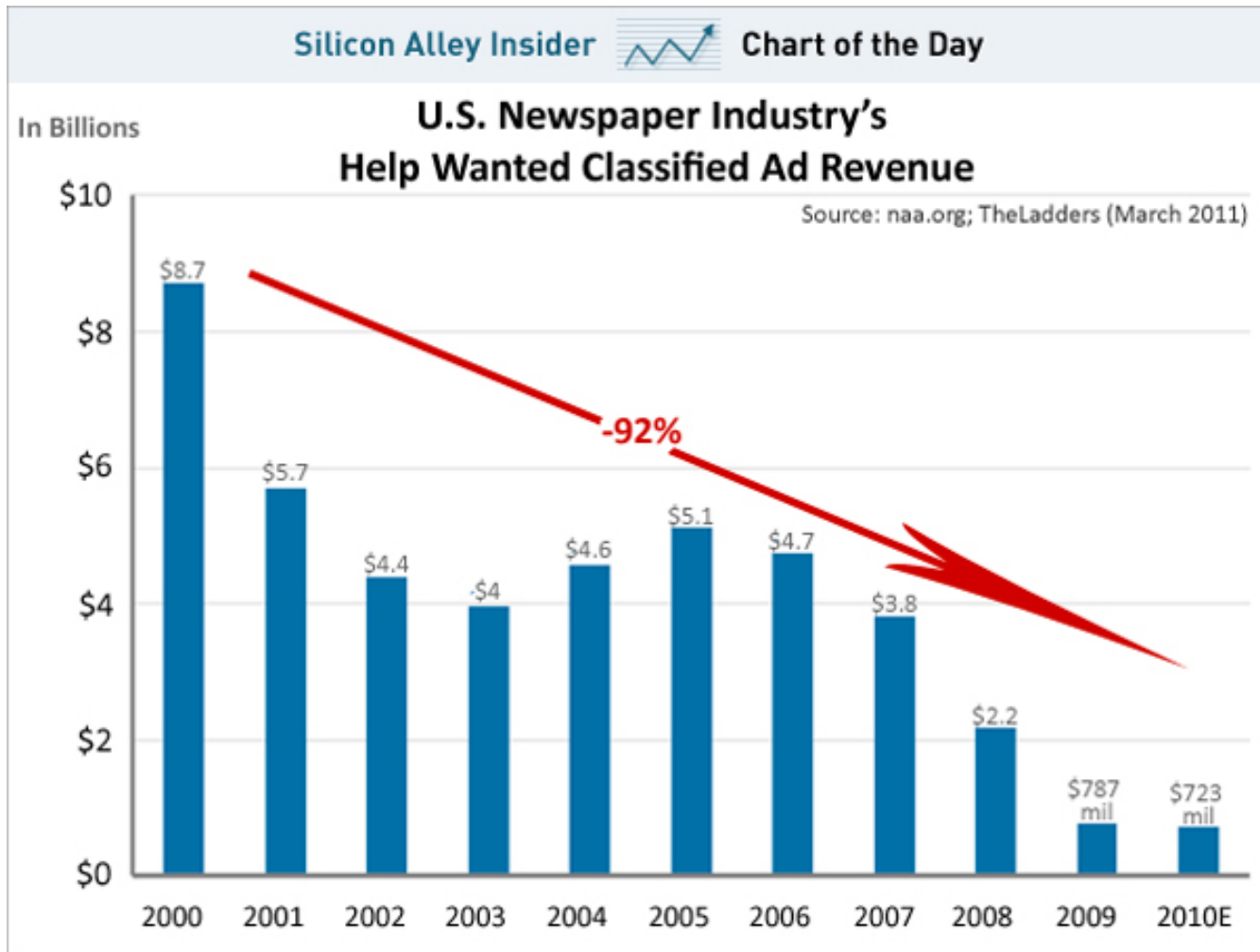
Exhibit 15)

U.S. Advertising Revenue by Media Forecast

Revenue by Media	2015	2016E	2017E	2018E	2019E	2020E	CAGR 2015-20	Contrib. 2015-20
TV	\$70.6	\$73.9	\$69.9	\$70.8	\$67.1	\$68.6	-1%	-4%
Internet	\$59.6	\$71.7	\$84.2	\$97.0	\$110.2	\$124.0	16%	130%
Radio	\$16.5	\$16.1	\$15.7	\$15.3	\$14.9	\$14.5	-3%	-4%
New spapers	\$13.2	\$11.7	\$10.2	\$8.8	\$7.4	\$6.1	-14%	-14%
Magazines	\$10.1	\$9.4	\$8.8	\$8.1	\$7.3	\$6.6	-8%	-7%
Outdoor	\$6.3	\$6.2	\$6.1	\$6.0	\$5.9	\$5.8	-2%	-1%
Total	\$176.3	\$189.0	\$194.9	\$206.0	\$212.9	\$225.7	5%	100%
Revenue by Media YoY growth	2015	2016	2017	2018	2019	2020		
TV		4.6%	-5.3%	1.2%	-5.2%	2.3%		
Internet		20.3%	17.4%	15.2%	13.6%	12.5%		
Radio		-2.4%	-2.5%	-2.6%	-2.7%	-2.8%		
New spapers		-11.4%	-12.5%	-13.9%	-15.6%	-17.8%		
Magazines		-6.6%	-7.2%	-8.0%	-8.9%	-10.0%		
Outdoor		-1.1%	-1.3%	-1.5%	-1.8%	-2.0%		
Total		7.2%	3.1%	5.7%	3.4%	6.0%		

Source: Company reports, MoffettNathanson estimates and analysis

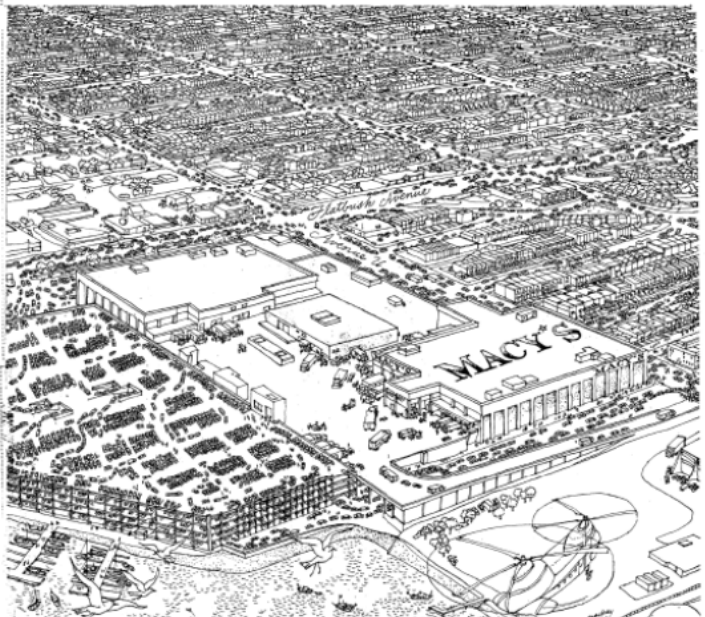
Newspaper advertising



Twenty years ago classifieds provided more than a third of the revenue of *The Washington Post*. Craigslist has destroyed that business for the *Post* and every major paper in the country. (Brookings, 2014)

NY Times, 09/10/1970

Where but **The newest store of the World's Largest Store. Macy's new in Brooklyn's Kings Plaza in Brooklyn. And what a store! Four floors of first the things that make Macy's unmistakably Macy's. From enclosed the excitement of fashion to the satisfaction of real value. shopping From the familiarity of famous names to the every- There's mall! day thrift of Macy's-Own-Brands. Plus everything more else you expect, even the unexpected abundance of in it services. Share it tomorrow at Macy's Kings Plaza. for you.**



Macy's Kings Plaza opens tomorrow

COME TO THE OPENING OF MACY'S KINGS PLAZA, FLATBUSH AVENUE AND AVENUE U IN BROOKLYN'S FIRST ENCLOSED MALL. OPEN EVERY DAY FROM 10 TO 9:30. EVEN SATURDAYS. BRING YOUR CAR...YOU'VE NEVER SEEN SO MUCH FREE PARKING

THE NEW YORK TIMES, THURSDAY, SEPTEMBER 10, 1970

distinctive and exclusive OUR OWN MAKE SHIRTS FOR WOMEN

(Coll.) *Plaid-spread glass collar shirt made by one of Brooks Brothers' (Dress polyester-cotton) fabrics. In pink, blue, and white, double cuffs, \$13*

(Cotton) *New over made shirt of English cotton. Reminiscent of English-pique shirt collars. In bold or fine of yellow-wood-rose or blue, or yellow-and-brown or copper, \$13*

(Cotton) *Over-the-shoulder simple cotton and find shirt with button-down collar. In white, \$9.50; green-and-blue, pink, and white, green, pink, blue or red, \$10*

Additional in store 10 to 16. See stores. Mail order below.

Brooks Brothers CLOTHING

Mens & Boys Furnishings, Gifts & Shoes

1230 Broadway, New York, N.Y. 10020

CHILEAN RIGHTIST WON'T TAKE OFFICE

His Opponent Aims to Bar Morales From Presidency

By Associated Press Staff

SAO PAULO, Chile, Sept. 9.—(AP)—Chilean rightist Augusto Pinochet, the military commander who has ousted Salvador Allende, the president-elect, will not take office as president of Chile, according to a spokesman here today.

The spokesman, unnamed today, said an off-camera meeting of the military junta on Sept. 9 decided to support the candidacy of General Augusto Pinochet, who is the brother of the late president's brother-in-law.

General Pinochet, 53, was elected president in a landslide victory over Allende in a referendum on Oct. 17, 1970. He was sworn in as president on Sept. 10.

General Pinochet is the only candidate to have been named by the military junta. He is the brother of the late president's brother-in-law.

General Pinochet is the only candidate to have been named by the military junta. He is the brother of the late president's brother-in-law.

ATTAINS WHITE HOUSE President Kenneth D. Keating of Florida today took steps to the official record will with a victory rate in South Africa and Rhodesia, as President's opening words of confidence of world-wide nations.

At the left is President Tito of Yugoslavia. Tomorrow's program will include a public policy to the United States and Great Britain in the Middle East. Delegates from about 60 nations are attending the meeting in London, England.

NEW Nine-day Cruises to San Juan and St. Thomas

MIS EUROPA

FROM NEW YORK

Jan. 5, 14, 23; Feb. 2, 13, 22; Mar. 3, 13, 22

FROM \$238.00

NORTH GERMAN LLOYD

Phone 212-241-2000

1800 Broadway, New York, N.Y. 10019

GO WEST, YOUNG MA'AM!

Here's the all-ethnic Bloomer styled skirt to go with jeans and d... sported in contrasting colors white shirt with navy striking, navy, brown or rust skirt, all with white edging. Of cotton and polyester, by Amy Posen, shown at on 24, 31, 38, 44, 50, 56, 62 and phone, Young World, 2nd Floor and all stores.

Bloomerfields

Bloomerfields, Lexington, MA, N.Y., 10027-25, 8100

Kolmer-Marcus

Because they can't be seen you need the "K-M"

"The K-M Touch" Does More For You!

Young Freeman Customized Clothes

It's in the clothes. It's in the fitting. "The K-M Touch." Makes you look better, feel more comfortable. And come on man, isn't it time you started enjoying it?

Phone at 212/478-2100. There is a 2-M's Clothing Store (Males Only) 1000 2 hours free parking at any garage. Make dates when you shop.

Rogers Peet

CAMPUS FRONT RUNNER

by Palm Beach

Our new Fall fashions have an air of excitement about them. Make the fashion choice, white, light, blue, red, green, orange, and navy. Double breasted all wool blazer in easy or loose fit, regular, short, long, and extra long.

DIAL A STEAK

A timely experience in dining... INN OF THE CLOCK

Most time the rage for a top steaks, only at a few tables, and \$1.50 a steak. There's the best steak in the South East. We'll make a platter with red and black potatoes, french fries, and a free salad. Or you can add a free salad. A complete steak dinner is \$15.00. A-Dial's going but be in time. Open every 212-241-2000. Dial Time. Don't wait. There'll be no more. www. dial.com

CH2-4100 THE PIPING HOT LINE

212-241-2000. Dial Time. Don't wait. There'll be no more. www. dial.com

danish

No Cakes Here! This is the only place in the city where you can get a real danish.

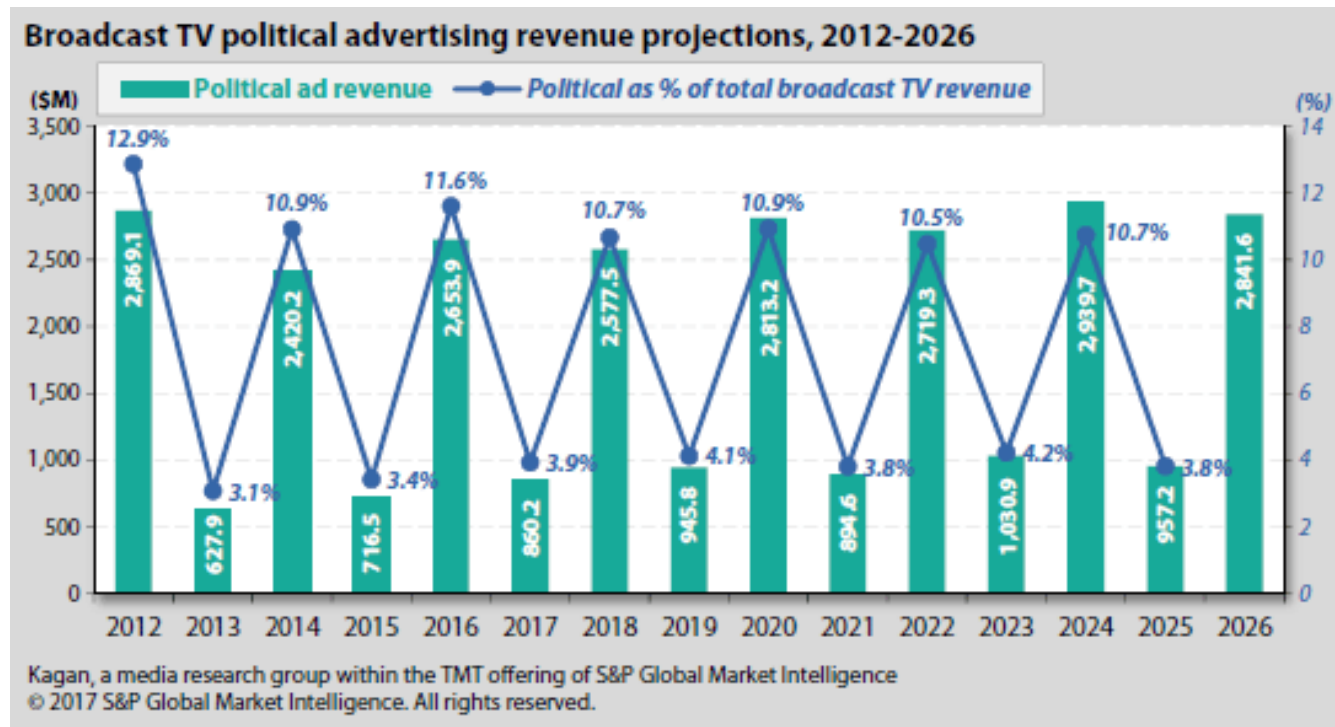
MOORE'S is coming!

TUESDAY, SEPT. 15 - 101 WEST 40th STREET

JONAH JONES

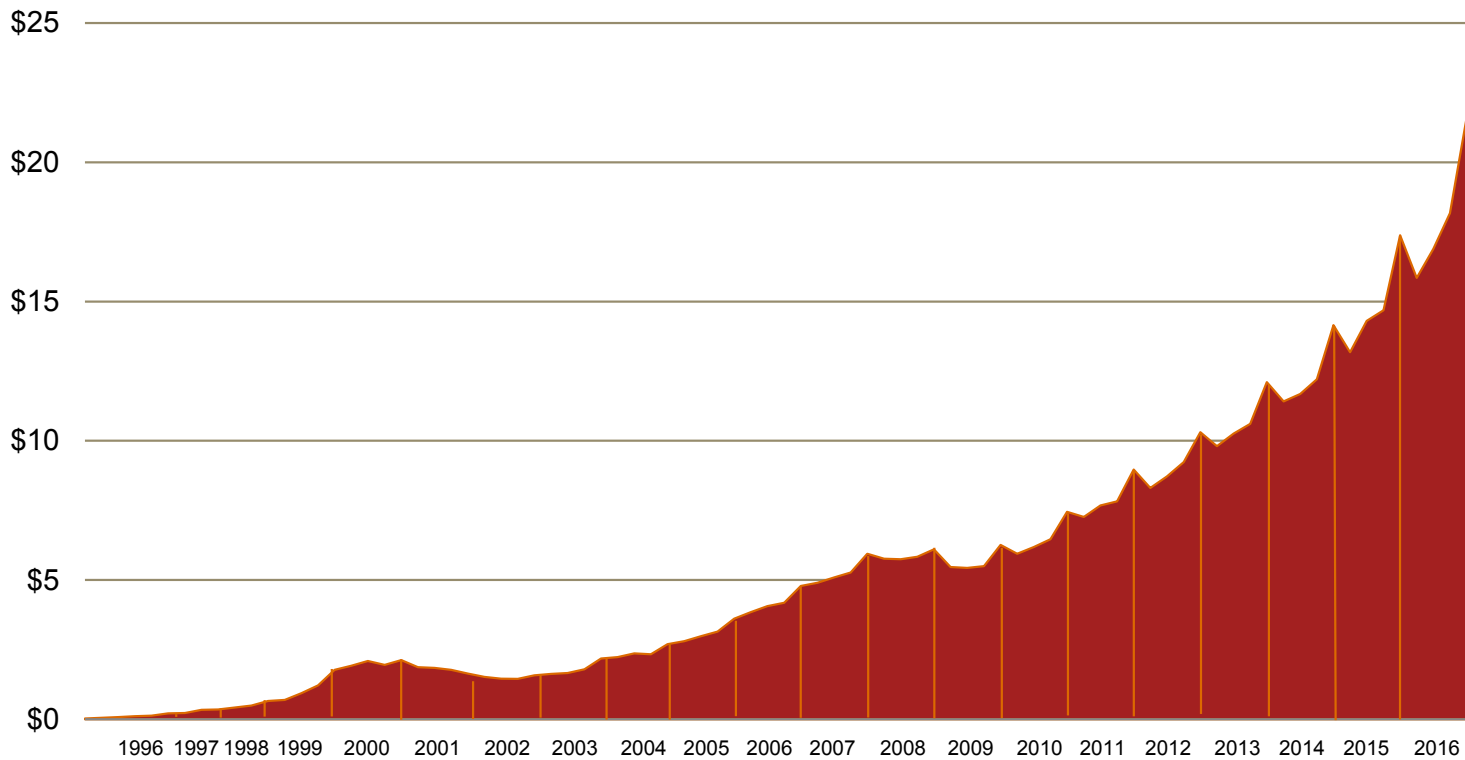
212-241-2000. Dial Time. Don't wait. There'll be no more. www. dial.com

Aside: political advertising on TV



Digital advertising revenue

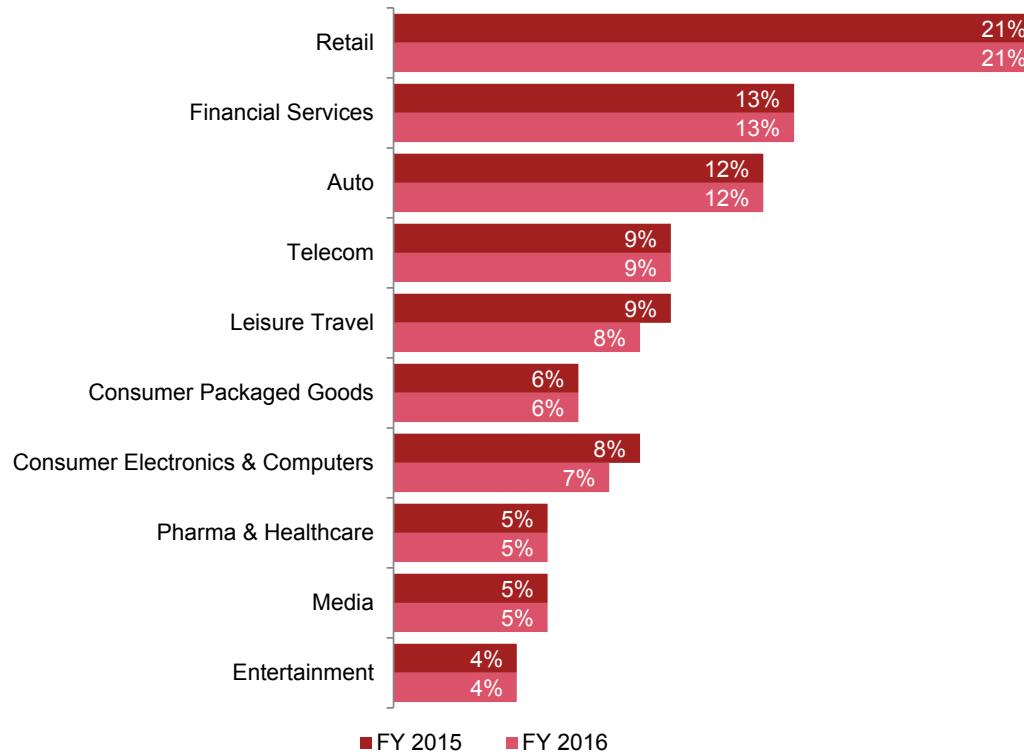
Quarterly revenue growth trends 1996-2016 (\$ billions)



Source: IAB/PwC Internet Ad Revenue Report, FY 2016

Who is advertising?

Internet ad revenues by major industry category*, year to date: 2015 vs. 2016



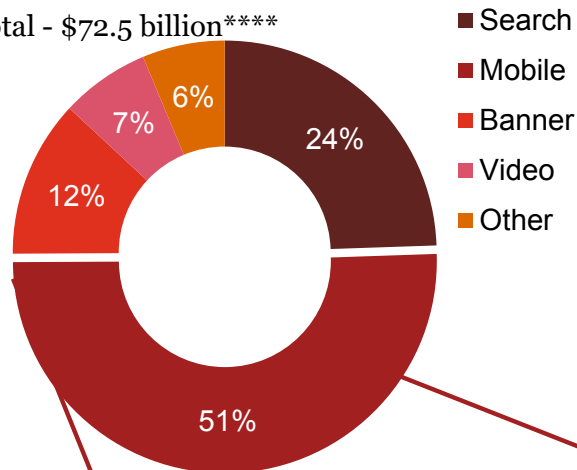
Source: IAB/PwC Internet Ad Revenue Report, FY 2016

* Industry category definitions may have changed over the time period depicted, both within the survey process and as interpreted by survey respondents. Amounts do not total to 100% as minor categories are not displayed.

What kind of advertising?

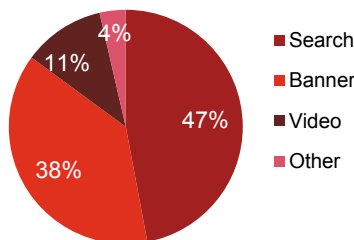
Ad formats – full year 2016

Total - \$72.5 billion****



- Search
- Mobile
- Banner
- Video
- Other

Mobile Formats

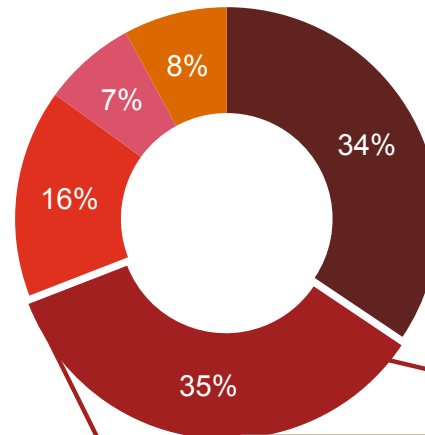


- Search
- Banner
- Video
- Other

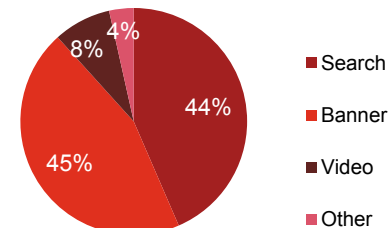
Source: IAB/PwC Internet Ad Revenue Report, FY 2016

Ad formats – full year 2015

Total - \$59.6 billion****



Mobile Formats



- Search
- Banner
- Video
- Other

Real-time brokered (programmatic): ~80%

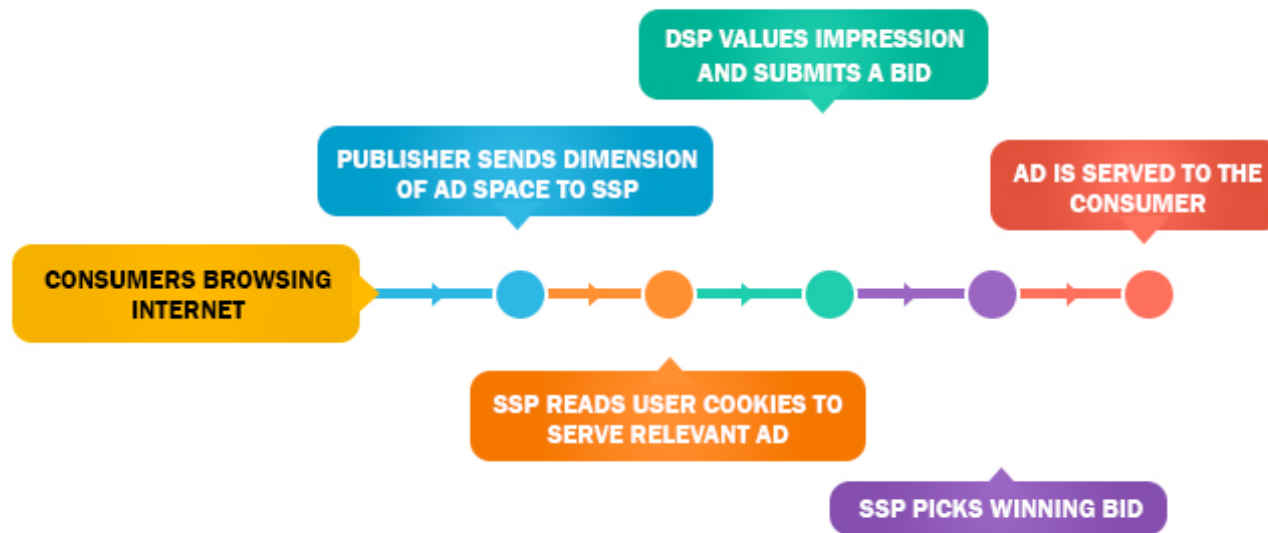
What kind of advertising?

- Display (banner) ads
 - brand awareness, mostly
 - fixed cost or bidding for pages
 - pop-ups, inline, interstitial (before & after)
- Search ads
 - bidding for key words
- Location-based (push) advertising
- Email-based
- Sponsored content
- Video ads
 - Pre-roll & insert
- Classifieds (e.g., Craigslist)



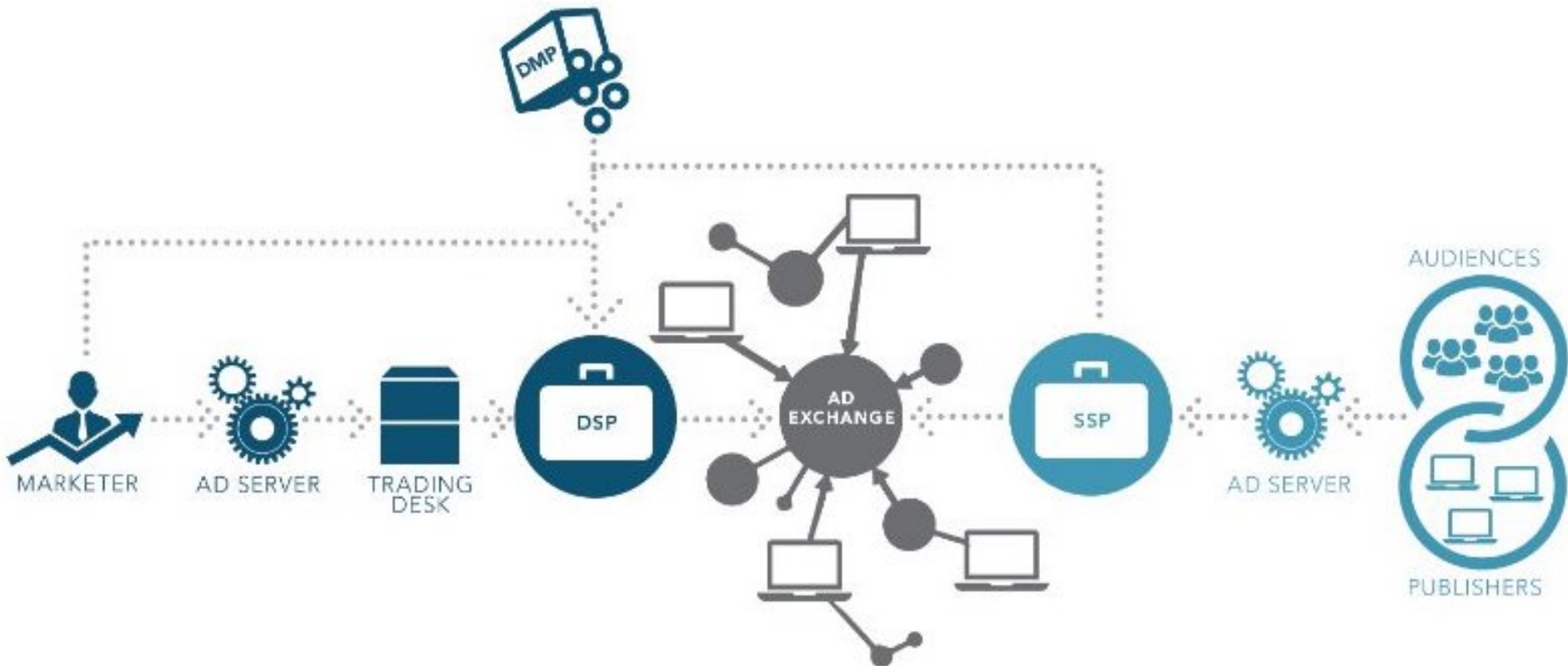
Programmatic advertising

Things Happened in This Chart
Are Matter of Milliseconds



DSP = demand-side platforms: advertisers offer their ads for placement
SSP = supply-side platform: publishers offer inventory for sale

Buying media programmatically



(source: DNB)

Types of banner advertising (& video?) inventory

	Type of Inventory (Reserved ¹ , Unreserved)	Pricing (Fixed ² , Auction)	Participation (One Seller-One Buyer, One Seller-Few Buyers, One Seller-All Buyers)	Other Terms Used in Market	Other Considerations
Automated Guaranteed	Reserved	Fixed	One-One	Programmatic guaranteed Programmatic premium Programmatic direct Programmatic reserved	<ul style="list-style-type: none"> • Prioritization in the ad server • Deal ID • Data usage • Transparency to buyer • Price floors
Unreserved Fixed Rate	Unreserved	Fixed	One-One	Preferred deals Private access First right of refusal	
Invitation-Only Auction	Unreserved	Auction	One-Few	Private marketplace Private auction Closed auction Private access	
Open Auction	Unreserved	Auction	One-All	Real-time bidding (RTB) Open exchange Open marketplace	

Source: Interactive Advertising Bureau 2013

also: sponsored content



Advertising reach

- Classical
 - TV, radio: rating points – 1% of TV households (116.3 M in 2014)
 - particular A18-49 (adults 18 to 49)
 - Live, Live+SD, Live+7
 - Newspaper: circulation
- Digital
 - CPM: thousand *impressions*
 - \$2.80 display ads; \$5 email; \$3 video
 - CPC: thousand *clicks*
 - → *CTR: click-through rate* (relevance for mobile?)
 - Google AdSense: 68% to publisher, 32% to Google

TV CPM

In looking at traditional TV video CPMs, Media Dynamics says broadcast network prime time is the highest -- at \$19.00. Late-night broadcast programming is at \$17.50; syndicated prime-access programming is at \$17.00; and cable prime-time programming at \$9.85.











Early-fringe syndicated programming averages \$9.25; broadcast early evening news is at \$9.00; and cable programming early fringe comes in at \$7.55. Network daytime is at \$6.50; with syndicated daytime programming at \$5.50; and cable daytime programming at \$3.30.

Radio CPM: ~\$20













Radio Advertising Costs by Market

City	M-F Spots	Sa/Su Spots	Weekly Cost
New York City	15	4	\$4,981.25
Dallas	15	4	\$1,760.00
Denver	15	4	\$1,127.50

How much can you make on web ads?

1	 WebAppers www.webappers.com	Skyscraper Banner 160x600 Middle Right	27k Est. Impressions	\$2.00 CPM	<input type="button" value="Waiting List"/>
2	 OnextraPixel www.onextrapixel.com	BSA Premium Ad Zone 728x90 Bottom Center	129k Est. Impressions	\$2.00 CPM	<input type="button" value="Waiting List"/>
3	 InstantShift www.instantshift.com	Sidebar Top 300x250 Top Right	184k Est. Impressions	\$1.80 CPM	<input type="button" value="Waiting List"/>
4	 Tuts+ Code code.tutsplus.com	Leaderboard 728x90 Top Center	1.38M Est. Impressions	\$8.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
5	 Photoshop Star www.photoshopstar.com	Header 728x90 Top Center	62k Est. Impressions	\$1.80 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
6	 Logopond logopond.com	Above Comments (CPM) 728x90 Top Center	212k Est. Impressions	\$2.25 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
7	 dafont.com www.dafont.com	Leaderboard CPM 728x90 Top Left	4.38M Est. Impressions	\$0.50 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
8	 dafont.com www.dafont.com	Skyscraper CPM 120x600 Top Left	2.20M Est. Impressions	\$0.50 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
9	 Webdesigner Depot www.webdesignerdepot.com	In article pages 300x250 Top Left	431k Est. Impressions	\$4.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
10	 Photoshop Tutorial photoshoptutorials.ws	Header Leaderboard 728x90 Top Right	177k Est. Impressions	\$2.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>

Fake news (mostly)

1	 chinaSMACK www.chinasmack.com	300x250 Sidebar A 300x250 Top Right	124k Est. Impressions	\$1.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
2	 chinaSMACK www.chinasmack.com	728x90 Header 728x90 Top Center	129k Est. Impressions	\$1.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
3	 LunaticOutpost.com lunaticoutpost.com	Ad in first post. (Every Pa 300x250 Top Right	450k Est. Impressions	\$0.27 CPM	<input type="button" value="Waiting List"/>
4	 DickMorris.com www.dickmorris.com	Rectangle below the fold 300x250 Bottom Right	135k Est. Impressions	\$1.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
5	 DickMorris.com www.dickmorris.com	Home Page Below Fold 1 300x250 Bottom Center	136k Est. Impressions	\$1.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
6	 DickMorris.com www.dickmorris.com	Single Post Below Post Left 300x250 Bottom Left	440k Est. Impressions	\$1.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
7	 DickMorris.com www.dickmorris.com	Single Post Below Right 300x250 Bottom Right	457k Est. Impressions	\$1.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
8	 Reason.com reason.com	Premium Rectangle 300x250 Top Right	1.63M Est. Impressions	\$4.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
9	 The Daily Wire dailywire.com	Medium Rectangle 300x250 Content	22.59M Est. Impressions	\$5.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
10	 Conservative Tribu conservativetribune.com	In-Content 1 300x250 Middle Left	21.35M Est. Impressions	\$6.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
11	 Western Journalism westernjournalism.com	In-Content 1 300x250 Middle Left	11.34M Est. Impressions	\$6.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>
12	 Conservative Tribu conservativetribune.com	In-Content 3 300x250 Bottom Left	13.39M Est. Impressions	\$5.00 CPM	<input type="button" value="+"/> <input type="button" value="Buy Now"/>

Web and mobile advertising

- Not just CPM – multiple ads per page
 - “\$48/1000 visits”
 - \$0.25-\$3 for generic sites
 - \$1-\$10 for content rich sites
 - \$10 for product-related sites
- Ad tracking
 - cross-site cookies – embedded frames or images
 - or track by IP address, browser characteristics, etc.
 - effectiveness?
- Impact of ad blocking?
 - IOS9
 - Europe: 20-30%



Privacy Badger

Example trackers (New York Times)



The screenshot shows the Privacy Badger interface. At the top left is the Privacy Badger logo (a badger) and the text "Privacy Badger". To the right are a question mark icon and a gear icon. Below the header, a message states: "Privacy Badger detected 16 trackers on this page. These sliders let you control how Privacy Badger handles each tracker." Below this message are three icons: a red circle with a slash, a yellow circle with a red 'x', and a green checkmark. The main area contains a list of trackers, each with a slider bar. The sliders are either red (indicating blocking) or green (indicating allowing). The trackers listed are:

Tracker	Control
static.chartbeat.com	Red slider (Blocked)
st.dynamicsyield.com	Green slider (Allowed)
static.dynamicsyield.com	Red slider (Blocked)
www.facebook.com	Green slider (Allowed)
www.google-analytics.com	Red slider (Blocked)
partner.googleadservices.com	Red slider (Blocked)

Tracking users and households

- Cookies (“same origin policy”)
- IP address
- Browser characteristics
 - e.g., user agent, links visited
- “Super cookies”
- ISP-based tracking



Receive our U-verse with AT&T GigaPower Premier Offer by choosing AT&T Internet Preferences. When you select AT&T Internet Preferences, we can offer you our best pricing on GigaPower because you let us use your individual Web browsing information, like the search terms you enter and the web pages you visit, to tailor ads and offers to your interests.

You won't necessarily receive more ads when you are online, but those you do see may be more suited to your interests. For example:

- If you search for concert tickets, you may receive offers and ads related to restaurants near the concert venue.
- After you browse hotels in Miami, you may be offered discounts for rental cars there.
- If you are exploring a new home appliance at one retailer, you may be presented with similar appliance options from other retailers.

You might receive these offers or ads online, via email or through direct mail. You have our pledge that AT&T is committed to protecting your privacy. We will not sell your personal information to anyone, for any reason. Period.


Browser strings

What's My User Agent?

Your User Agent is:

```
Mozilla/5.0 (Macintosh; Intel Mac OS X 10_12_6) AppleWebKit/537.36  
(KHTML, like Gecko) Chrome/60.0.3112.113 Safari/537.36
```

Your IP Address is:

 2001:18d8:ffff:16:1ca7:2212:aef8:3975

Browser Information:

JavaScript Enabled: Yes

Cookies Enabled: Yes

Device Pixel Ratio: 1

Screen Resolution: 1920px x 1200px

Browser Window Size: 1410 px x 931 px

US dominates marketing

Top ten ad markets

US\$m, current prices. Currency conversion at 2016 average rates.

<i>Country</i>	<i>Adspend 2016</i>	<i>Country</i>	<i>Adspend 2019</i>
1. United States	190,778	1. United States	210,544
2. China	74,961	2. China	89,936
3. Japan	41,924	3. Japan	44,424
4. United Kingdom	24,160	4. United Kingdom	25,812
5. Germany	21,951	5. Germany	23,715
6. Brazil	13,047	6. Brazil	14,111
7. France	11,381	7. South Korea	12,113
8. South Korea	11,271	8. Australia	11,973
9. Australia	10,930	9. France	11,899
10. Canada	8,739	10. Indonesia	10,795

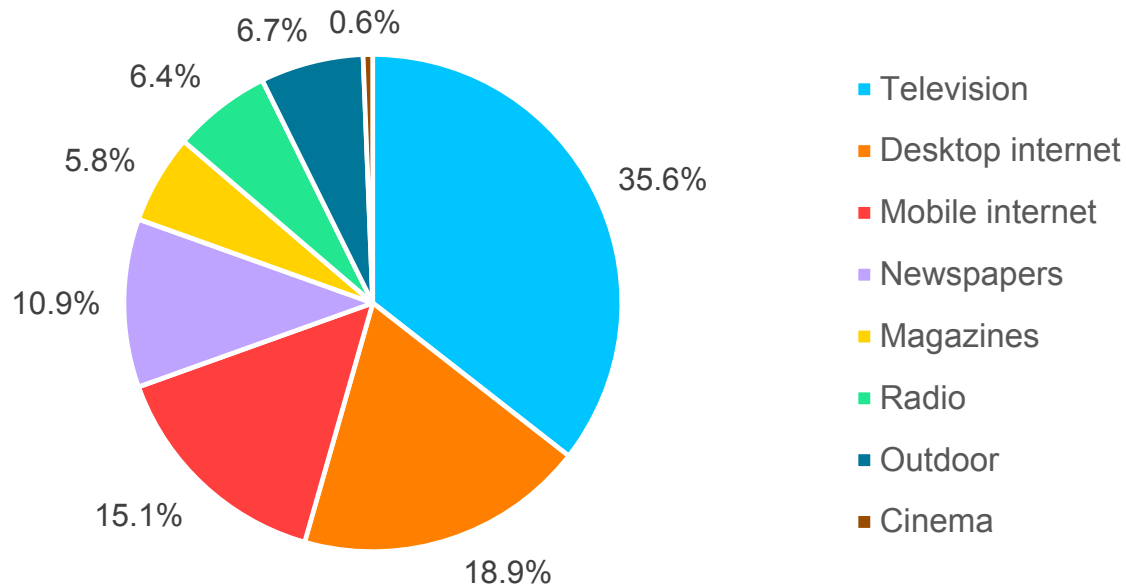
Source: Zenith

Top 10 Ad Markets - 2016 (sorted by ad\$/capita)

	adspend(\$M)	pop. (M)	ad\$/capita (\$)	gdp/capita (\$)	ad\$/gdp (%)
US	190778	323.1	\$590.46	\$57,466.79	1.027
Aus	10930	24.13	\$452.96	\$49,927.82	0.907
UK	24160	65.64	\$368.07	\$39,899.39	0.922
Japan	41924	127	\$330.11	\$38,894.47	0.849
Germany	21951	82.67	\$265.53	\$41,936.06	0.633
Canada	8739	36.29	\$240.81	\$42,157.93	0.571
SK	11271	51.25	\$219.92	\$27,538.81	0.799
France	11381	66.9	\$170.12	\$36,854.97	0.462
Brazil	13047	207.7	\$62.82	\$8,649.95	0.726
China	74961	1379	\$54.36	\$8,123.18	0.669

Global ad spending by medium

Share of global adspend by medium 2016

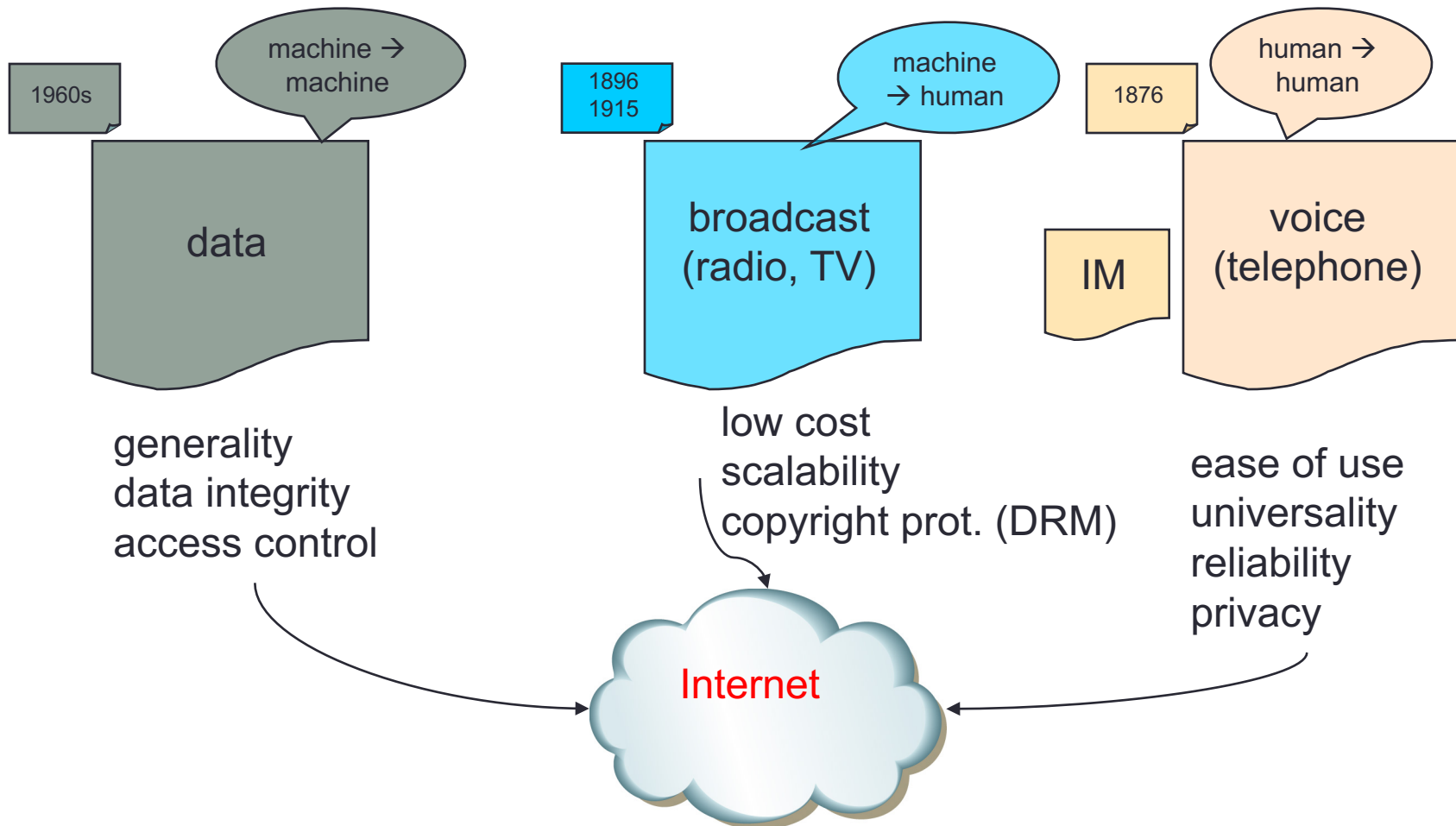


Source: Zenith

A BIT OF TECHNOLOGY

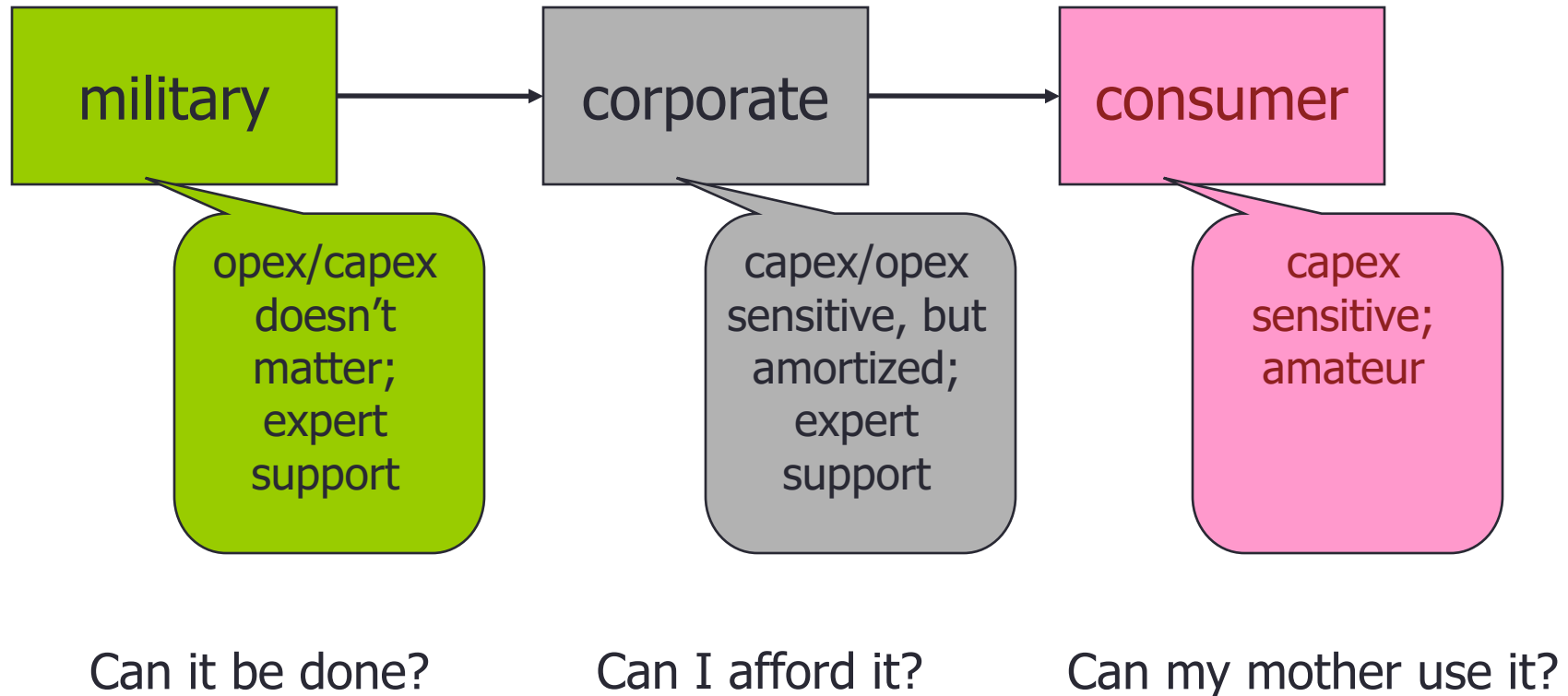
Converging communities

since 1900: separate networks, companies, professions

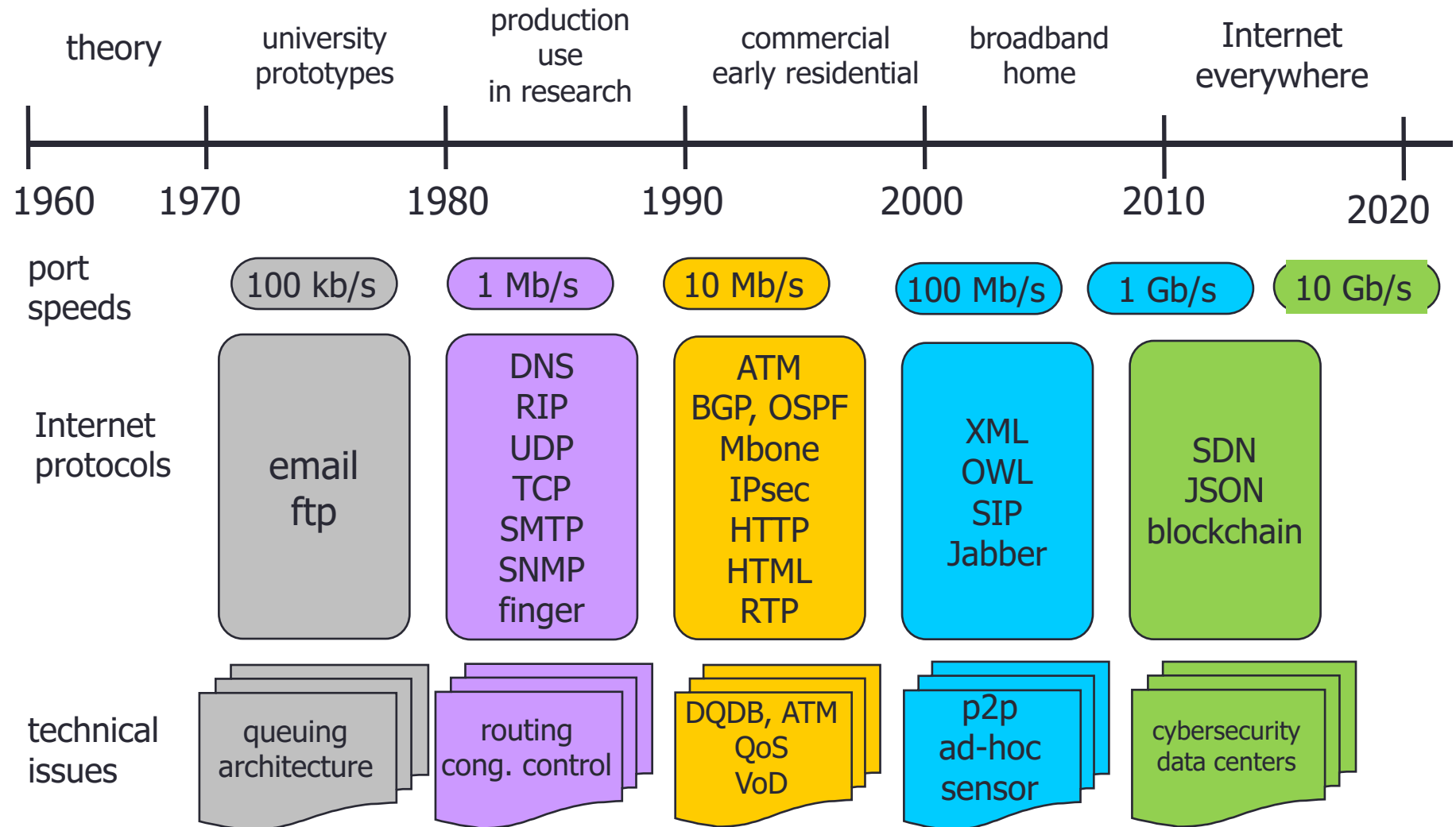


Lifecycle of technologies

traditional technology propagation:



Internet and networks timeline



What has changed?

1980s/1990s	2000s+
Rapid technology evolution in network core	Relatively stable core technology
Internet exceptionalism (no distance! no borders!)	National laws & customs
Internet utopianism	“Big Switch”, harms & limitations
Performance!	Reliability? Usability!
Cost-insensitive (and “free” phone access)	Deployment cost barriers
Separated from commercial media (newspapers, magazines, radio, TV)	Affects all media
Self-revealed data (email, BBS)	Intimate data (information access, behavioral, sensors)
Little economic impact	One of the largest US exports

What's different?

What	Utilities (gas, water, electricity)	Internet	Consumer electronics
Geographic scope	regional	local, national, international	mostly international
Economics	enabler	entry, competition, enabler	Trade, patents
Impact on culture	minimal	foundational	rarely (Walkman, iPhone)
Impact on domestic politics	in LDCs	jobs, education, health, transportation, copyright, income inequality	health & education (smartphones)
Impact on international politics	water rights?	trade, espionage, propaganda, cyberattacks, copyright, ...	trade