

Lecture

Internet Trends and Web Basics

This content is protected and may not be shared, uploaded, or distributed.

What are We Talking About Today?

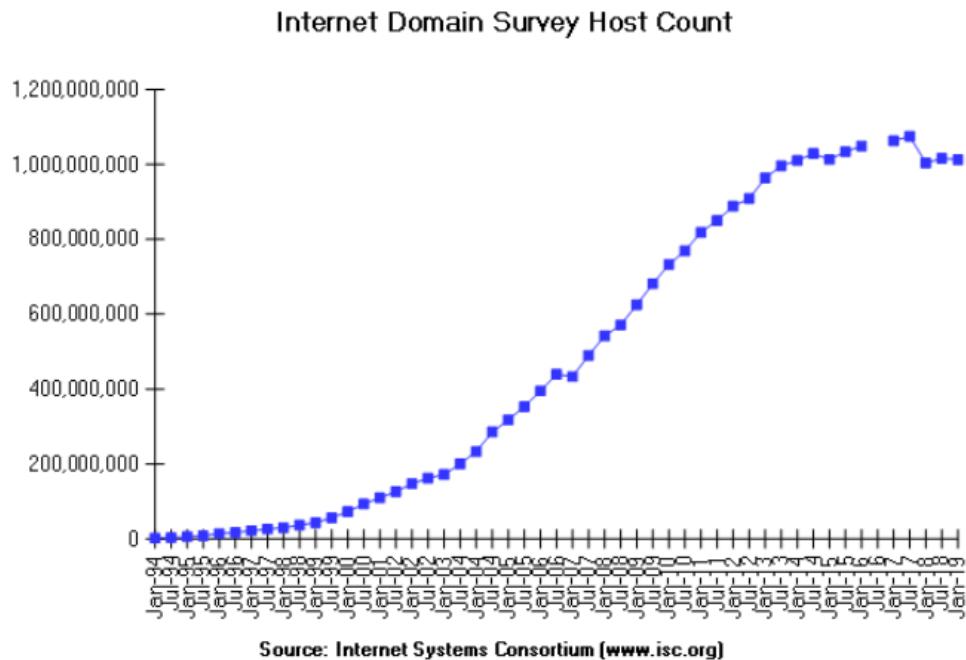
- **Internet vs. World Wide Web**
 - Internet: Global digital infrastructure
 - WWW: System for accessing web content
 - Intranet/Extranet: Internal and external networks
- **Recent Internet Trends**
 - Growth in users, smartphones, and digital data
 - Rise in social media and cloud usage
 - Mobile surpassing desktop for internet access
- **Web Technologies & History**
 - Client/Server Architecture: Browsers and servers
 - Core Technologies: HTTP, URLs, HTML
 - Key Milestones: Development of WWW, major browsers, companies like Google and YouTube.

The Internet and the WWW are Different

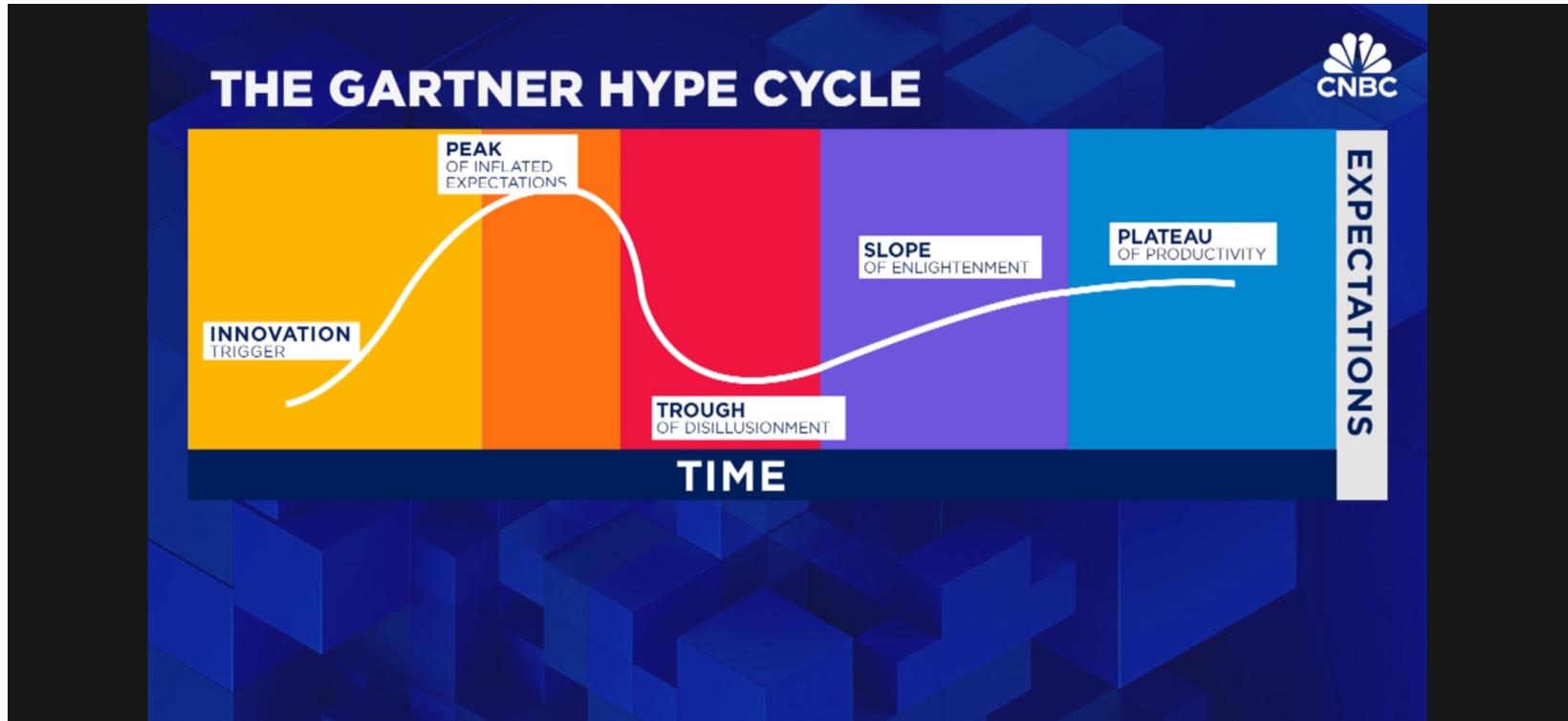
- The *Internet* is a global digital infrastructure that connects hundreds of millions of computers and people
- The *World Wide Web* is a mechanism that unifies the retrieval and display of a subset of data on the Internet
- An *intranet* is a local/global information structure that connects an organization internally. Intranets today often make use of Web technologies
- An *extranet* is a private network that uses the public telecommunication system to securely share part of a business's information or operations with suppliers, vendors, partners, customers, or other businesses.

How Big is the Internet (historical)

<https://www.isc.org/network/survey>



Gartner Hype Cycles



Source: <https://www.cnbc.com/video/2024/07/19/ais-trillion-dollar-time-bomb.html>

Gartner Hype Cycles (cont'd)

- **Innovation Trigger**
 - A potential technology breakthrough kicks things off. Early proof-of-concept stories and media interest trigger significant publicity. Often no usable products exist, and commercial viability is unproven.
- **Peak of Inflated Expectations**
 - Early publicity produces a number of success stories – often accompanied by scores of failures. Some companies take action; many do not.
- **Trough of Disillusionment**
 - Interest wanes as experiments and implementations fail to deliver. Producers of the technology shake out or fail. Investments continue only if the surviving providers improve their products to the satisfaction of early adopters.

Gartner Hype Cycles (cont'd)

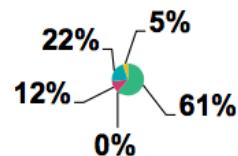
- **Slope of Enlightenment**
 - More instances of how the technology can benefit the enterprise start to crystallize and become more widely understood. Second- and third-generation products appear from technology providers. More enterprises fund pilots; conservative companies remain cautious.
- **Plateau of Productivity**
 - Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off.

Source:

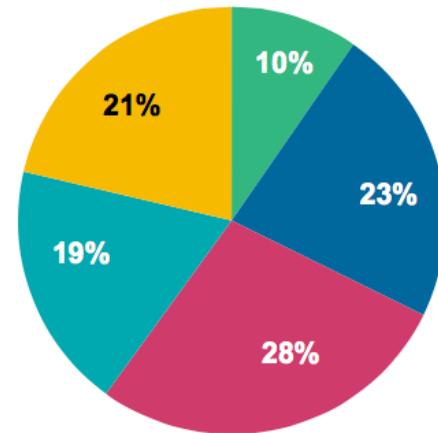
<https://www.gartner.com/en/research/methodologies/gartner-hype-cycle>

Internet Users – 1995 → 2014... <1% to 39% Population Penetration Globally

1995
35MM+ Internet Users
0.6% Population Penetration



2014
2.8B Internet Users
39% Population Penetration



■ USA ■ China ■ Asia (ex. China) ■ Europe ■ Rest of World

@KPCB

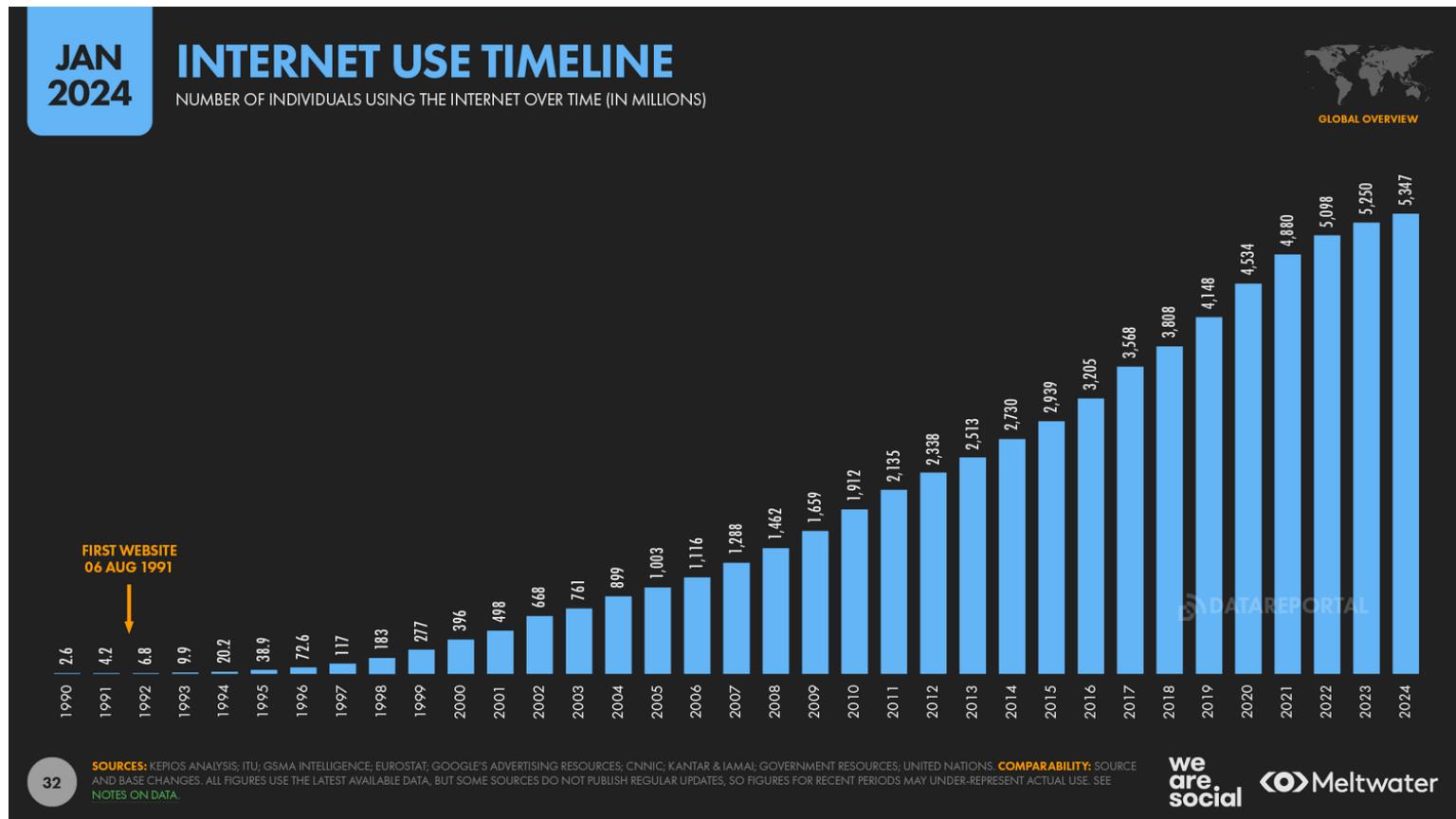
Source: Euromonitor, ITU, US Census.

4

The following slides are based upon a presentation by Mary Meeker of Bond and formerly of Kleiner Perkins Caufield and Byers, see <https://www.bondcap.com/#internettrends>

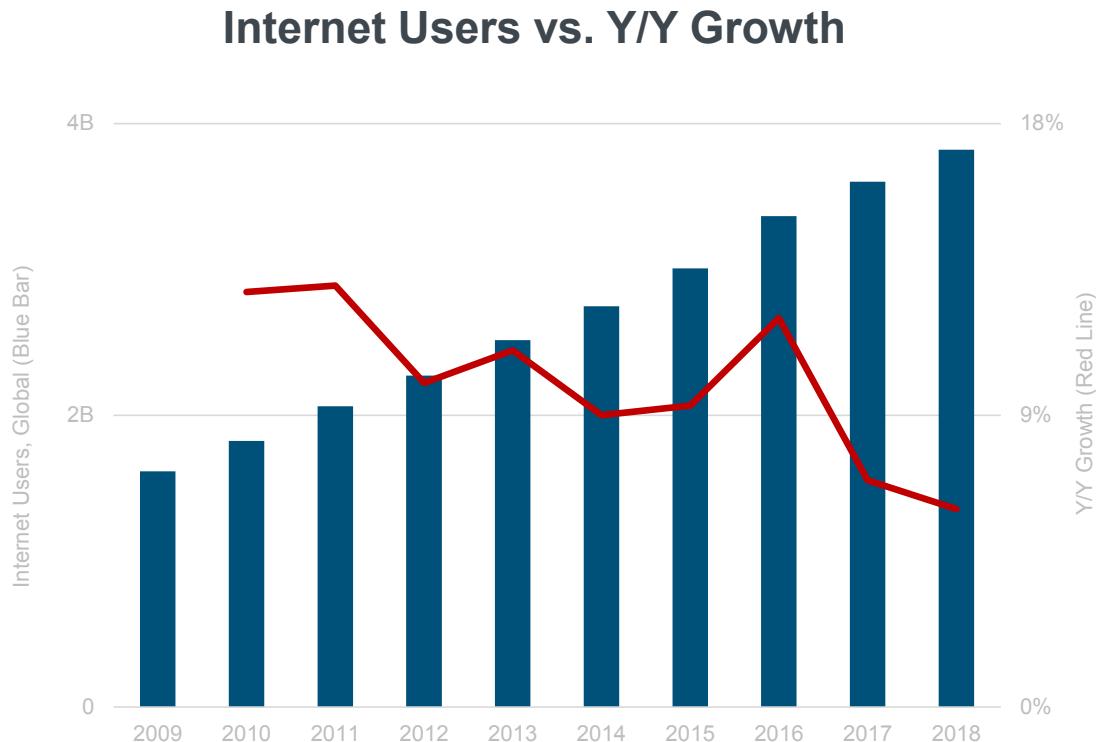
Internet Users 2024

5.35 billions or 66.2% of global population



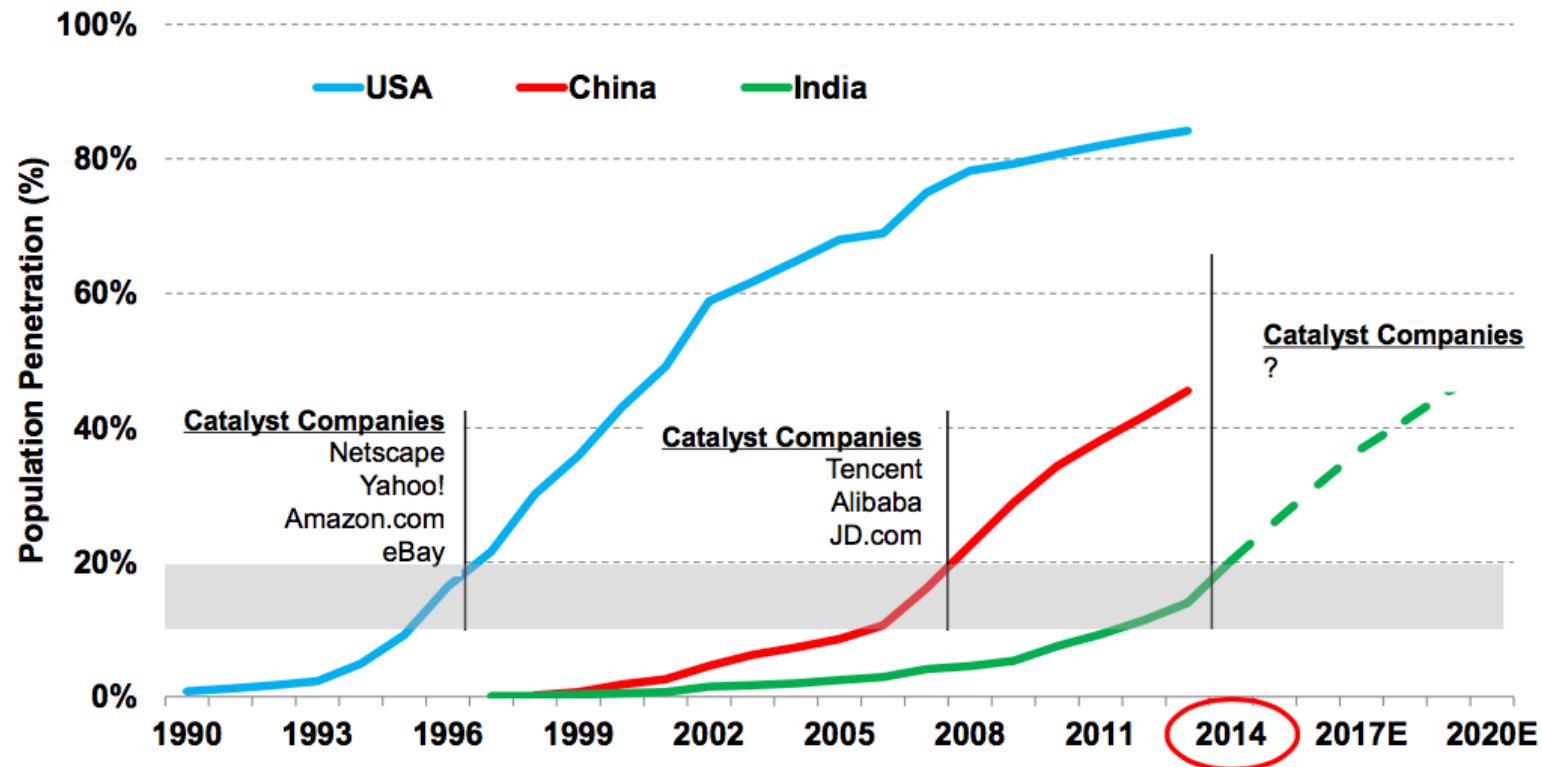
Source: <https://datareportal.com/reports/digital-2024-deep-dive-the-state-of-internet-adoption>

Global Internet User Growth = Solid But Slowing +6% vs. +7% Y/Y



India = Appears to Be @ Internet Penetration Growth Inflection

Internet User Penetration Curve, USA / China / India, 1990 – 2020E



@KPCB

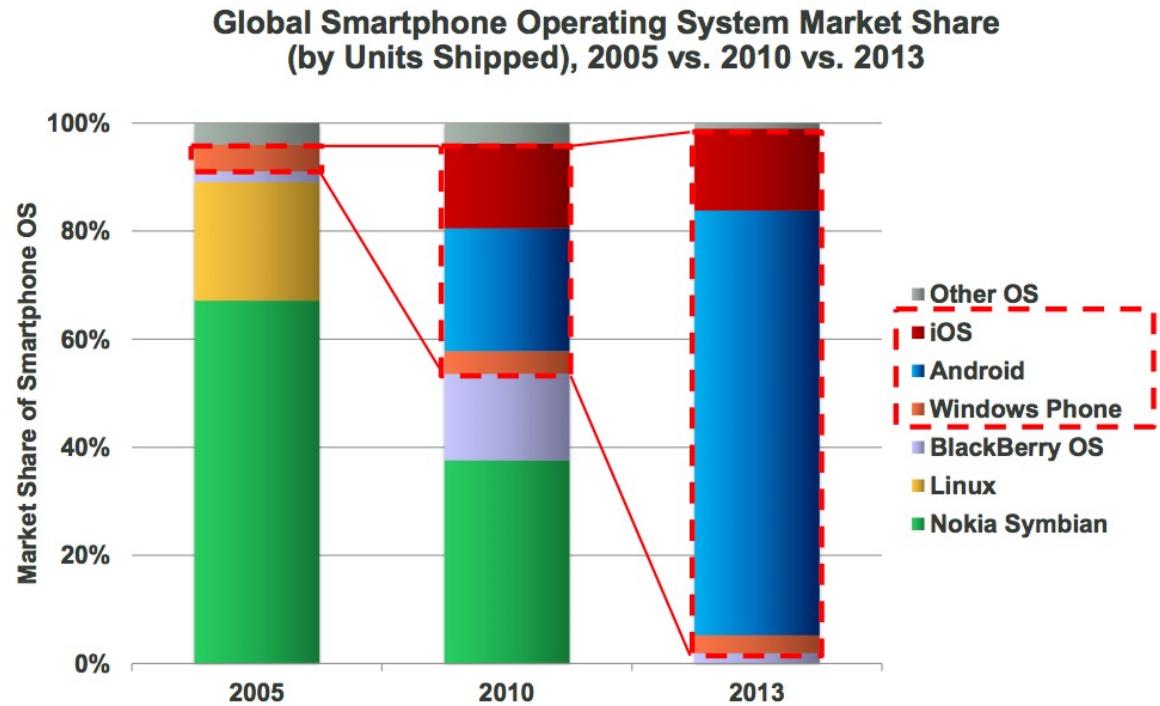
Source: World Bank, Hillhouse Capital forecast for India beyond 2014.

Hillhouse Capital

165

Global Smartphone Operating Systems 'Made in USA'... 97% Share from 5% Eight Years Ago

Examining smartphone operating systems, over the past seven years, iOS and Android have made major gains with Nokia disappearing and Linux a very small piece of the pie



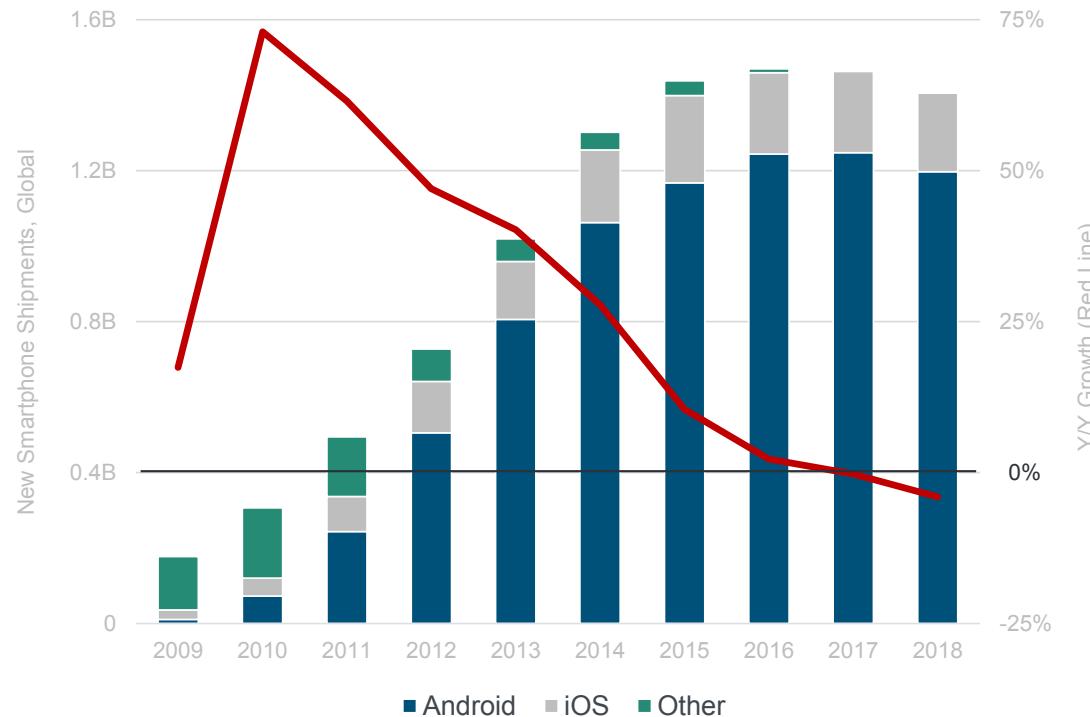
@KPCB

Source: 2005 & 2010 data per Gartner, 2013 data per IDC.

10

Global New Smartphone Unit Shipments = Declining -4% vs. 0% Y/Y

New Smartphone Unit Shipments vs. Y/Y Growth



Data Volume = Extraordinary Growth... ~13% Structured / Tagged & Rising Rapidly

There has been exponential growth in online information;
 1 Zettabyte = 1,024 Exabytes
 1 Exabyte = 1,024 Petabytes
 1 Petabyte = 1,024 Terabytes
 1 Terabyte = 1,024 Gigabytes
 or
 1 Zettabyte = 1,000,000,000,000 gigabytes

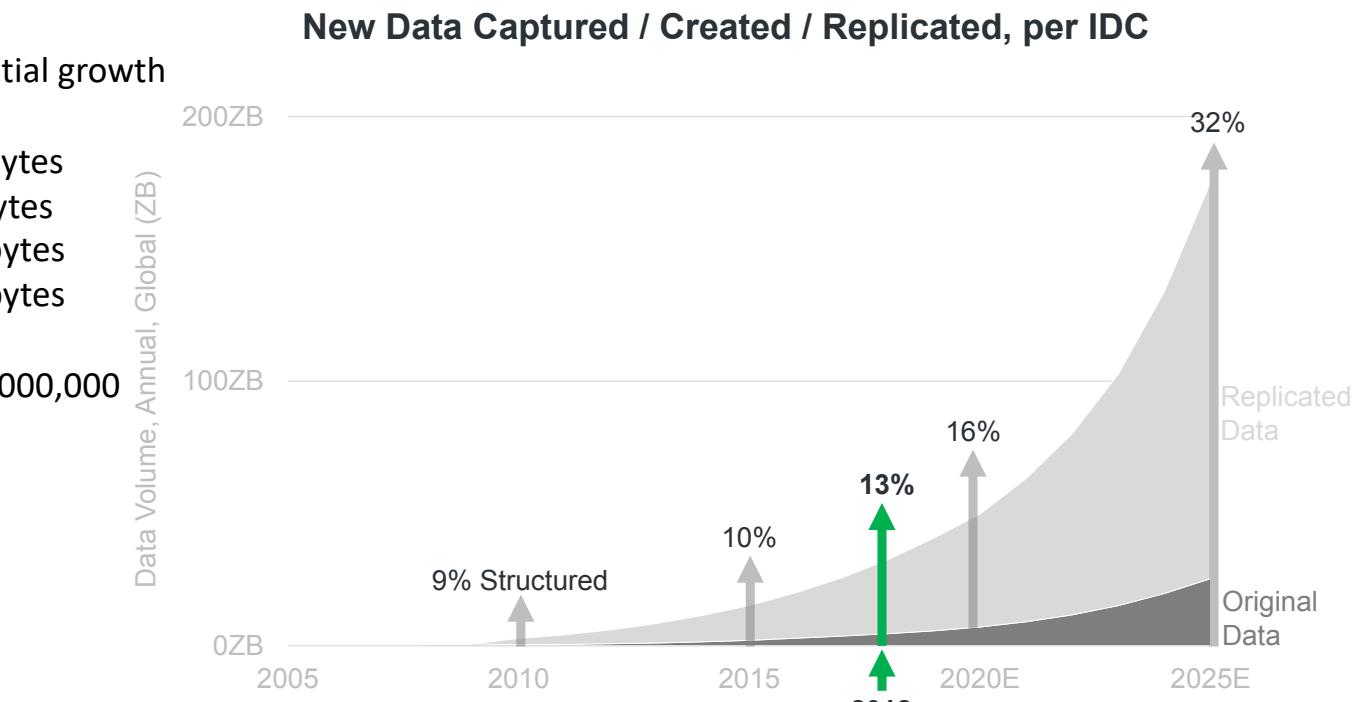
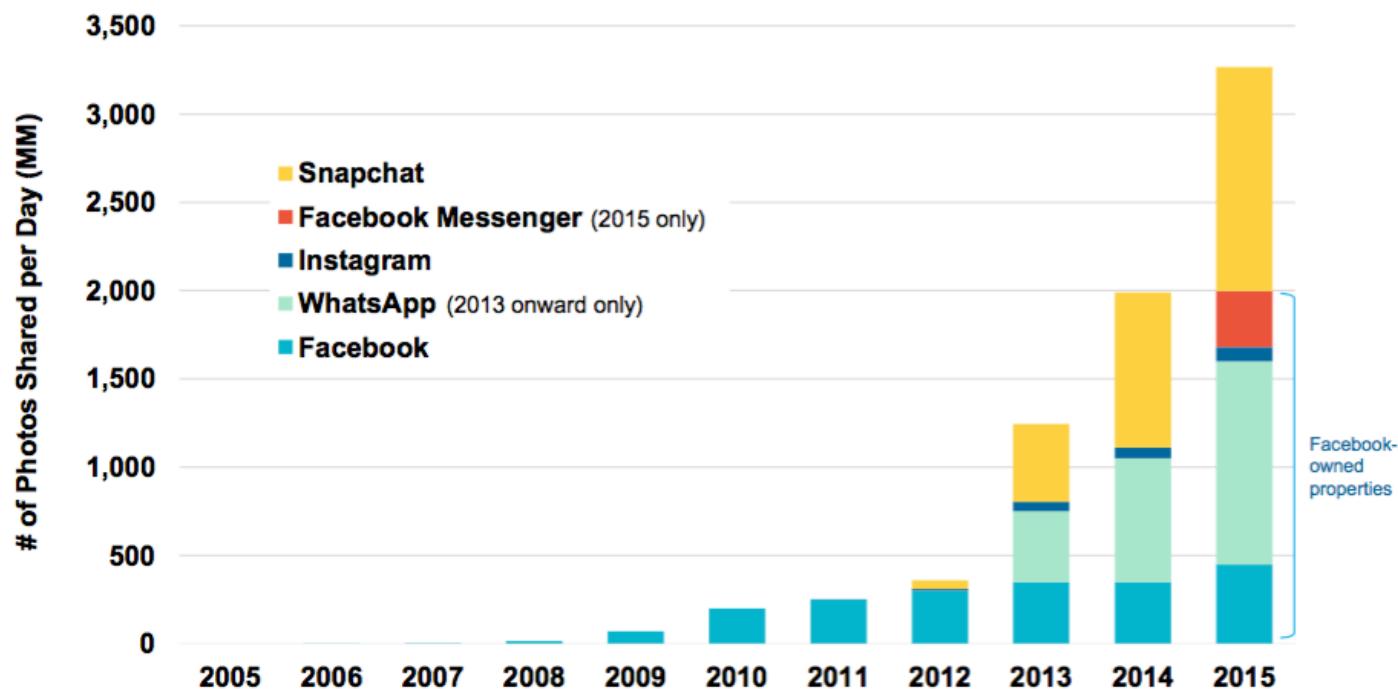


Image Growth Remains Strong

Daily Number of Photos Shared on Select Platforms, Global, 2005 – 2015



Source: Snapchat, Company disclosed information, KPCB estimates

Note: Snapchat data includes images and video. Snapchat stories are a compilation of images and video. WhatsApp data estimated based on average of photos shared disclosed in Q1:15 and Q1:16. Instagram data per Instagram press release. Messenger data per Facebook (~9.5B photos per month). Facebook shares ~2B photos per day across Facebook, Instagram, Messenger, and WhatsApp (2015).

KPCB INTERNET TRENDS 2016 | PAGE 90

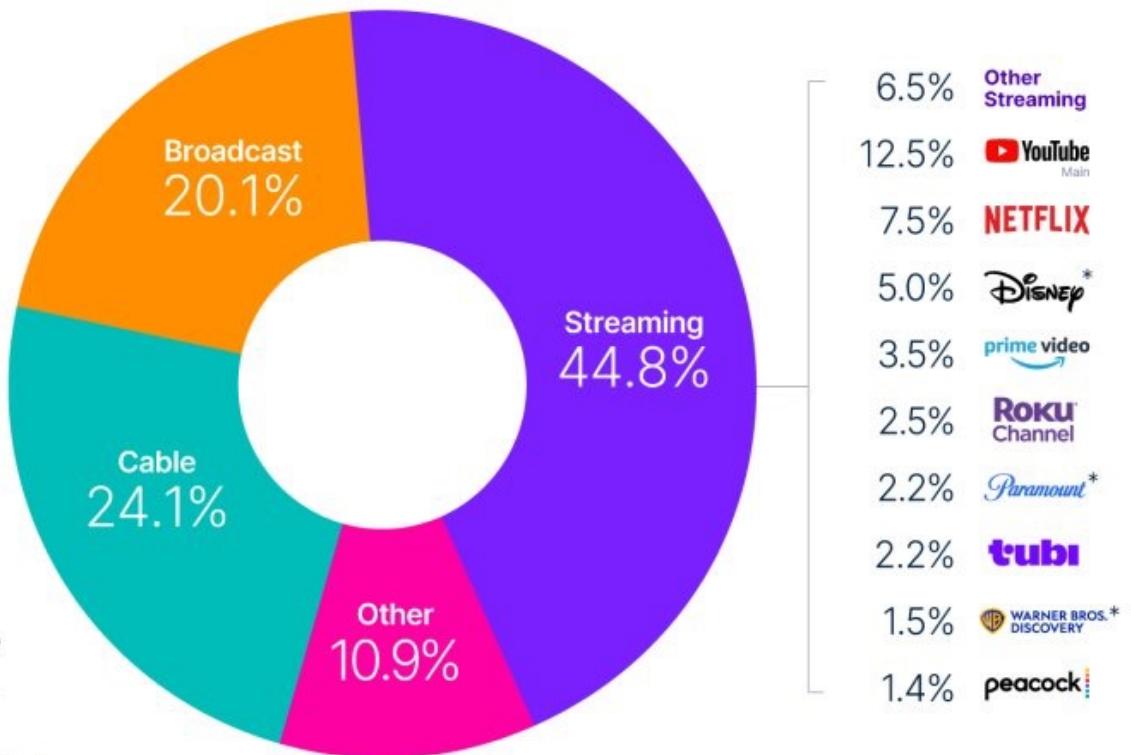


The Gauge™

Nielsen's Total TV and Streaming Snapshot

May 2025

Total Day | Persons 2+



* Disney includes viewing on Disney+, ESPN+ and Hulu SVOD

* Paramount includes viewing on Paramount+ and Pluto

* Warner/Discovery includes viewing on Discovery+ and Max

Methodology available @ www.nielsen.com/thegauge

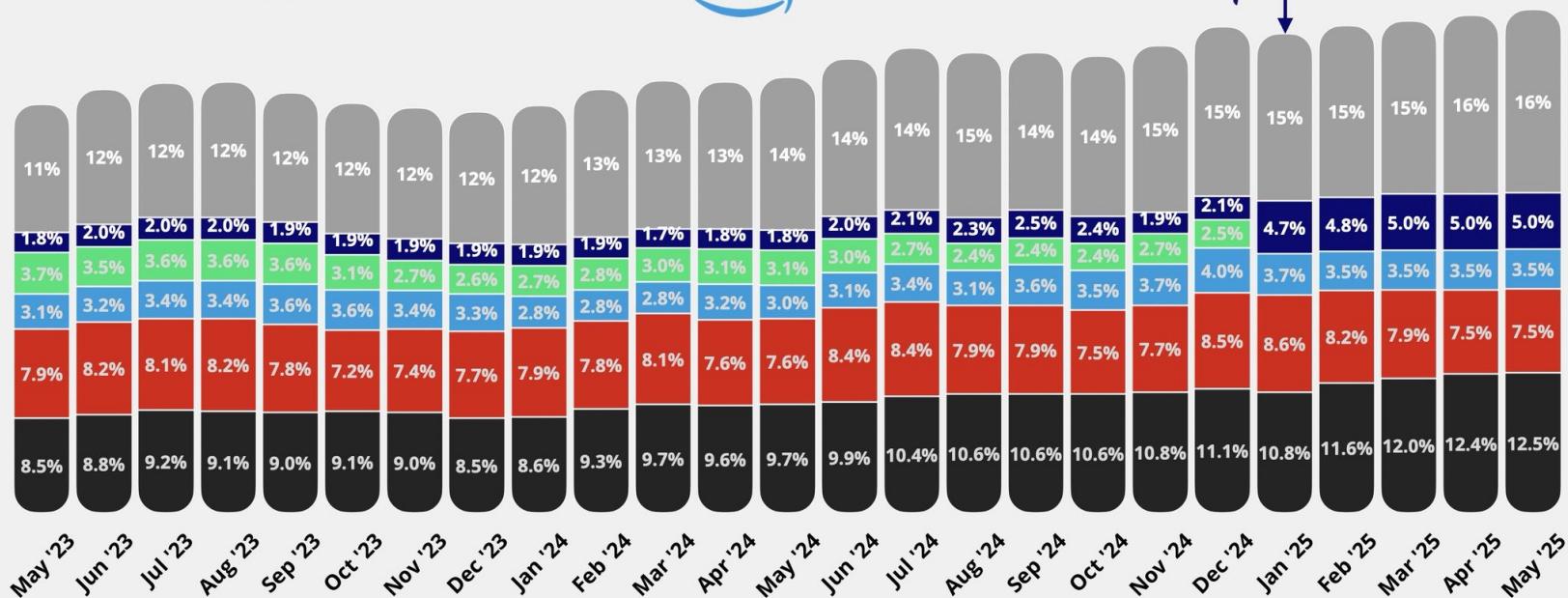
Source: Nielsen National TV Panel plus Streaming Platform Ratings

Copyright © 2025 The Nielsen Company

Streaming in % of US TV Time

■ YouTube ■ NETFLIX ■ prime video ■ hulu ■ Disney+ ■ Other

Disney+
Hulu
ESPN+
together



Source: Nielsen (Persons 2+)

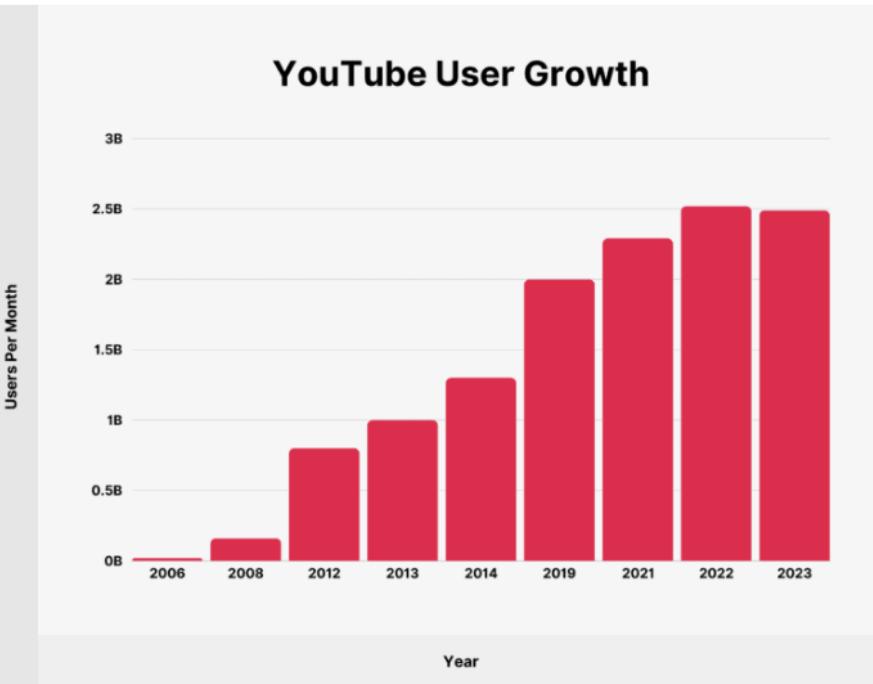
appeconomyinsights.com

APP ECONOMY INSIGHTS

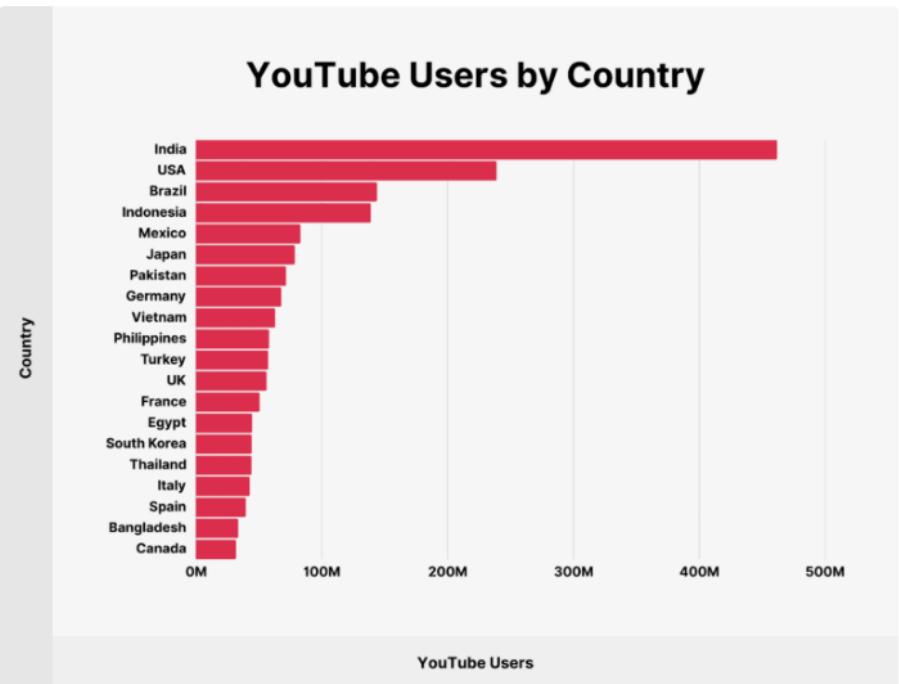
YouTube Users 2024

YouTube currently has 2.49 billion users, half of the global online population

YouTube User Growth

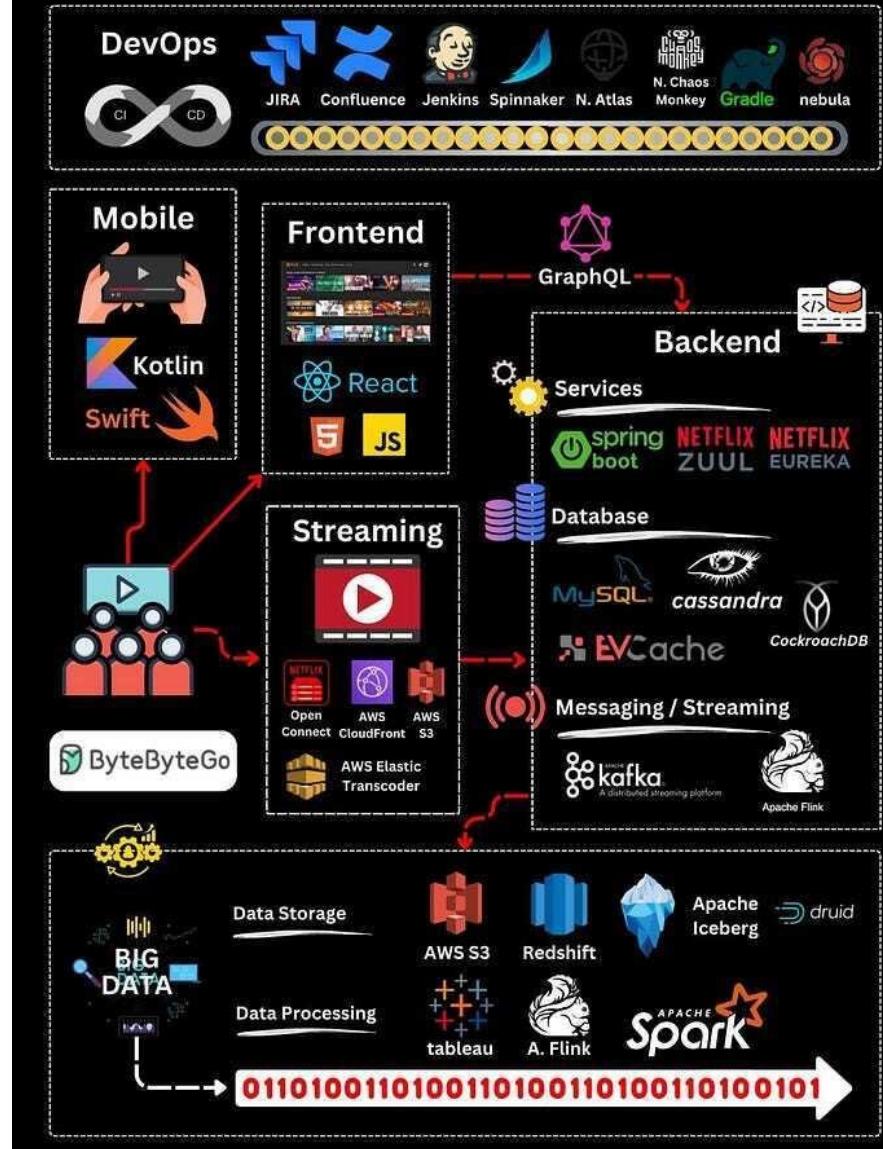


YouTube Users by Country

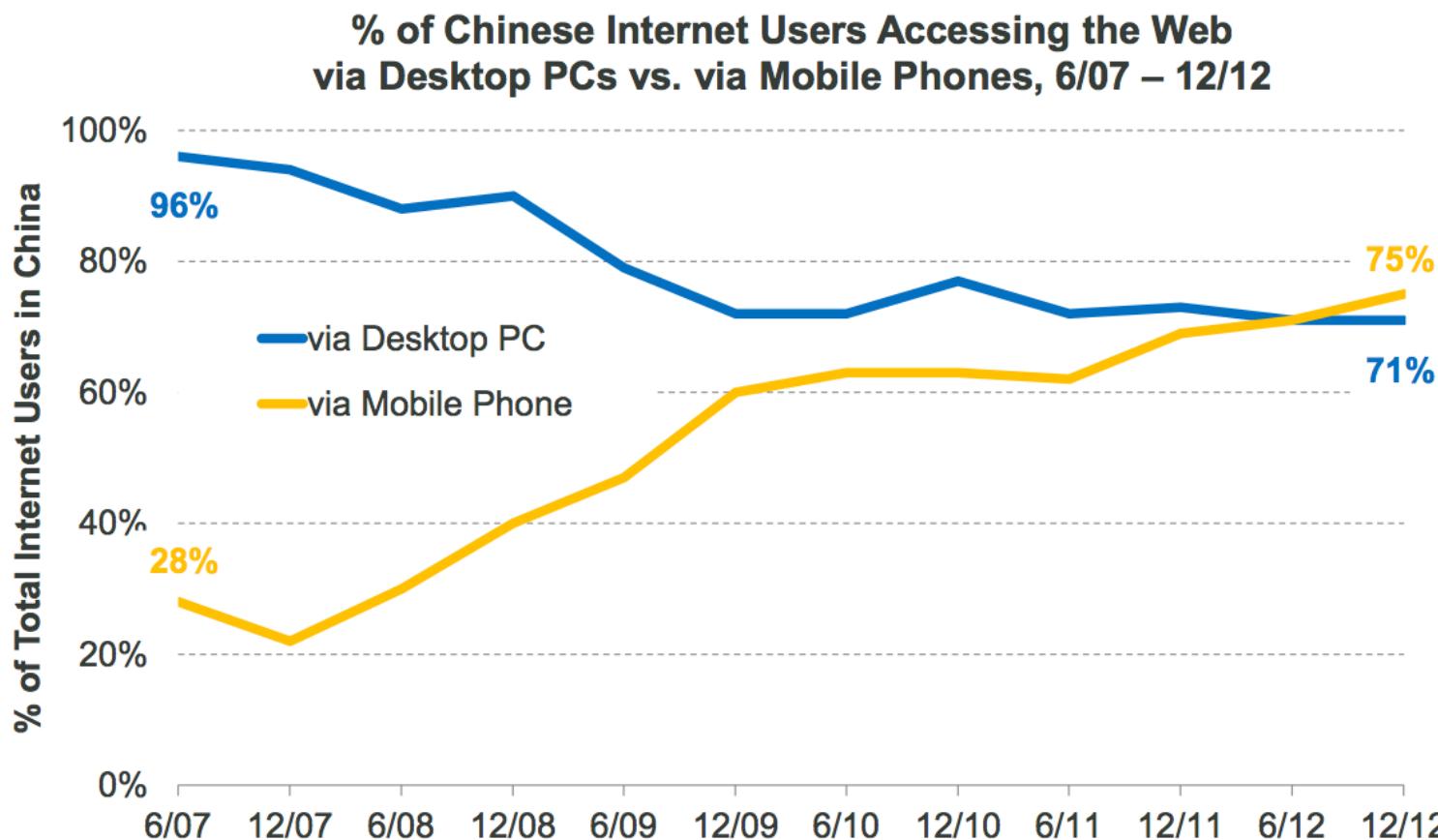


Source; <https://backlinko.com/youtube-users>

NETFLIX Tech Stack



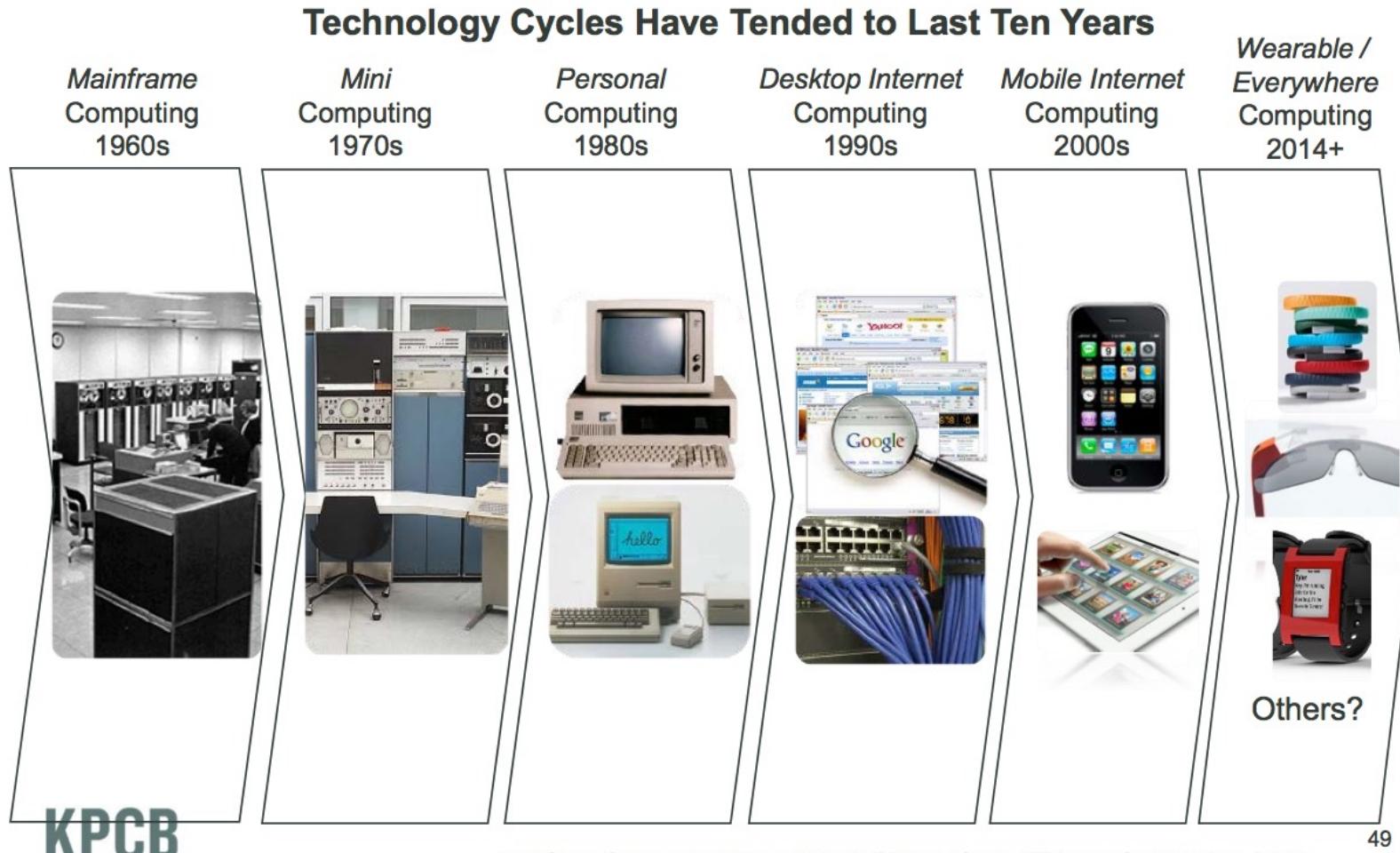
China – Mobile Internet Access Surpassed PC, Q2:12



KPCB

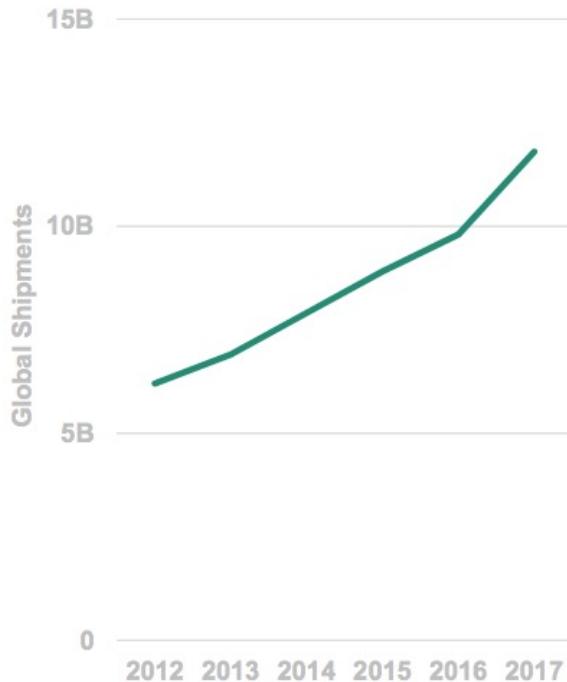
Source: CNNIC, 1/13. 33

Technology Cycles – Still Early Cycle on Smartphones + Tablets, Now Wearables Coming on Strong, Faster than Typical 10-Year Cycle

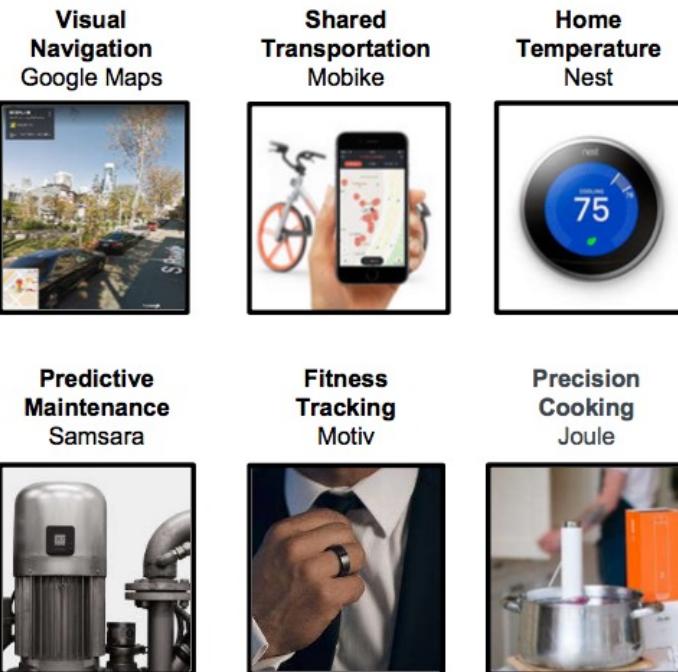


...Data Gathering + Sharing + Optimization (2006 →) = Enabled by Sensor Pervasiveness...

MEMS Sensor / Actuator Shipments

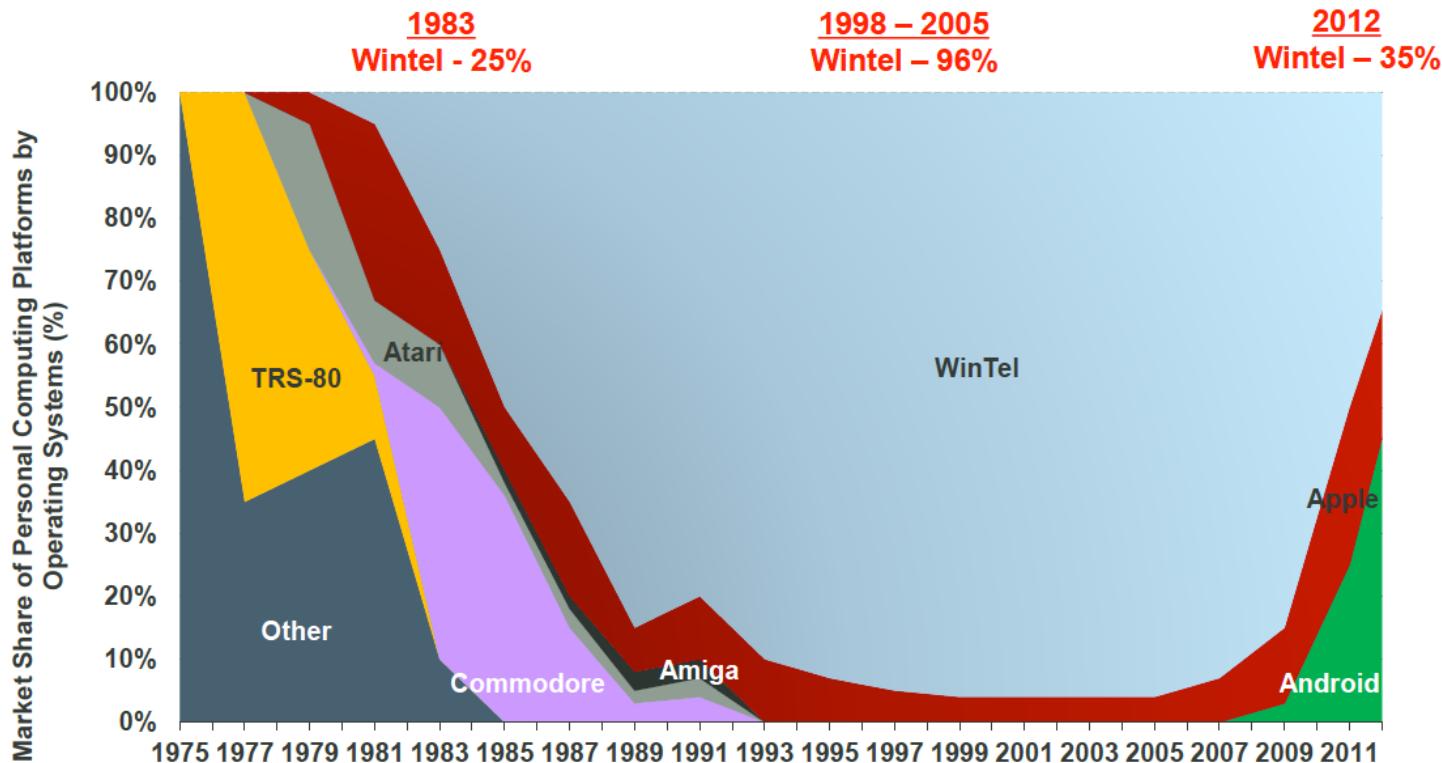


Sensors + Data = In More Places



Re-Imagination of Computing Operating Systems - iOS + Android = 60% Share vs. 35% for Windows

Global Market Share of Personal Computing Platforms by Operating System Shipments, 1975 – 2012



KPCB

Source: Asymco.com (as of 2011), Public Filings, Morgan Stanley Research, Gartner for 2012 data.

109

...While The Cloud Rises

Amazon Web Services (AWS) Leading Cloud Charge...

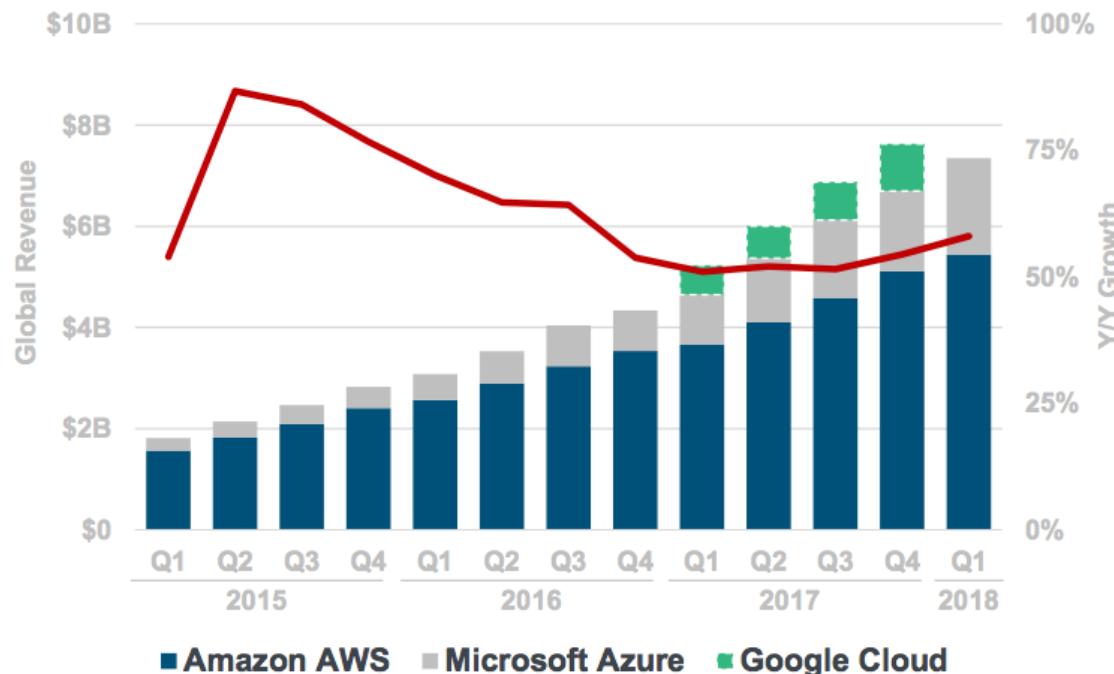


*Note: S3 is AWS' storage product and used as proxy for AWS scale / growth .
Source: Company data.

74

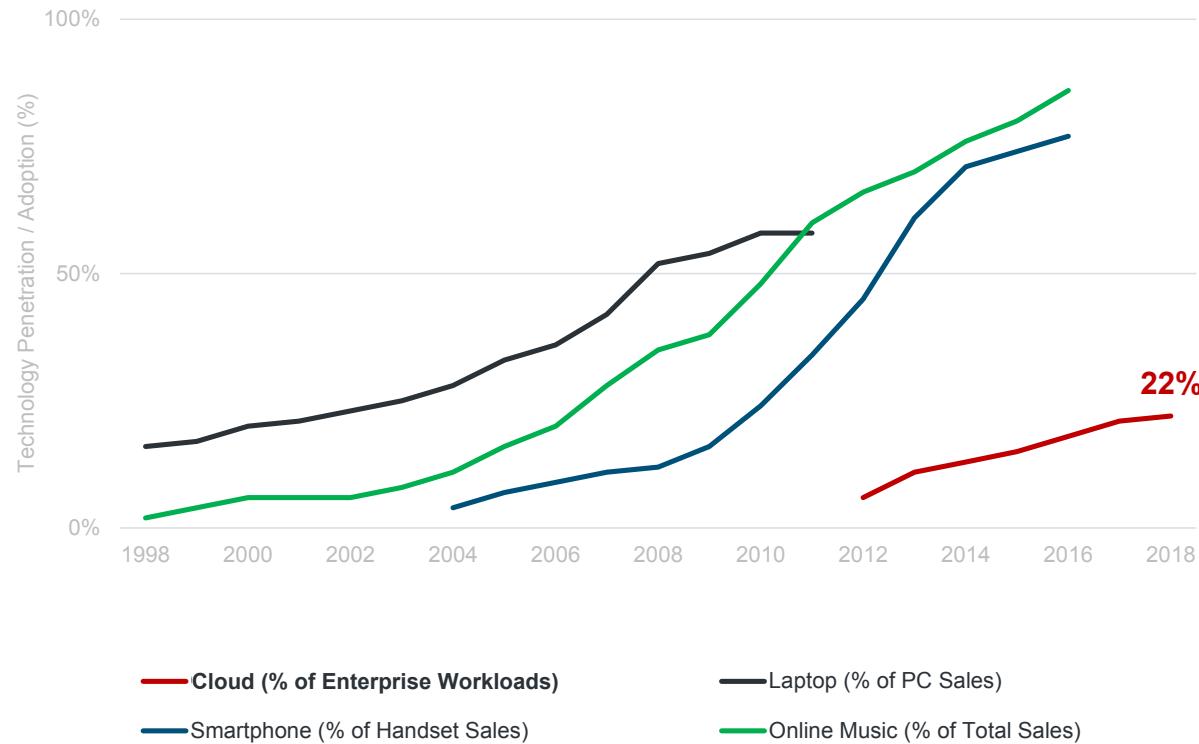
...Computing Big Bangs Volume Effects = Cloud Revenue Re-Accelerating +58% vs. +54% Q/Q

Cloud Service Revenue – Amazon + Microsoft + Google



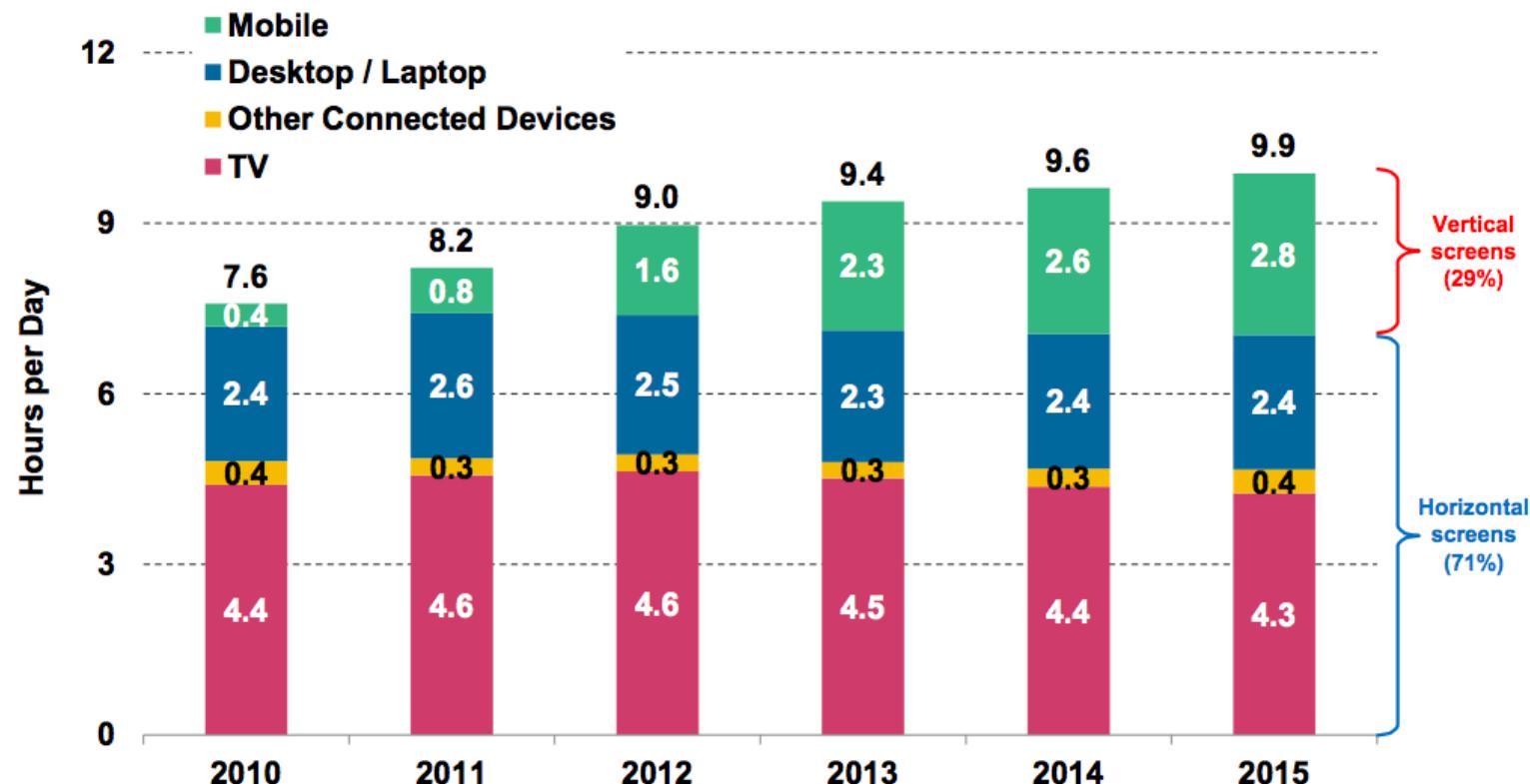
...Cloud Deployment =
22% of Workloads +2x vs. Five Years Ago

Technology Adoption Rates, Global per Morgan Stanley



...Vertical Viewing = 29% of View Time (Multi-Platform) vs. 5% Five Years Ago, USA...

Time Spent on Screens by Orientation (Hours / Day), USA, 2010 – 2015



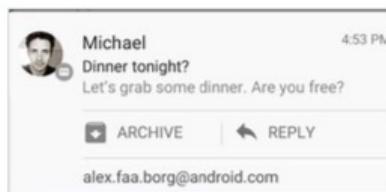
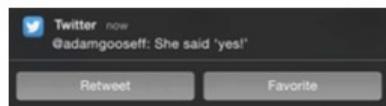
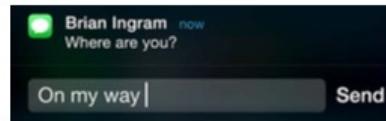
@KPCB

Source: eMarketer 4/15, Coacute analysis. Note: Other connected devices include OTT and game consoles. Mobile includes smartphone and tablet. Usage includes both home and work. Ages 18+; time spent with each medium includes all time spent with that medium, regardless of multitasking; for example, 1 hour of multitasking on desktop/laptop while watching TV is counted as 1 hour for TV and 1 hour for desktop/laptop.

24

Notifications = Growing Rapidly & Increasingly Interactive... Driving New Touch Points with Messaging Platforms + Other Apps

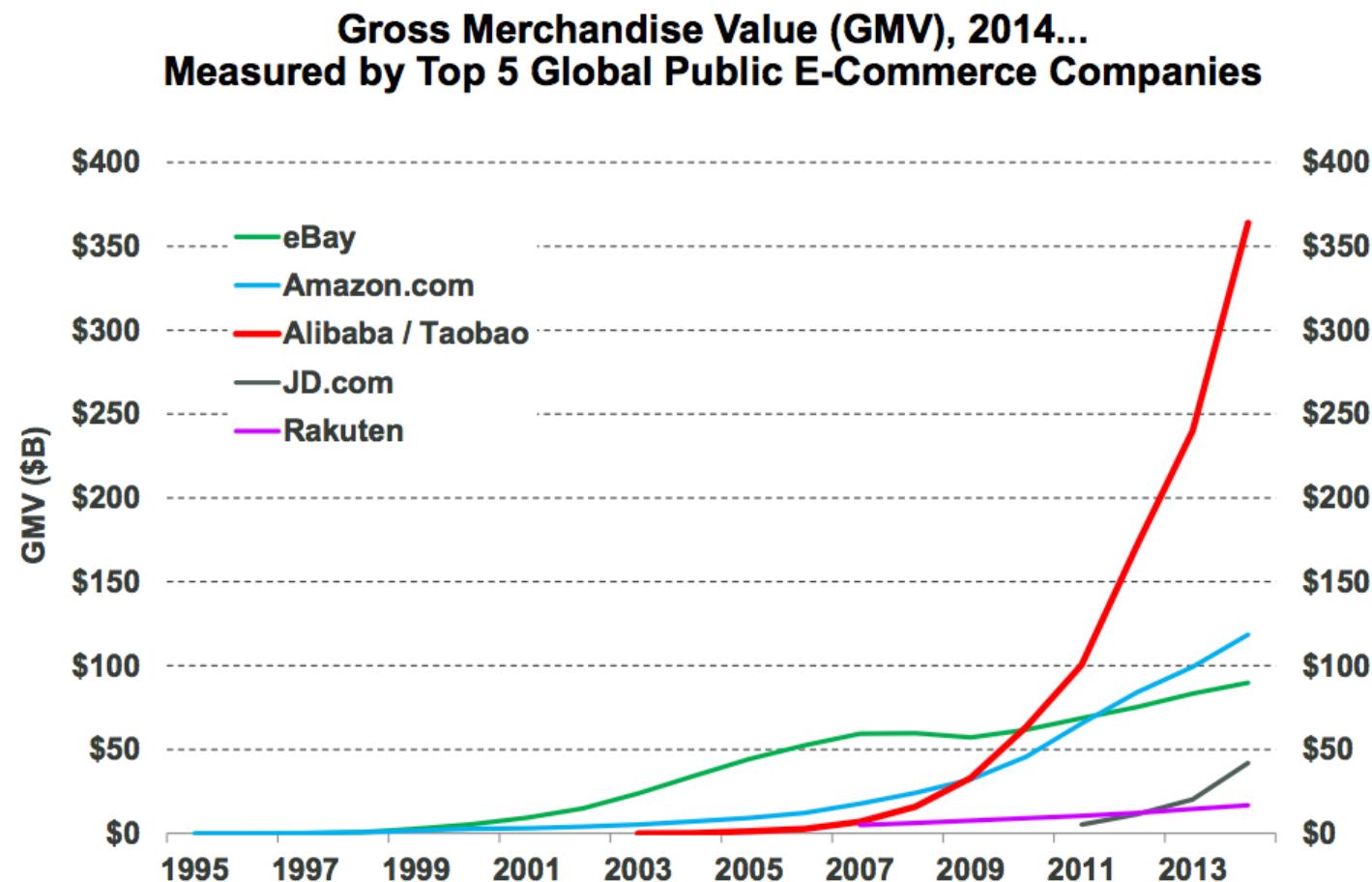
**Direct Interaction
on Notification Panel –**
without users interrupting
what they're doing...



...More Up Close & Personal –
as notifications appear on more
& more mobile devices

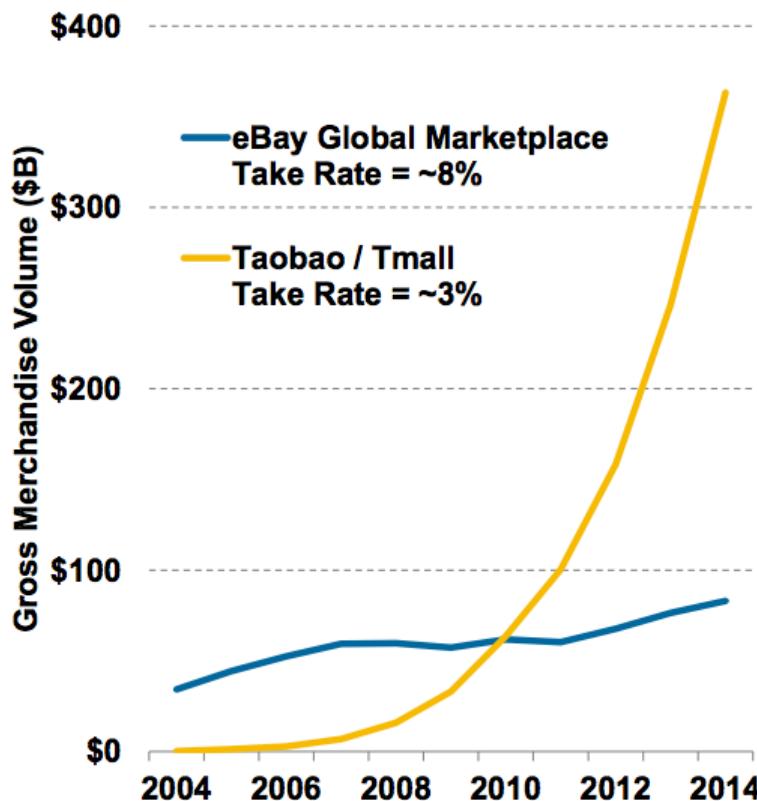


1st Generation 'Online Platforms / Marketplaces for *Products* Rising =
Optimized for Desktop Internet + Traditional Shipping Delivery

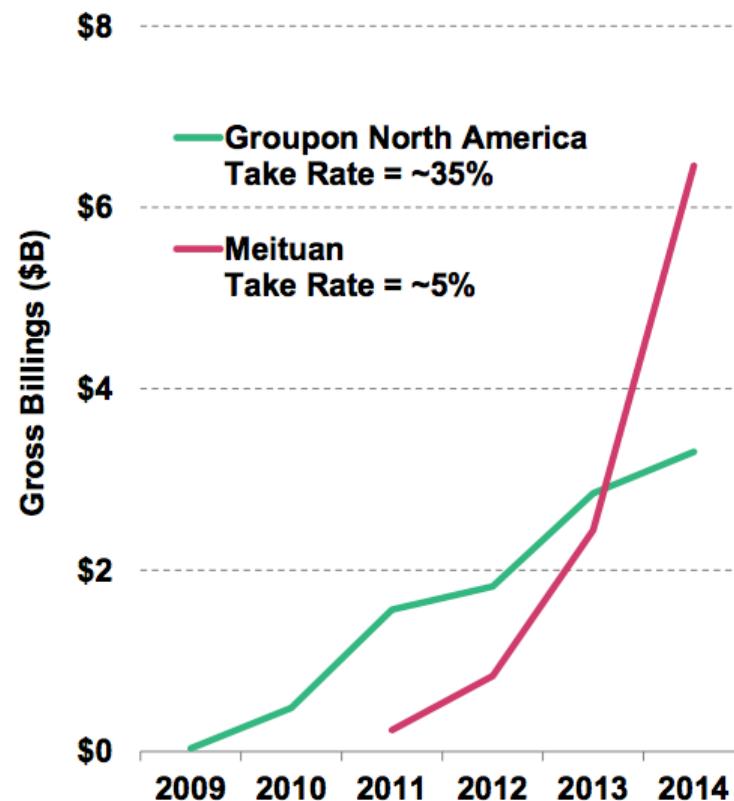


China E-Commerce = Low Take Rates* Helped China Marketplace Leaders Pass USA Peers

Gross Merchandise Value, 2004 – 2014
eBay vs. Alibaba (Taobao / Tmall)



Gross Billings, 2009 – 2014
Groupon N. America vs. Meituan



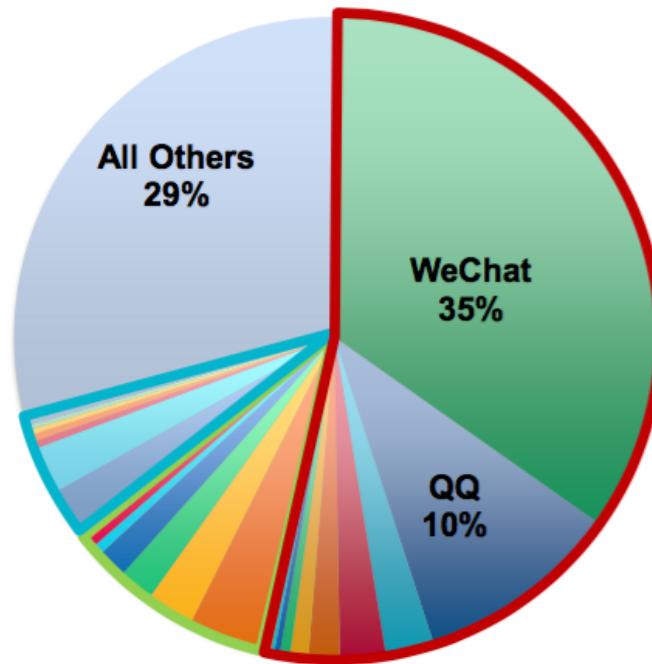
Source: Meituan gross billings data are estimates by Tuan800.com, eBay, Groupon, Alibaba GMV data per company.
Note: Take rate defined as net revenue divided by gross merchandise value or gross billings. eBay marketplace take rate excludes PayPal (~3%),
eBay, Alibaba GMV data per company. Meituan take rate is estimate per media report.

Hillhouse Capital
158

China Mobile Internet Usage Leaders...

Tencent + Alibaba + Baidu = 71% of Mobile Time Spent

Share of Mobile Time Spent, April 2016
Daily Mobile Time Spent = ~200 Minutes per User, Average



Tencent

- WeChat
- QQ
- QQ Browser
- Tencent Video
- Tencent News
- Tencent Games
- QQ Music
- JD.com
- QQ Reading

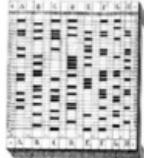
Alibaba

- UCWeb Browser
- Taobao
- Weibo
- YouKu Video
- Momo
- Shuqi Novel
- AliPay
- AutoNavi

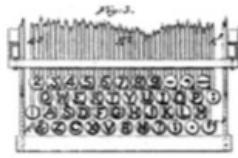
Baidu

- Mobile Baidu
- iQiyi / PPS Video
- Baidu Browser
- Baidu Tieba
- 91 Desktop
- Baidu Maps
- All Other

Human-Computer Interaction (1830s – 2015), USA = Touch 1.0 → Touch 2.0 → Touch 3.0 → Voice



Punch Cards for
Informatics
1832



QWERTY
Keyboard
1872



Electromechanical
Computer (Z3)
1941



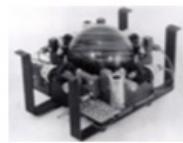
Electronic Computer
(ENIAC)
1943



Paper Tape Reader
(Harvard Mark I)
1944



Mainframe Computers
(IBM SSEC)
1948



Trackball
1952



Joystick
1967



Microcomputers
(IBM Mark-8)
1974



Portable Computer
(IBM 5100)
1975



Commercial Use of
Window-Based GUI
(Xerox Star)
1981



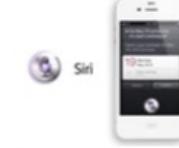
Commercial Use
of Mouse
(Apple Lisa)
1983



Commercial Use
of Mobile
Computing
(PalmPilot)
1996



Touch + Camera -
based Mobile
Computing
(iPhone 2G)
2007



Voice on Mobile
(Siri)
2011

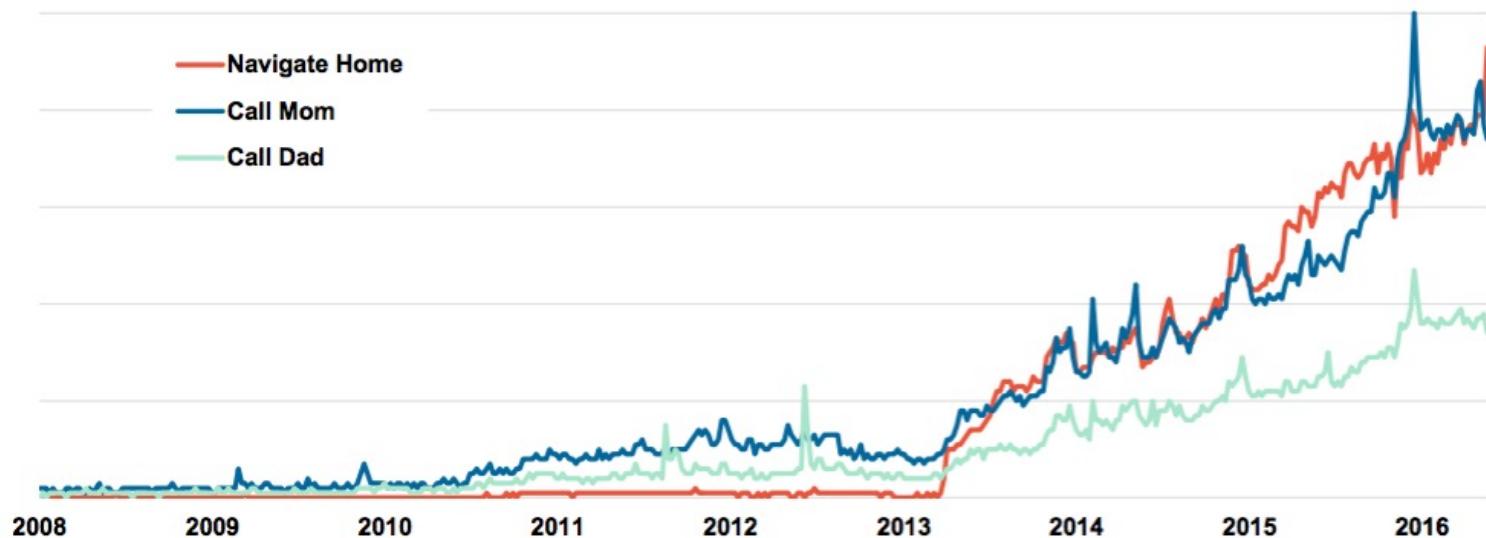


Voice on Connected /
Ambient Devices
(Amazon Echo)
2014

Google Voice Search Queries = Up >35x Since 2008 & >7x Since 2010, per Google Trends

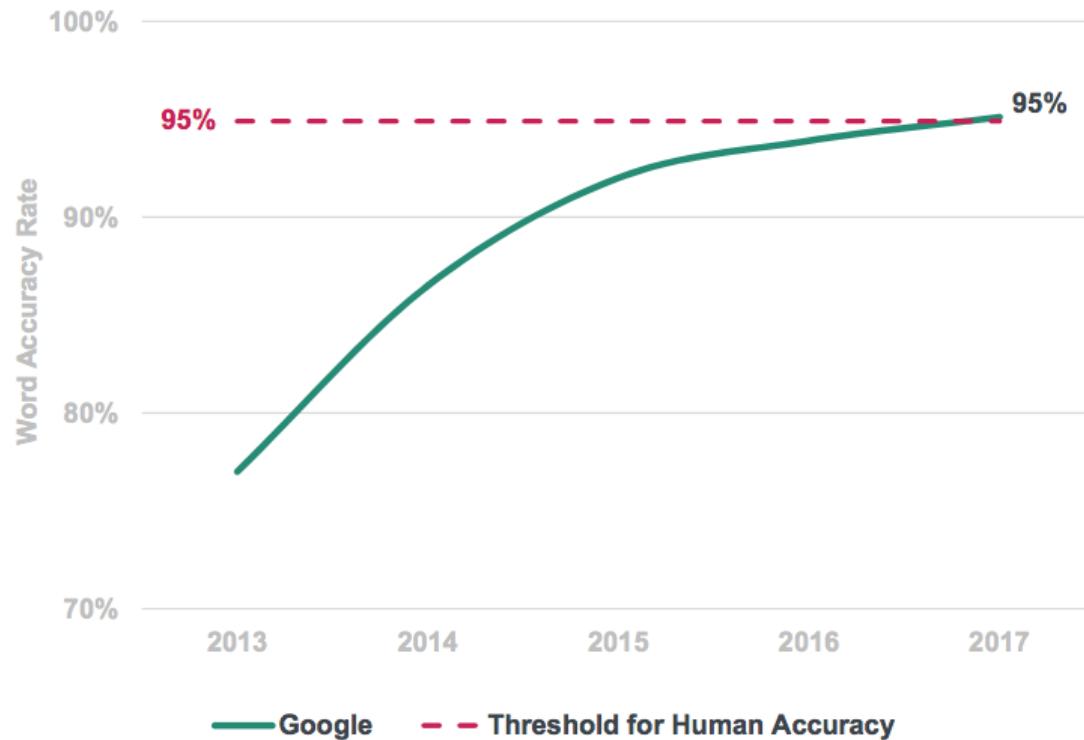
Google Trends imply queries associated with voice-related commands have risen >35x since 2008 after launch of iPhone & Google Voice Search

Google Trends, Worldwide, 2008 – 2016



Voice = Technology Lift Off...

Google Machine Learning Word Accuracy



Is it a Car...Is it a Computer?...

Is it a Phone...Is it a Camera?



Is it a Car...Is it a Computer?



...One Can...

Lock / Monitor / Summon One's Tesla from One's Wrist



Tesla Voice Commands

V10.2 Tesla Voice Commands

File Edit View Insert Format Data Tools Add-ons Help

View only

https://teslavoice.glideapp.io

1 Tesla Voice Commands - V10.2 and Beyond Add by using this form: https://forms.gle/eBugENRJDyvPiogh7

2 Updated 9:32pm CST, 1/14/2020 - 140 commands!

3 PLEASE NOTE: List updates occur at least once each day

4 Thanks for your patience as we take time to try out the submissions before adding them to the list.

5 Questions, concerns, corrections? Tweet to @LifeMiddle or email lifewithmiddle@gmail.com

6 System (Color Background=Six Only) Command Now Available as an app: Similar Commands

System (Color Background=Six Only)	Command	Similar Commands
7 Apps	Show/hide calendar	
8 Apps	Open Browser	Open/Close Web, Web, Web Browser
9 Apps	Show/hide charging screen	Show/Hide Charging
10 Apps	Open/Close Easter Eggs	
11 Apps	Open/Close Energy [App]	Open/Show Energy Graph
12 Apps	Open/Close Phone	
13 Apps	Open/Close Toybox	
14 Bug Reporting	[File] Bug report [brief description]	
15 Bug Reporting	Report Error	
16 Bug Reporting	Take a screenshot	
17 Car Controls	Adjust mirrors	Adjust Driver/left/My Mirror, Adjust right mirror (adjust position)
18 Car Controls	Adjust steering wheel	
19 Car Controls	Eject Passenger Seat	Turns passenger seat heater to high
20 Car Controls	Enable/Disable sentry mode	Keep Summer Safe, Keep Tesla Safe
21 Car Controls	Fold/Unfold mirrors	Open/Close Mirrors
22 Car Controls	Lock/unlock doors	Lock/Unlock
23 Car Controls	Lock/Unlock Windows	Turn window lock on/off, enable/disable window locks
24 Car Controls	My butt is cold	Surprisingly, "My butt is (too) hot" says it'll turn down the heat
25 Car Controls	Open/Close charge port door	Open Charge Port
26 Car Controls	Open/Close Internet	
27 Car Controls	Set (XXX) Seat Heater to (YYY)	Set XXX seat [heat] 1 (2 or 3) bacon
28 Car Controls	Set front seats to YYY	
29 Car Controls	Set rear seats to YYY	
30 Car Controls	Set wipers [to] auto /1/2/3/4	[Turn windshield] wipers (auto/on/off/medium/high)
31 Car Controls	Show Homellink Settings	
32 Car Controls	Show Wi-Fi [Settings]	
33 Car Controls	Show/Close Backup/Rear Camera	
34 Car Controls	Show/Close Bluetooth	

Commands List

2:31 Categories

Apps (7)

Bug Reporting (3)

Car Controls (34)

Car Info (3)

Configuration (11)

Easter Eggs (3)

Future (12)

Games (2)

HVAC (24)

Interior Controls (3)

Media (11)

Model S and X Only (1)

Navigation (12)

Categories Commands What's New Submit

Scan with camera to install app. Learn how.

Tesla Voice Commands

by Pirin

Crowdsourced reference of Voice Commands discovered in latest versions of Tesla OS

SHARE APP

MAKE YOUR OWN APP WITH glide.

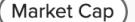
<https://teslavoice.glideapp.io/>

Global Market Capitalization Leaders = USA Stable @ 23 of 30...Technology Stable @ 9 of 30

Rank 2019	Company	Sector	Region	Market Cap Value (\$B)		
				6/7/19	6/7/16	% Change
1	Microsoft	Technology	USA	\$1,007B	\$410B	+146%
2	Amazon	Technology	USA	888	343	+159%
3	Apple	Technology	USA	875	540	+62%
4	Alphabet	Technology	USA	741	497	+49%
5	Berkshire Hathaway	Financial Services	USA	505	350	+44%
6	Facebook	Technology	USA	495	340	+46%
7	Alibaba	Technology	China	402	195	+106%
8	Tencent	Technology	China	398	206	+93%
9	Visa	Financial Services	USA	372	192	+94%
10	Johnson & Johnson	Healthcare	USA	368	318	+16%
11	JPMorgan	Financial Services	USA	354	239	+48%
12	Exxon Mobil	Energy	USA	316	371	(15%)
13	Nestlé	Food / Beverages	Switzerland	306	230	+33%
14	Walmart	Retail	USA	303	221	+37%
15	ICBC	Financial Services	China	285	224	+27%
16	Procter & Gamble	Home Goods	USA	273	220	+24%
17	Mastercard	Financial Services	USA	271	106	+156%
18	Bank of America	Financial Services	USA	262	149	+76%
19	Royal Dutch Shell	Energy	Netherlands	259	198	+31%
20	Samsung	Technology	South Korea	249	166	+50%
21	Disney	Media	USA	248	160	+55%
22	Cisco	Technology	USA	239	146	+64%
23	Pfizer	Pharmaceuticals	USA	238	212	+12%
24	AT&T	Telecom	USA	237	242	(2%)
25	Verizon	Telecom	USA	237	207	+15%
26	UnitedHealth	Healthcare	USA	235	131	+79%
27	Roche	Healthcare	Switzerland	233	224	+4%
28	Chevron	Energy	USA	231	191	+21%
29	Coca-Cola	Food / Beverages	USA	220	196	+12%
30	Home Depot	Retail	USA	217	161	+35%
Total				\$11,264	\$7,385	

Largest Companies by Marketcap

Companies: 10,642 total market cap: \$139.212 T  

Rank by        

Rank	Name	Market Cap	Price	Today	Price (30 days)	Country
1	 NVIDIA NVDA	\$ 4.458 T	\$183.14	▼ 1.44%		USA
2	 Alphabet (Google) GOOG	\$ 4.059 T	\$336.31	▼ 0.03%		USA
3	 Apple AAPL	\$ 3.841 T	\$259.96	▼ 0.42%		USA
4	 Microsoft MSFT	\$ 3.414 T	\$459.38	▼ 2.40%		USA
5	 Amazon AMZN	\$ 2.529 T	\$236.65	▼ 2.45%		USA
6	 TSMC TSM	\$ 1.696 T	\$327.11	▼ 1.24%		Taiwan
7	 Broadcom AVGO	\$ 1.611 T	\$339.89	▼ 4.15%		USA
8	 Saudi Aramco 2222.SR	\$ 1.610 T	\$6.66	▲ 0.24%		S. Arabia
9	 Meta Platforms (Facebook) META	\$ 1.551 T	\$615.52	▼ 2.47%		USA
10	 Tesla TSLA	\$ 1.460 T	\$439.20	▼ 1.79%		USA

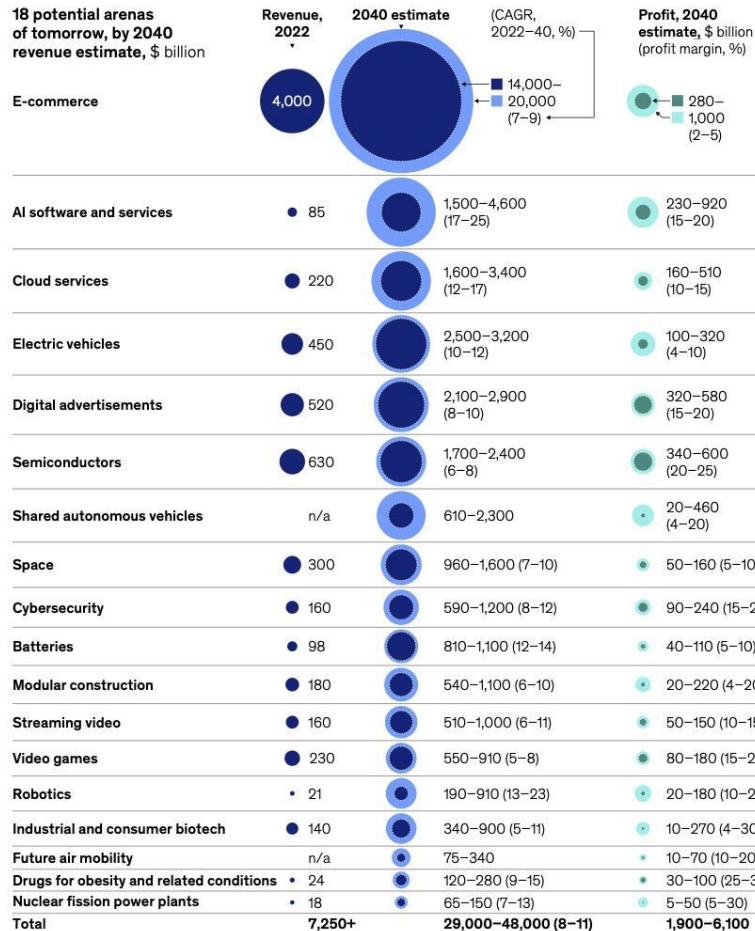
USA = Many Highly Valued Private Tech Companies Founded By... 1st Generation Immigrants

Company	Founder / Co-Founder	Country of Origin	Valuation (\$B)
WeWork	Adam Neumann	Israel	\$47B
SpaceX	Elon Musk	South Africa	31
Stripe	John Collison Patrick Collison	Ireland	23
Palantir	Peter Thiel	Germany	21
Epic Games	Mark Rein	Canada	15
DoorDash	Tony Xu	China	13
Wish	Peter Szulczewski Danny Zhang	Canada	9
Instacart	Apoorva Mehta	India	8
Slack	Stewart Butterfield Serguei Mourachov Cal Henderson	Canada Russia UK	7
UiPath*	Daniel Dines Marius Tirca	Romania	7
Tanium	David Hindawi	Iraq	7
Unity Technologies	David Helgason Nicholas Francis Joachim Ante	Iceland Denmark Germany	6
Robinhood	Baiju Bhatt Vlad Tenev	India Bulgaria	6
Compass	Ori Allon	Israel	4
Credit Karma	Kenneth Lin	China	4
Houzz	Adi Tatarko Alon Cohen	Israel	4
Snowflake	Marcin Zukowski Benoit Dageville Thierry Cruanes	Netherlands France France	4
Rubrik	Bipul Sinha Arvind Nithrakashyap Arvind Jain Soham Mazumdar	India India India	3
Zoox	Tim Kentley-Klay	Australia	3
Oscar Health	Mario Schlosser	Germany	3

Company	Founder / Co-Founder	Country of Origin	Valuation (\$B)
Crowdstrike	Dmitri Alperovitch	Russia	\$3B
Affirm	Max Levchin	Ukraine	3
Databricks	Ali Ghodsi Matei Zaharia Ion Stoica	Sweden Romania Romania	3
Nuro	Jiajun Zhu Dave Ferguson	China New Zealand	3
Automation Anywhere	Ankur Kothari Mihir Shukla Neeti Metha Shukla Rushabh Parm	India India India India	3
Confluent	Jun Rao Neha Narkhede	China India	3
Roblox	David Baszucki	Canada	2
Medallia	Borge Hald	Norway	2
Lime	Toby Sun Brad Bao	China	2
Zume Pizza	Alex Garden	Canada	2
Gusto	Tomer London	Israel	2
Lemonade	Shai Winingger Daniel Schreiber	Israel	2
LegalZoom	Brian Lee	South Korea	2
Avant	Al Goldstein John Sun	Uzbekistan China	2
Apttus	Paul Zhang Krik Krappe	China UK	2
Postmates	Bastian Lehmann	Germany	2
Sprinklr	Ragy Thomas	India	2
Cloudflare	Michelle Zatlyn	Canada	2
Carta	Manu Kumar	India	2
ZocDoc	Oliver Kharraz	Germany	2
Warby Parker	Dave Gilboa	Sweden	2
Carbon3D	Alex Ermoshkin	Russia	2
Pony.ai	James Peng Tiancheng Lo	China	2
ServiceTitan	Ara Mahessian	Iran	2
Segment	Vahe Kuzoyan	Armenia	2
Quanergy	Ilya Volodarsky Tianyue Yu	Russia China	2

Source for Valuation & Founders Backgrounds: Based on analysis by Pitchbook, Wall Street Journal, CB Insights, Forbes, Business Insider, & the National Foundation for American Policy. *UiPath is headquartered in New York, NY but was originally founded in Romania.

The 18 potential arenas of tomorrow could generate \$29 trillion to \$48 trillion in revenues and \$2 trillion to \$6 trillion in profits.



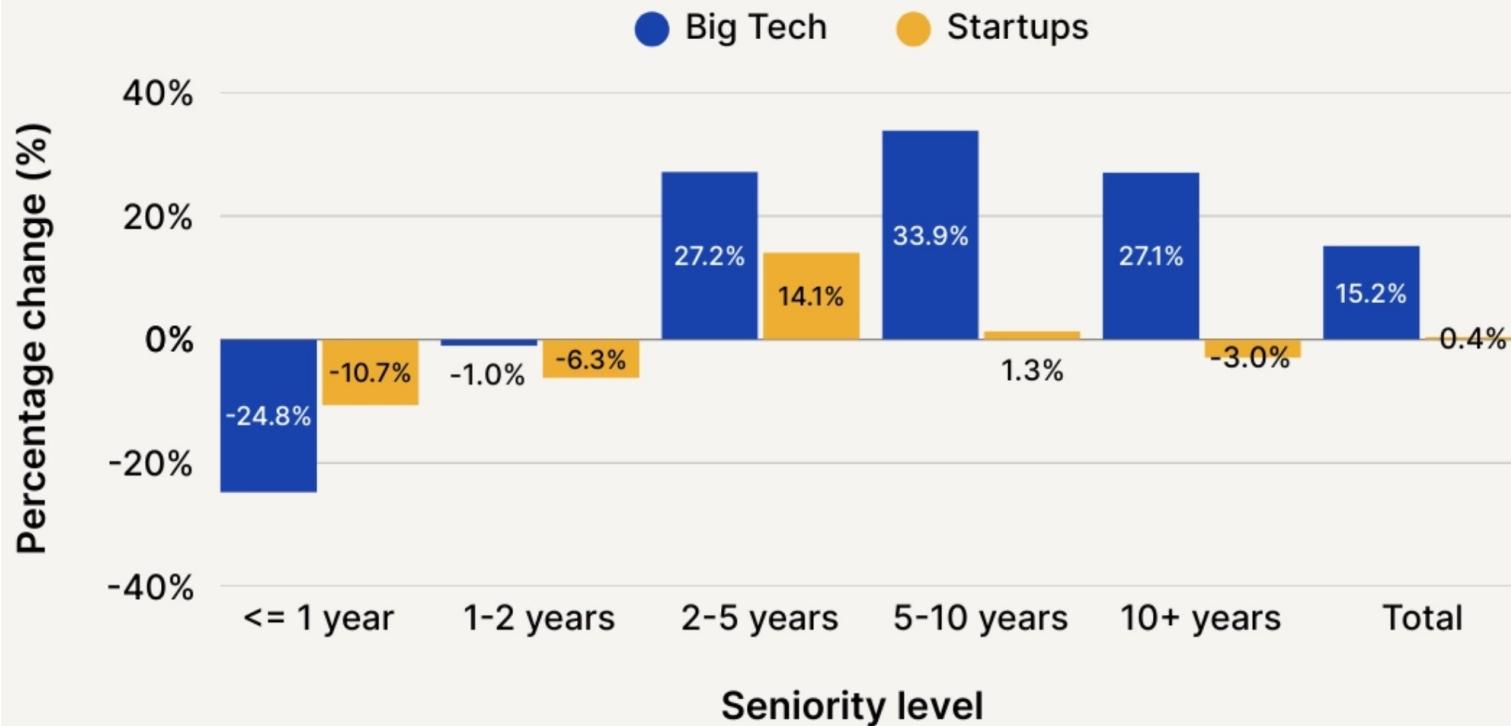
Source: The next big arenas of competition, McKinsey Global Institute, October 2024



<https://www.signalfire.com/blog/signalfire-state-of-talent-report-2025>

New grads left behind: Entry-level tech hiring fell 25% in 2024 despite market recovery

Percentage change in number of new hires by seniority (2023-2024)



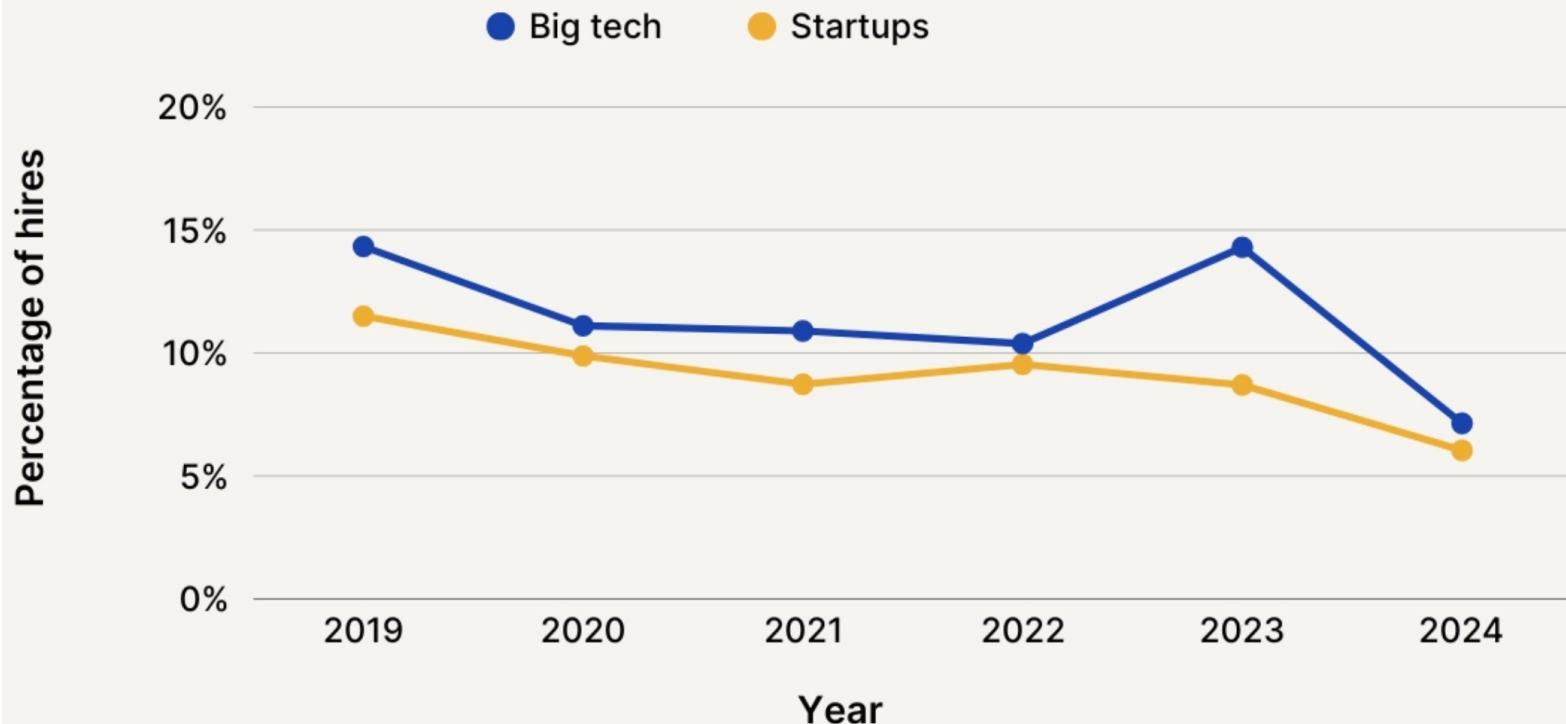
*Big tech represents the top 15 technology companies by market cap.

*Startups represents companies funded by the Top 100+ VC firms that closed a Seed through Series C round in the previous 4 years.

 SignalFire

Gen Z squeeze: Entry-level share of hires down 50% from pre-pandemic levels

Percentage of new hires with one year or less of total experience at time of hire.



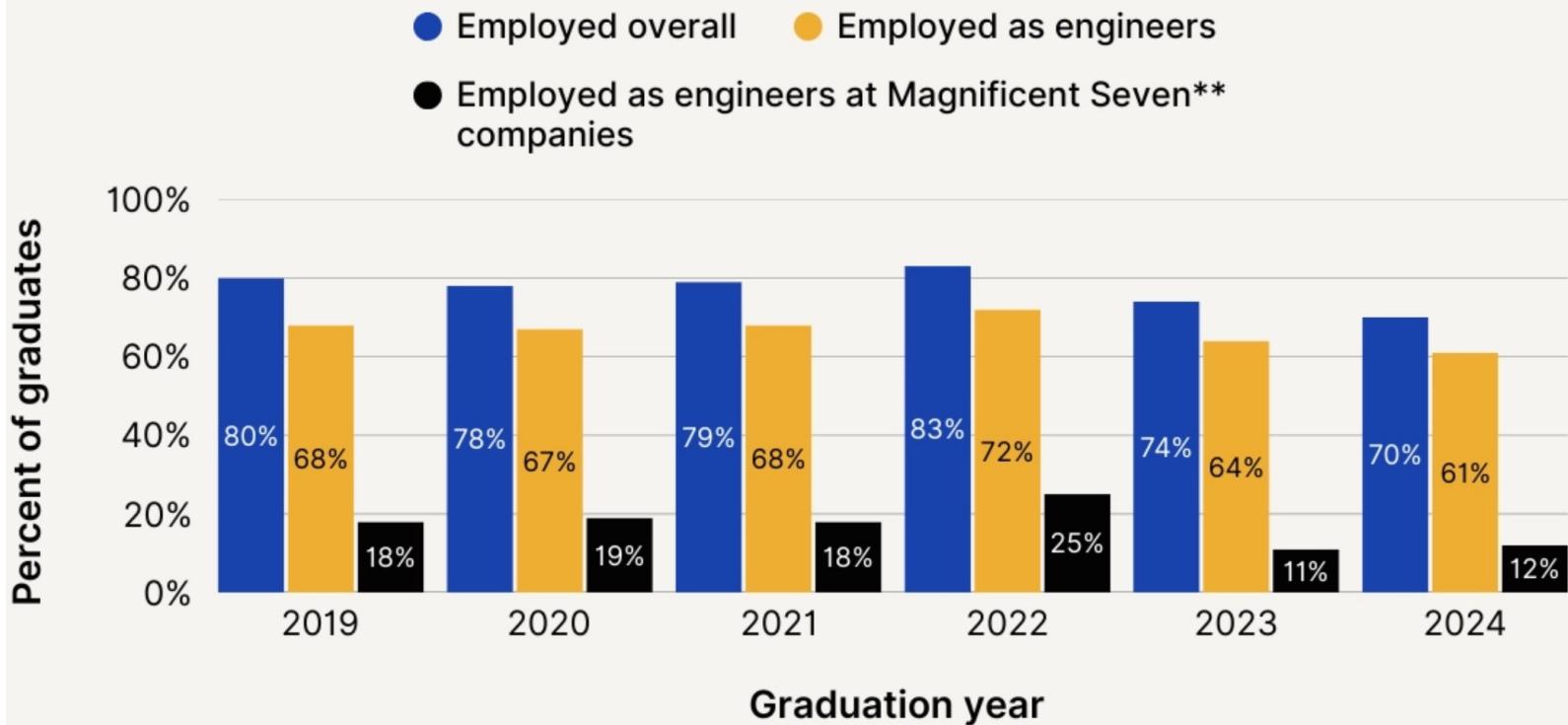
*Big tech represents the top 15 technology companies by market cap.

*Startups represents companies funded by the top 100+ VC firms that closed a Seed through Series C round in the previous 4 years.

SignalFire

Post-peak reality: Top computer science grads are struggling to land jobs—dream roles are even rarer

Share of graduates of top CS programs* employed 6 months after graduation



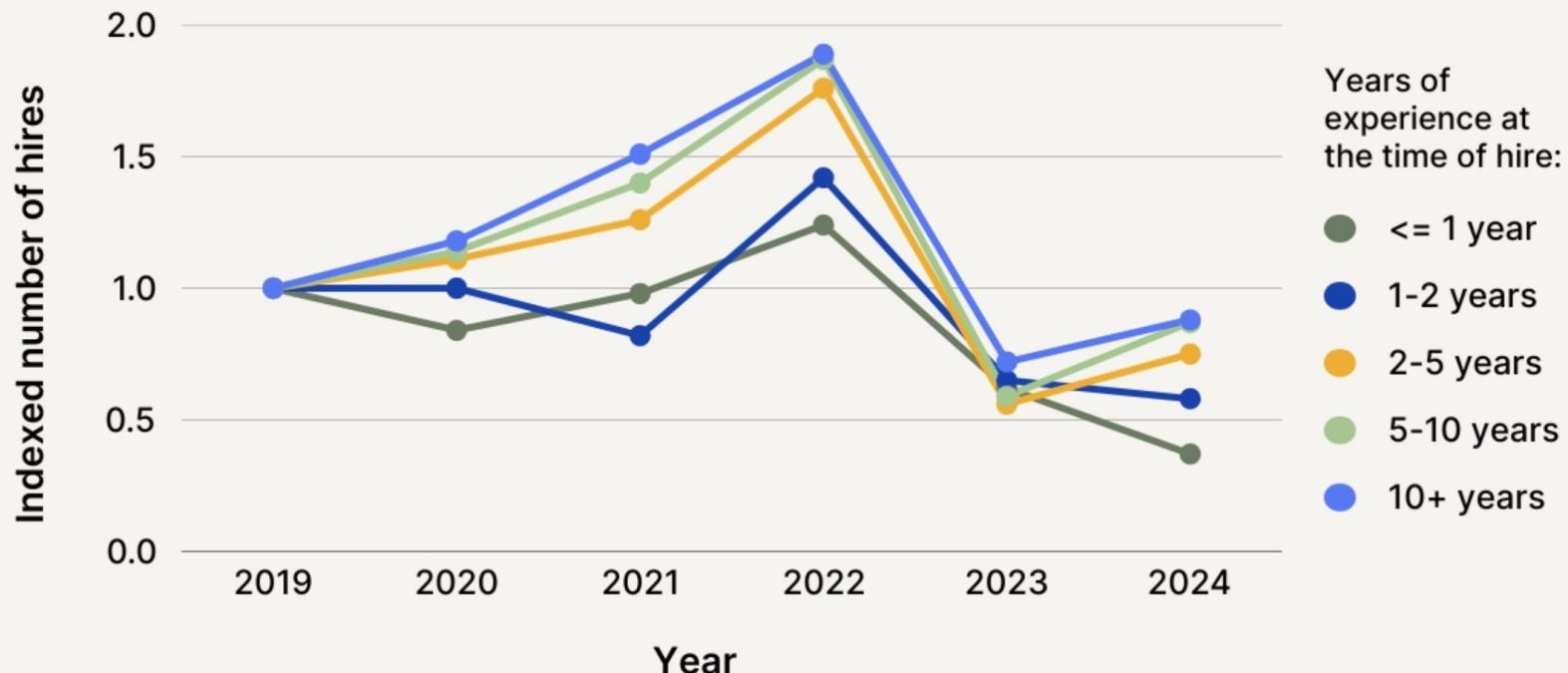
*Based on CS graduates from the top 20 engineering programs in the U.S. based on the *U.S. News' Best Undergraduate Engineering Programs Rankings*.

**Magnificent Seven (MAG7) companies include Alphabet, Amazon, Apple, Meta Platforms, Microsoft, NVIDIA, and Tesla.

 SignalFire

Big Tech: 2023 hiring crash hits all levels 2024 rebound favors seniors, while new grads get left behind

Indexed new hire count from 2019-2024 shows Big Tech slashed early-career hires, but cautiously rehired mid-career employees and senior execs.

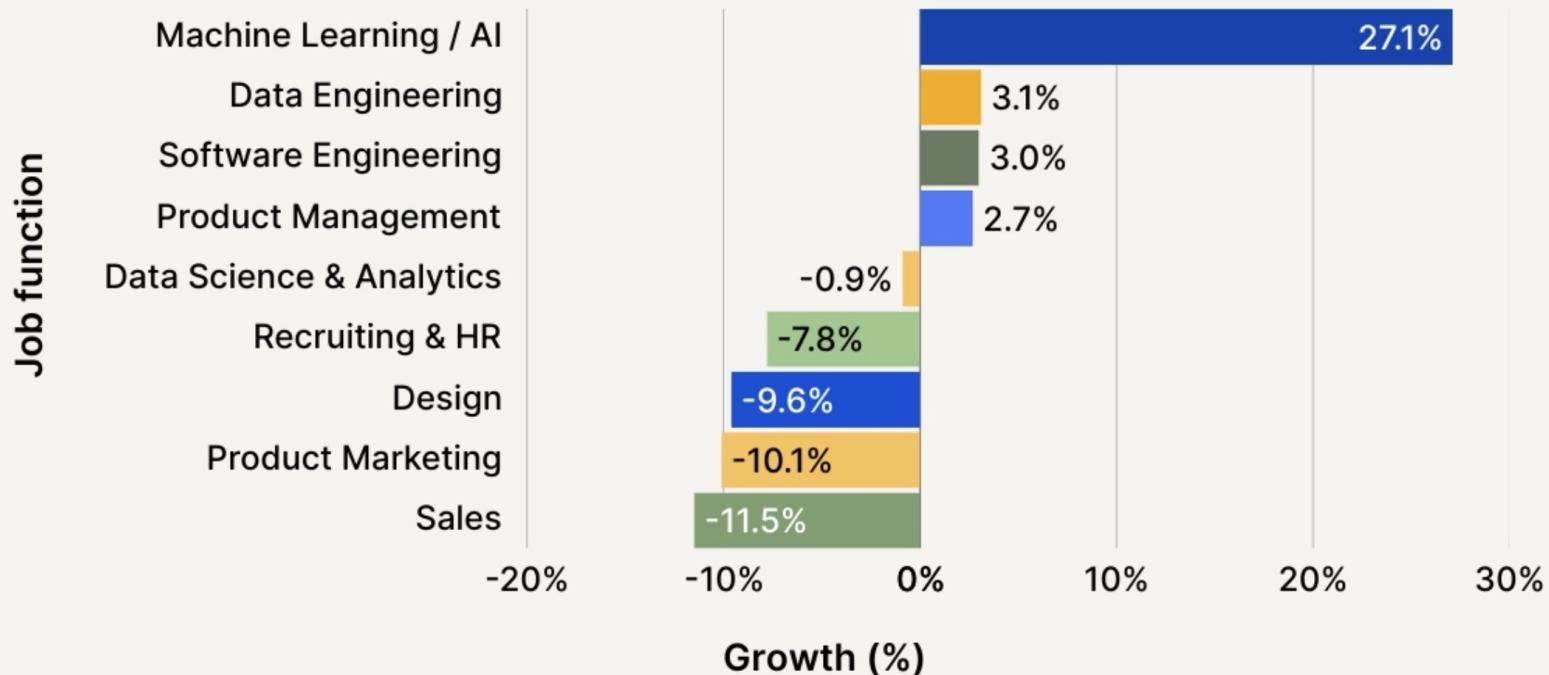


*This graph only includes employees of the top 15 technology companies by market cap.

SignalFire

AI surge reshapes hiring: Big Tech prioritizes technical roles, slows GTM hiring

2023 vs. 2024: Big Tech hiring change by job function

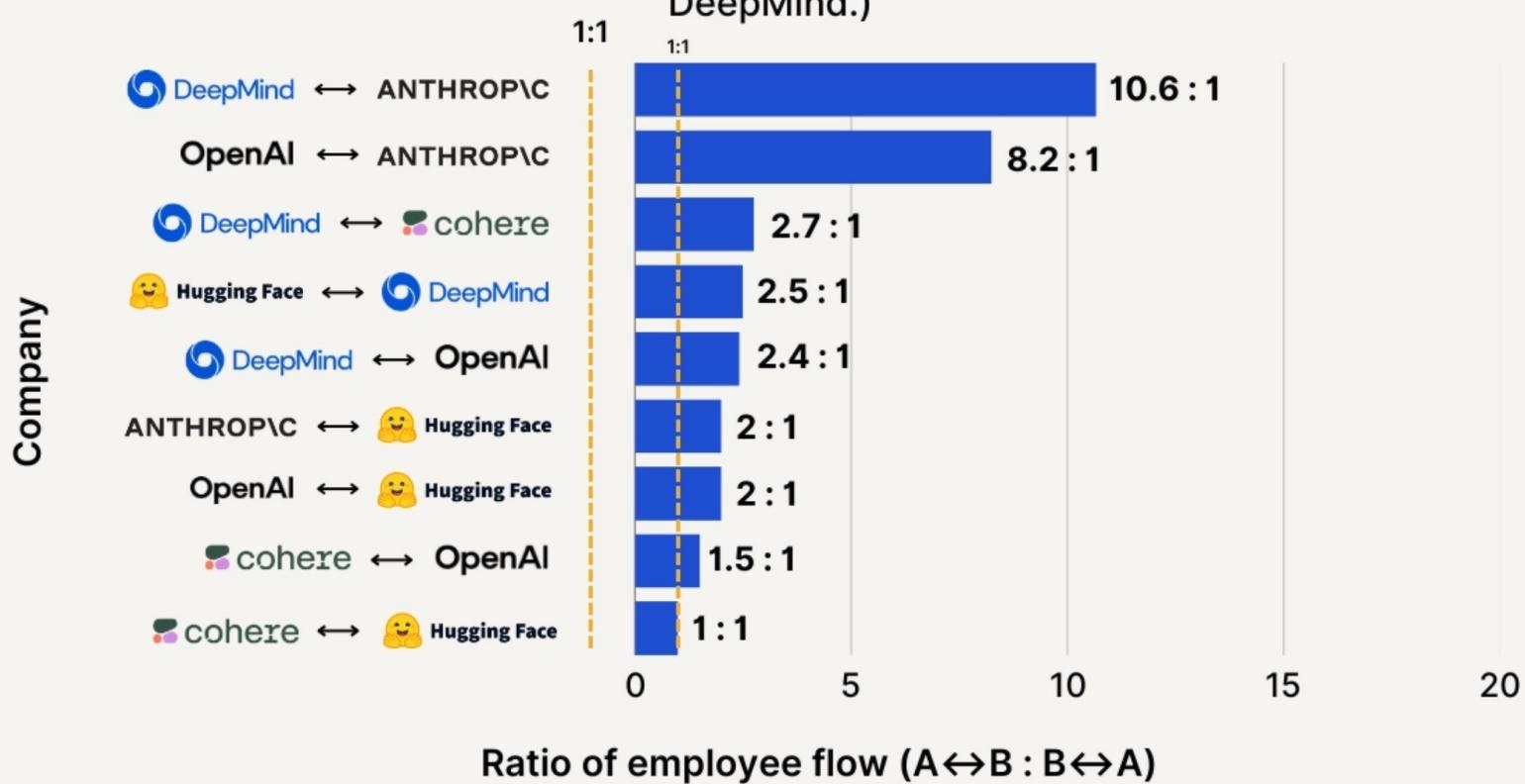


*Big tech represents the top 15 technology companies by market cap.

SignalFire

AI's talent shuffle: Mapping the movement between top AI labs

Bidirectional movement between major AI labs. (For example, for every 10.6 DeepMind employees that moved to Anthropic, 1 Anthropic employee moved to DeepMind.)



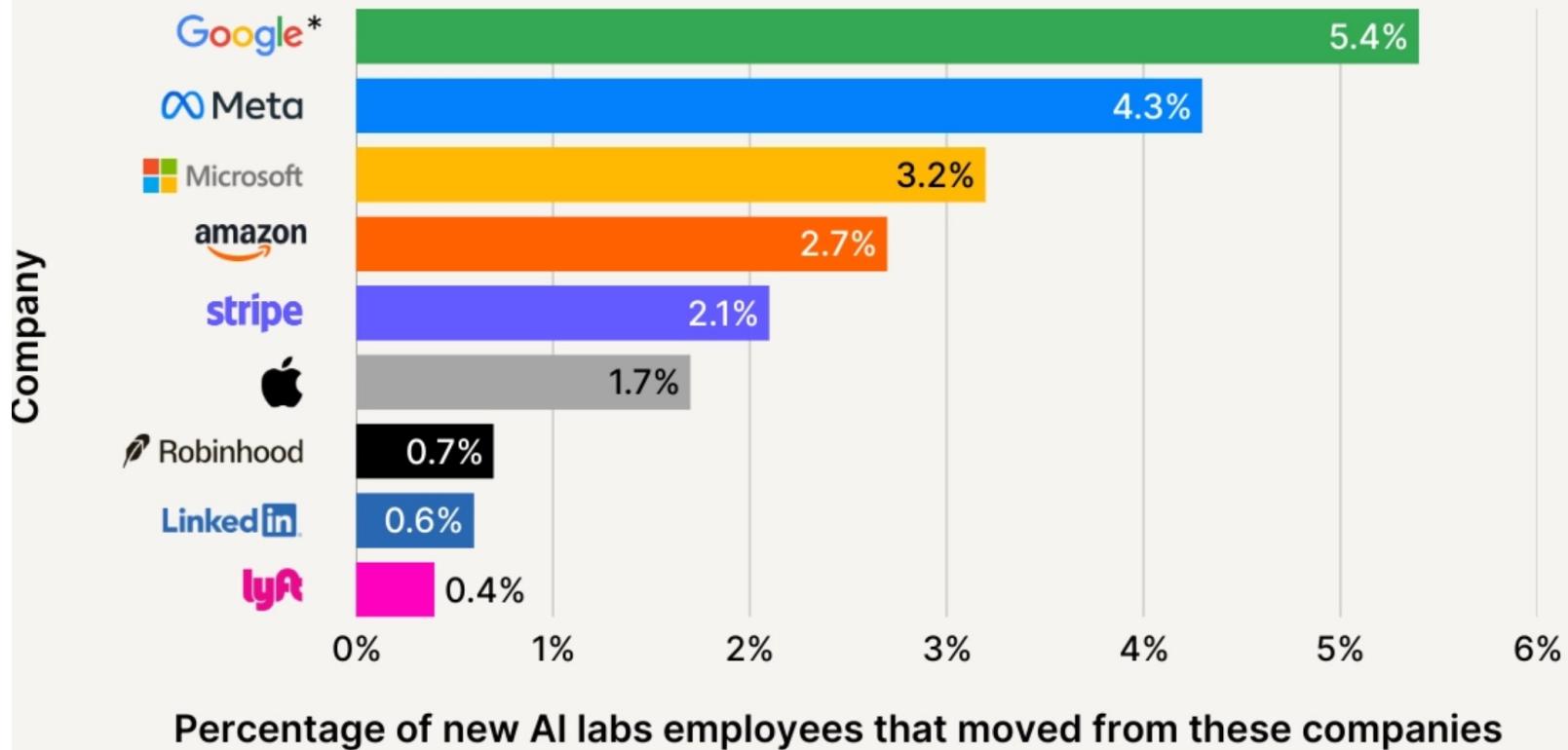
*This graph shows the ratios of bidirectional movement between the top AI labs.

*We excluded newer AI labs (e.g., DeepSeek and xAI/Grok) from our analysis because they were not in operation for the whole of 2024.

 **SignalFire**

Which tech giants are losing their best talent to AI labs?

AI labs are poaching top talent from Big Tech, with Google, Meta, Amazon, and Microsoft as prime targets.



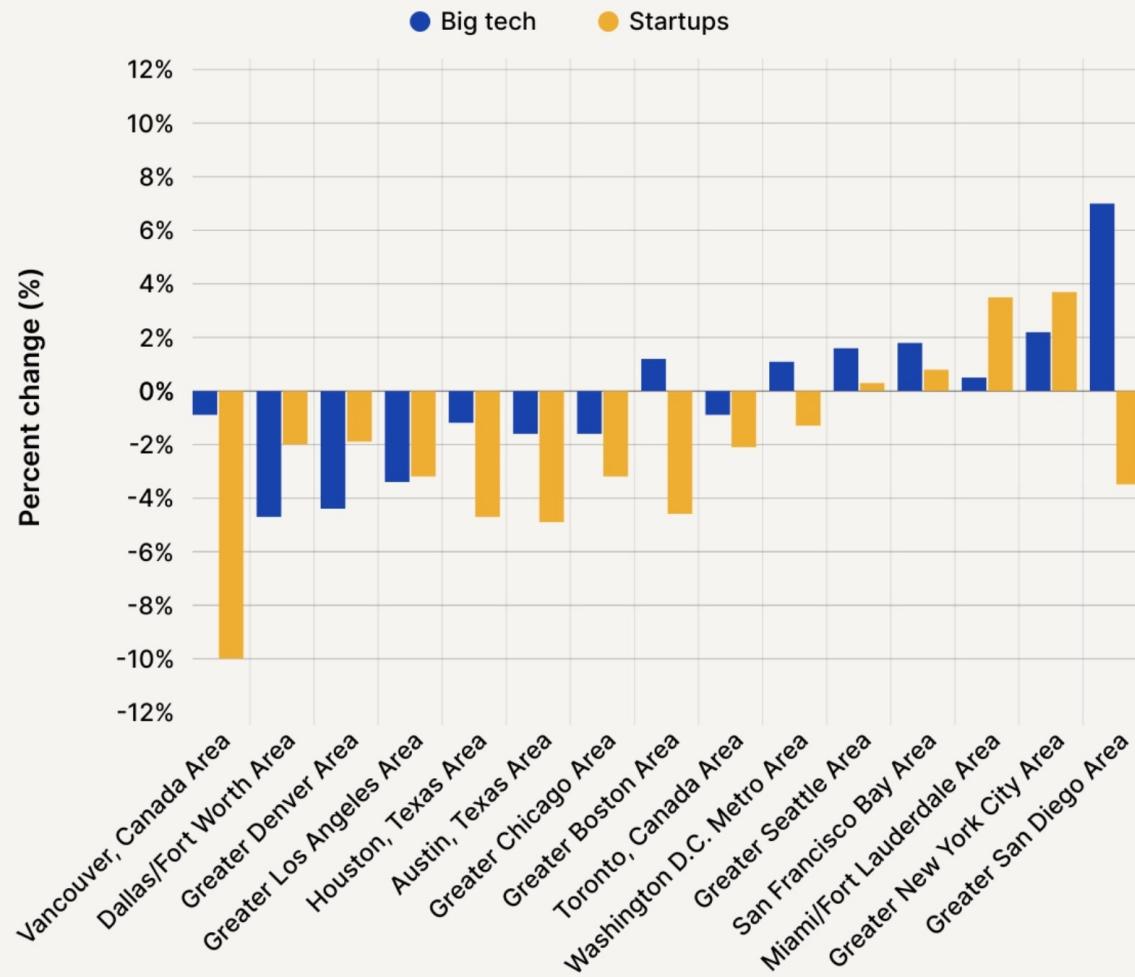
*Google (not including Deepmind)

This graph shows the previous employers of AI lab joiners in 2024 (percentage of total).

*Exclusions: We excluded some newer AI labs as we didn't have complete data for 2024.

Big hubs gain jobs as startup team size shrinks; Miami and San Diego defy this trend

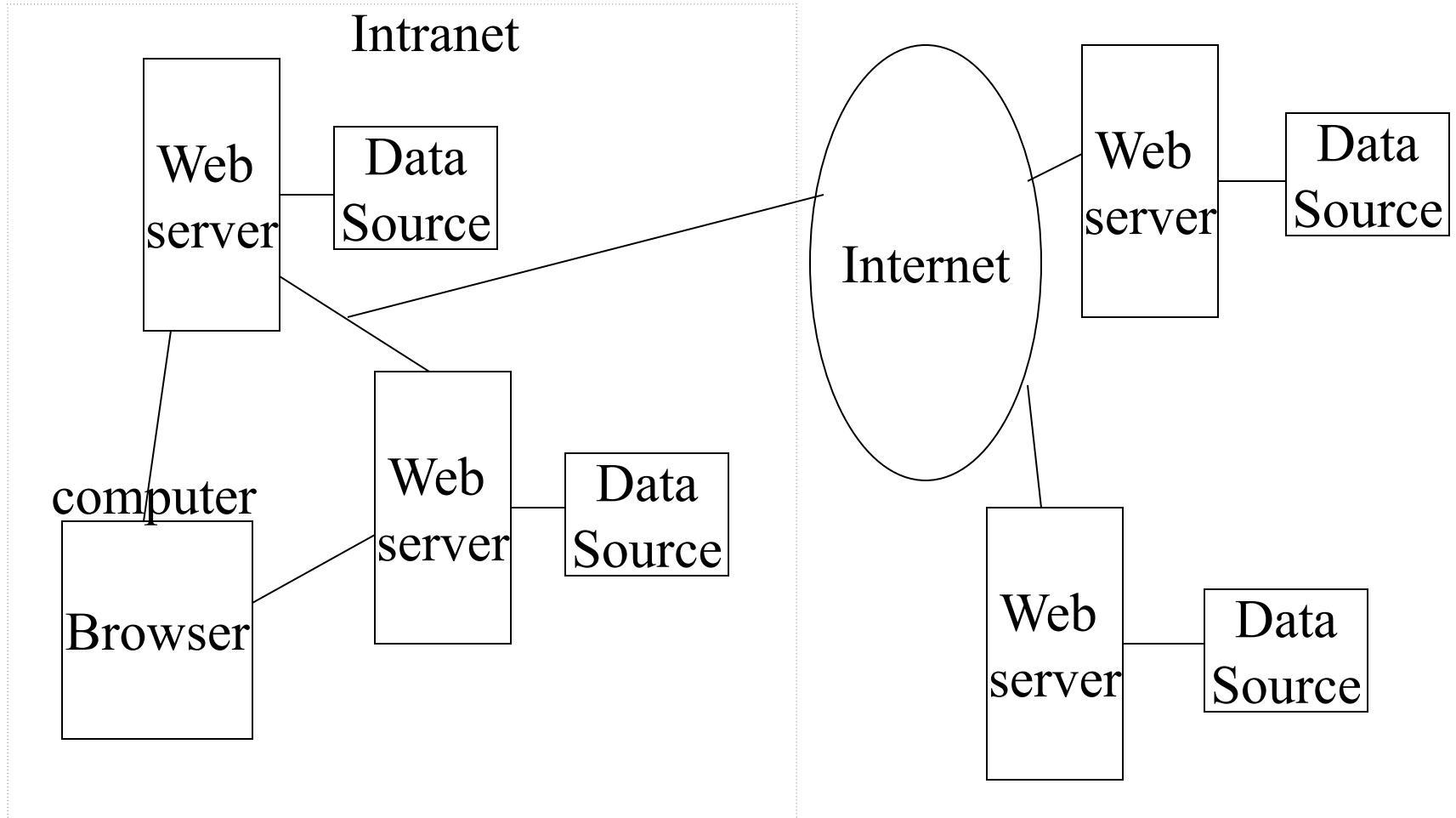
YoY growth in big tech and startup employment in (2024 vs. 2023)



The World Wide Web (WWW)

- Material relevant to exams starts HERE with this slide.

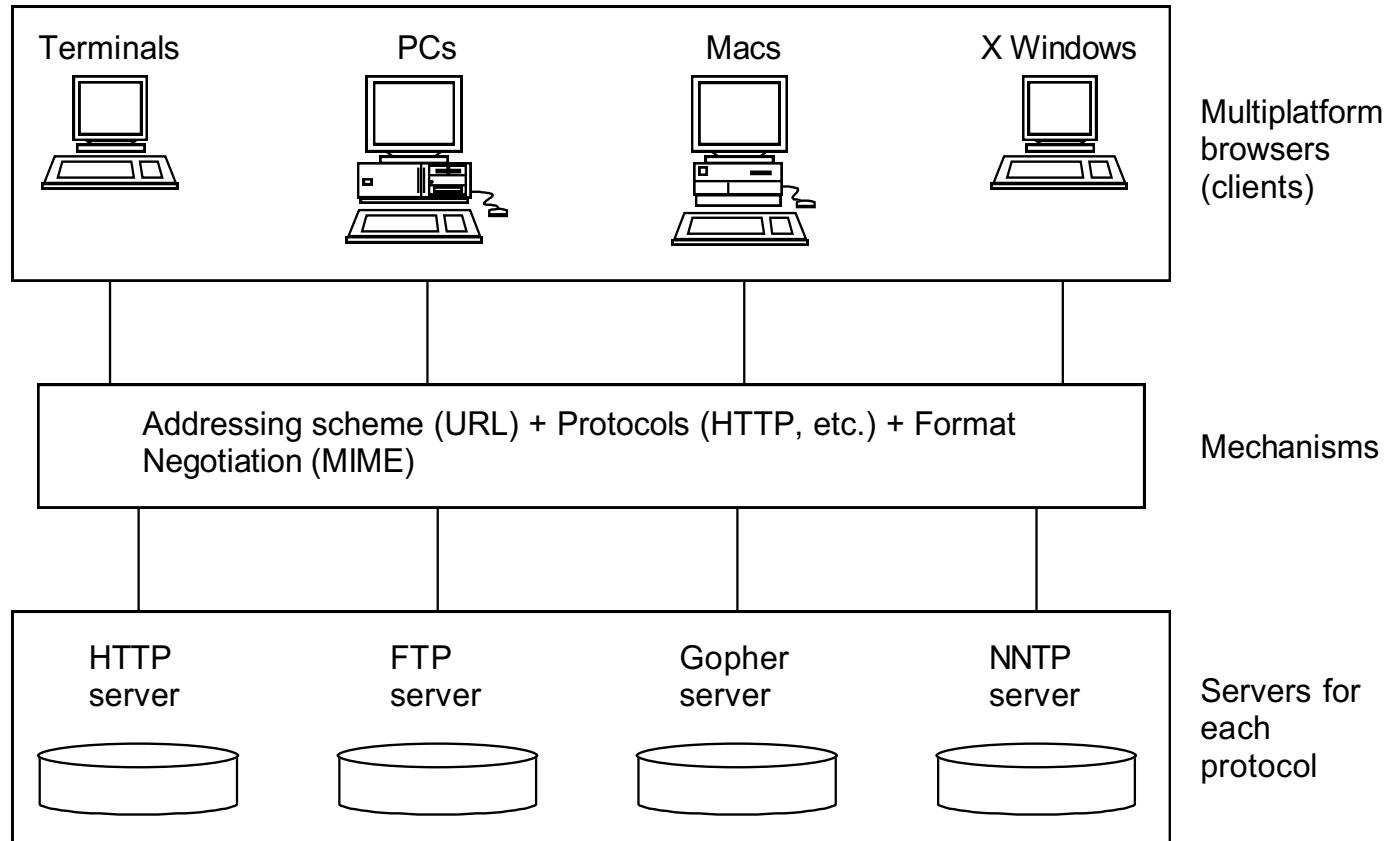
Graphical View of the WWW



Major Technology Components

- **Client/server architecture**
 - where client programs interact with web servers
- **Network protocol**
 - HTTP, Hypertext Transfer Protocol, is the language understood by browsers and web servers
 - designed to move quickly from document to document
- **Addressing system** (Uniform Resource Locators)
 - `http://domain/directory/file.html`
- **Markup Language**
 - every web server understands and every browser displays
 - includes support for HyperText and multimedia

Client/Server Architecture Model



The WWW Server

- Web browsers and Web servers communicate according to a protocol known as HTTP (HyperText Transfer Protocol)
 - The current HTTP protocol is version 2.0
- The Web server is a software system running on a machine often called the Web server, don't confuse them
- A web server can
 - receive and reply to HTTP requests
 - retrieve documents from specified directories
 - run programs in specified directories
 - handle limited forms of security
- A web server does not
 - know about the contents of a document, links in a document, images in a document or whether a particular file, e.g. a *.gif file, is in the correct format

Uniform Resource Locator (URL)

- A mechanism whereby an Internet resource can be specified in a single line of ASCII text
- See **RFC 1738**: <http://www.faqs.org/rfcs/rfc1738.html>

URL

Refers to:

file:///pub/xt.ps

a PostScript file in directory pub on your local machine

ftp://usc.edu/docs/sweng.txt

file sweng.txt in directory docs on usc.edu, an anonymous ftp site

http://nunki.usc.edu/mydocs/book.doc

a file in directory mydocs on machine nunki.usc.edu, a WWW site

news:comp.compilers

the newsgroup computers.compilers

mailto:horowitz@usc.edu

an e-mail address

General Description of a URL

1. **Scheme** followed by a colon http:, ftp:, news:, mailto:, wais:, telnet:
2. **Double slash** (optional. Required for http, ftp) //
3. Internet **domain** name e.g., www.usc.edu
4. **Port** number (optional; e.g., www.usc.edu:8081)
Standard or default port numbers:

---	ftp is 21	gopher is 70
---	telnet is 23	http is 80
---	smtp is 25	nntp is 119
---	imap is 143	secure nntp is 563
---	pop3 is 110	secure pop3 is 995
5. **Path** e.g., /pub/docs

URL Character Set

- RFC 1738, Dec. 1994 defines the URL character set as
"...Only alphanumerics [0-9a-zA-Z], the special characters "\$-_.+!*'()", **[not including the quotes]**, and reserved characters used for their reserved purposes may be used unencoded within a URL."
- However, HTML supports ISO-8859-1 (ISO-Latin) character set
 - HTML 4.x extends the character set to all of Unicode
- Therefore, in URLs an escape mechanism is used, % followed by two hex digits
- Characters that should be encoded include:
%, /, ., . ., #, ?, :, \$, +, @, &, =
- Here are some encoded values for so-called “unsafe” characters

~	%7E		%7C
SPACE	%20	\	%5C
%	%25	^	%5E
&	%26	[%5B
=	%3D]	%5D
?	%3F	#	%23
{	%7B	>	%3E
}	%7D	<	%3C

Markup Languages

- HTML - hypertext markup language, specifies document layout and the specification of hypertext links to text, graphics and other types of objects
- Browsers display text and graphics using the markup as guidance
- However, HTML is *not* like a word processing program, e.g., Microsoft Word or WordPerfect, and *not* like a page description languages, e.g., postscript
 - as a result, translation into HTML can produce a result that does not look exactly like the original

Hypertext vs Hyperlinking

- **Hypertext:**
 - Text containing embedded links to other text or resources
 - Enables non-linear navigation within documents or across the web
 - Example: Clickable words or phrases within a webpage
- **Hyperlinking:**
 - The mechanism or action of connecting one resource to another
 - Provides pathways for navigation
 - Example: A clickable link that takes you to another page
- **Analogy:**
 - Hypertext is the content; Hyperlinking is the connection

Apple's Role in Hypertext

- 1987 - **Apple HyperCard** introduced hypertext navigation in local documents
- HyperCard allowed users to create 'stacks' of interactive cards with links
- Early hypertext systems enabled non-linear document navigation offline
- Modern macOS uses hypertext in Help systems, Notes, and local PDFs
- Apple helped popularize hypertext well before the modern web

Hypertext: Historical Timeline

1945 - Vannevar Bush proposes Memex, a conceptual hypertext system

1965 - Ted Nelson coins the term 'Hypertext'

1987 - Apple releases HyperCard, bringing hypertext to personal computers

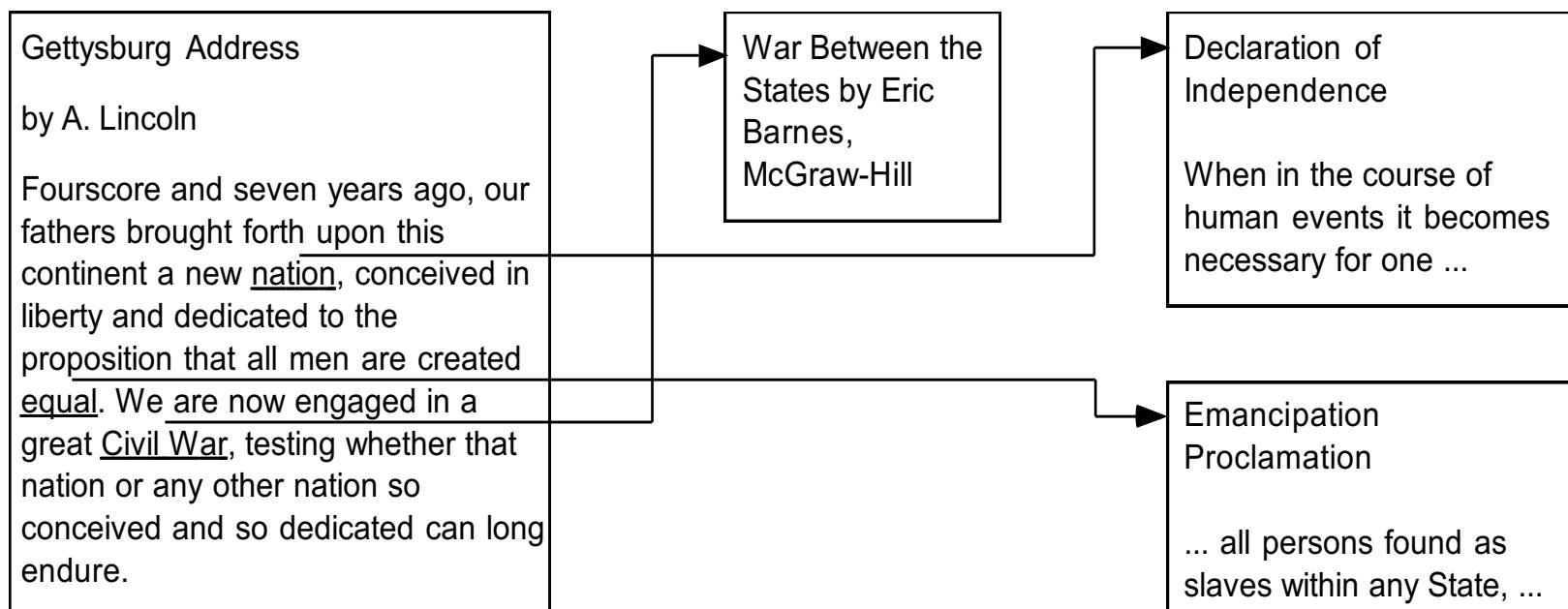
1989 - Tim Berners-Lee proposes the World Wide Web using hypertext principles

1993 - Mosaic browser popularizes hypertext-based web navigation

Today - Hypertext exists on websites, apps, and local documents

What is HyperText on the Web?

- Regular text, with the additional feature of hyperlinks to related documents (resources)
- As you read documents and follow links, you traverse a “web” of interconnections

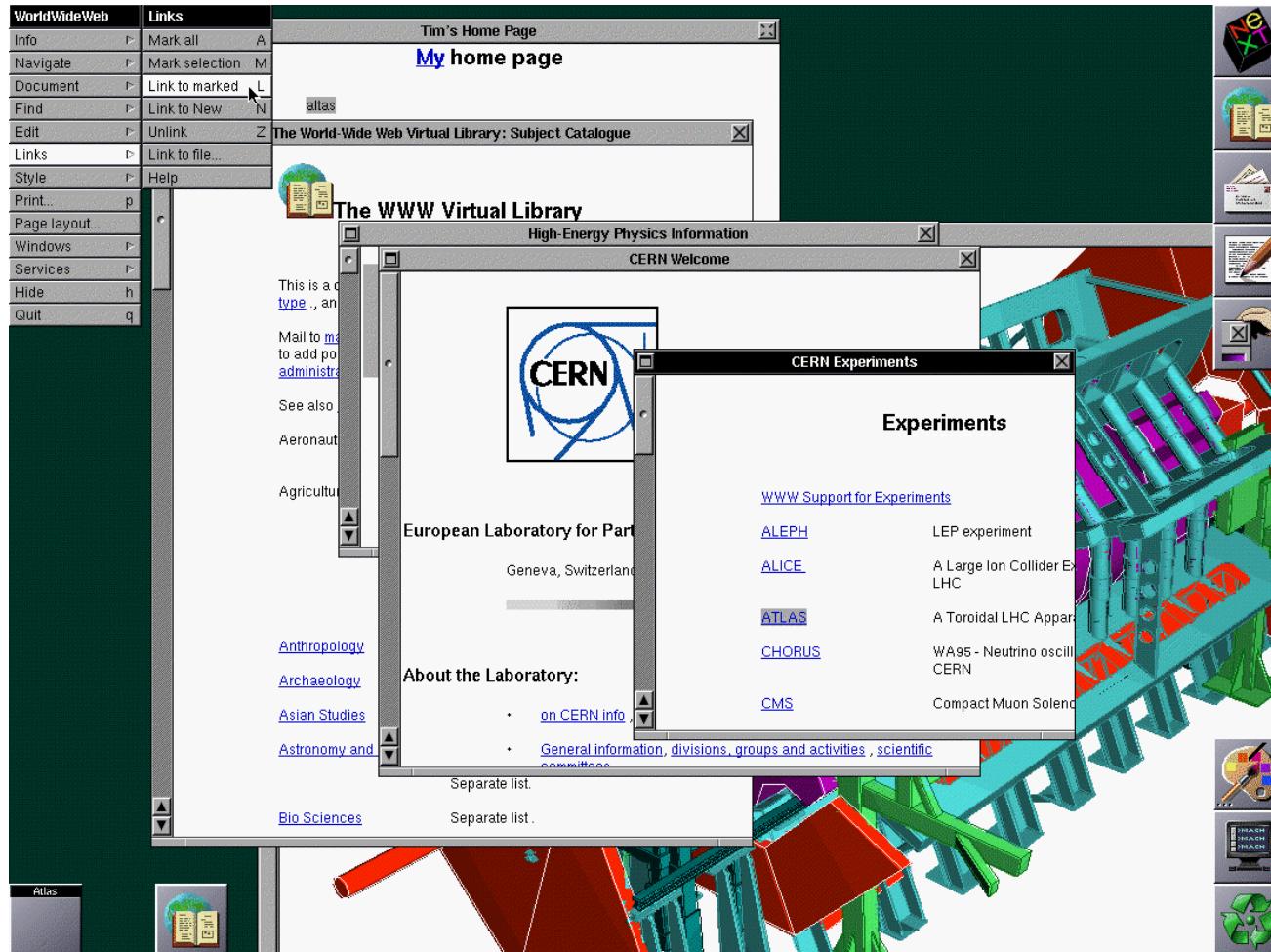


Early History of the WWW

- 1989-1990 Tim Berners-Lee conceives the WWW at CERN in Geneva
- 1990 Berners-Lee releases WWW prototype on NeXT computer
- 1992 Release of source code for line mode browser,
lynx and HTTP
- 1993 Mosaic browser from NCSA is released
- 1993 WWW internet traffic now measures 1% of NSF backbone
- 12/94 Netscape Navigator 1.0 is released
World Wide Web Consortium formed
- 1995 Microsoft Windows 95 and Internet Explorer 1.0 released
- 1995 Java is released
- 1998 Google is started
- 1999-2001 A burst of Internet start-up companies which flamed out because they were not profitable. Also known as the "Internet Bubble."
- 2004 Firefox 1.0 is released
- 2005 YouTube is founded
- 2008 Google Chrome 1.0 is released

First Web Communication (Dec 1990)

See <http://www.w3.org/History.html> and tim Berners-Lee's presentation at the 10th anniversary, <http://www.w3.org/2004/Talks/w3c10-HowItAllStarted/?n=1>



Original WWW “The Project” site at CERN

<http://info.cern.ch/hypertext/WWW/TheProject.html>

The screenshot shows a web browser window with the title "The World Wide Web project". The address bar displays the URL "info.cern.ch/hypertext/WWW/TheProject.html". The main content area features a large heading "World Wide Web". Below it, a paragraph explains that the WorldWideWeb (W3) is a wide-area [hypermedia](#) information retrieval initiative aiming to give universal access to a large universe of documents. A note states that everything online about W3 is linked directly or indirectly to this document, including an [executive summary](#), [Mailing lists](#), [Policy](#), November's [W3 news](#), and [Frequently Asked Questions](#). The page includes a sidebar with links to various sections: "What's out there?", "Help", "Software Products", "Technical", "Bibliography", "People", "History", "How can I help?", and "Getting code". Each link is accompanied by a brief description.

The World Wide Web

The WorldWideWeb (W3) is a wide-area [hypermedia](#) information retrieval initiative aiming to give universal access to a large universe of documents.

Everything there is online about W3 is linked directly or indirectly to this document, including an [executive summary](#) of the project, [Mailing lists](#) , [Policy](#) , November's [W3 news](#) , [Frequently 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](#) , [Mail robot](#) , [Library](#))

[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.

London Olympics (July 2012)

See <http://www.zdnet.com/article/web-inventor-tim-berners-lee-stars-in-olympics-opening-ceremony/>

<https://www.youtube.com/watch?v=KW6ivwDcOY4>



Sir Tim Berners-Lee live-tweets during the 2012 Olympics opening ceremony, with a NeXT Cube by his side

WWW Consortium

- Founded in 1994, headed by Tim Berners-Lee,
<http://www.w3.org>
- Goal: “to lead the World Wide Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability.”
- Many of the technologies guided by the WWW consortium will be discussed this semester:
 - HTML, Style Sheets, Document Object Model, international character sets, HTTP, XML, etc.