

Lecture

Internet Trends and Web Basics

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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

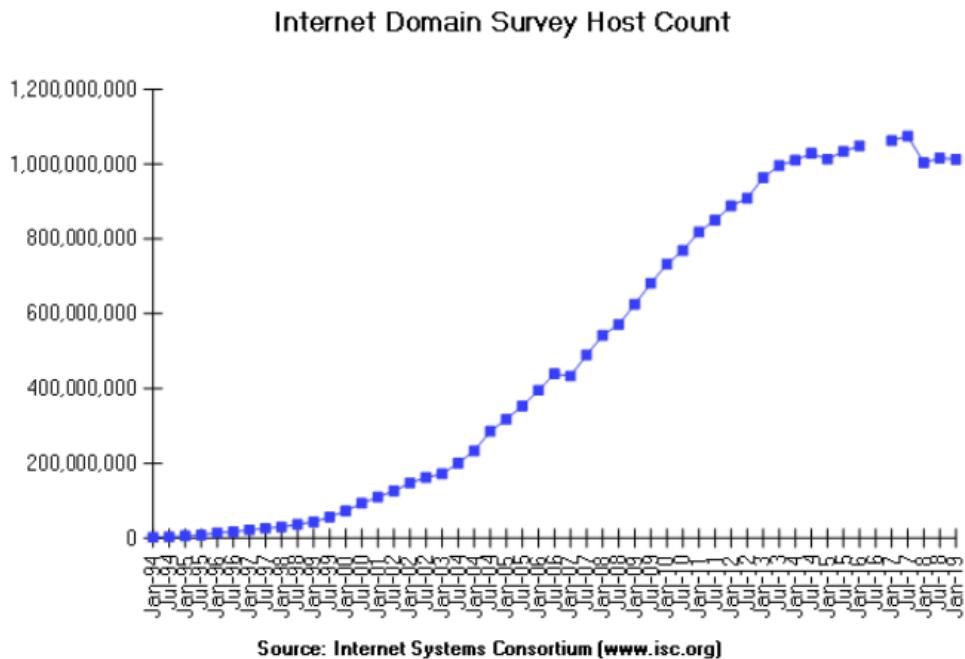
- The *Internet* is a global digital infrastructure that connects hundreds of millions of computers and people
- The *World Wide Web* is a mechanism that unifies the retrieval and display of a subset of data on the Internet
- An *intranet* is a local/global information structure that connects an organization 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.

Recent Trends in Internet Development

- Growth in number of users connected
- Growth in Smartphone use, particularly iOS and Android
- Growth in digital data, especially photos and video
- Growth in Social Media
- Growth in Internet use from Mobile over desktop/laptop
- Growth in tablet usage over desktops/laptops
- Decreased dominance of Microsoft Windows
- Growth in use of the cloud

How Big is the Internet (historical)

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

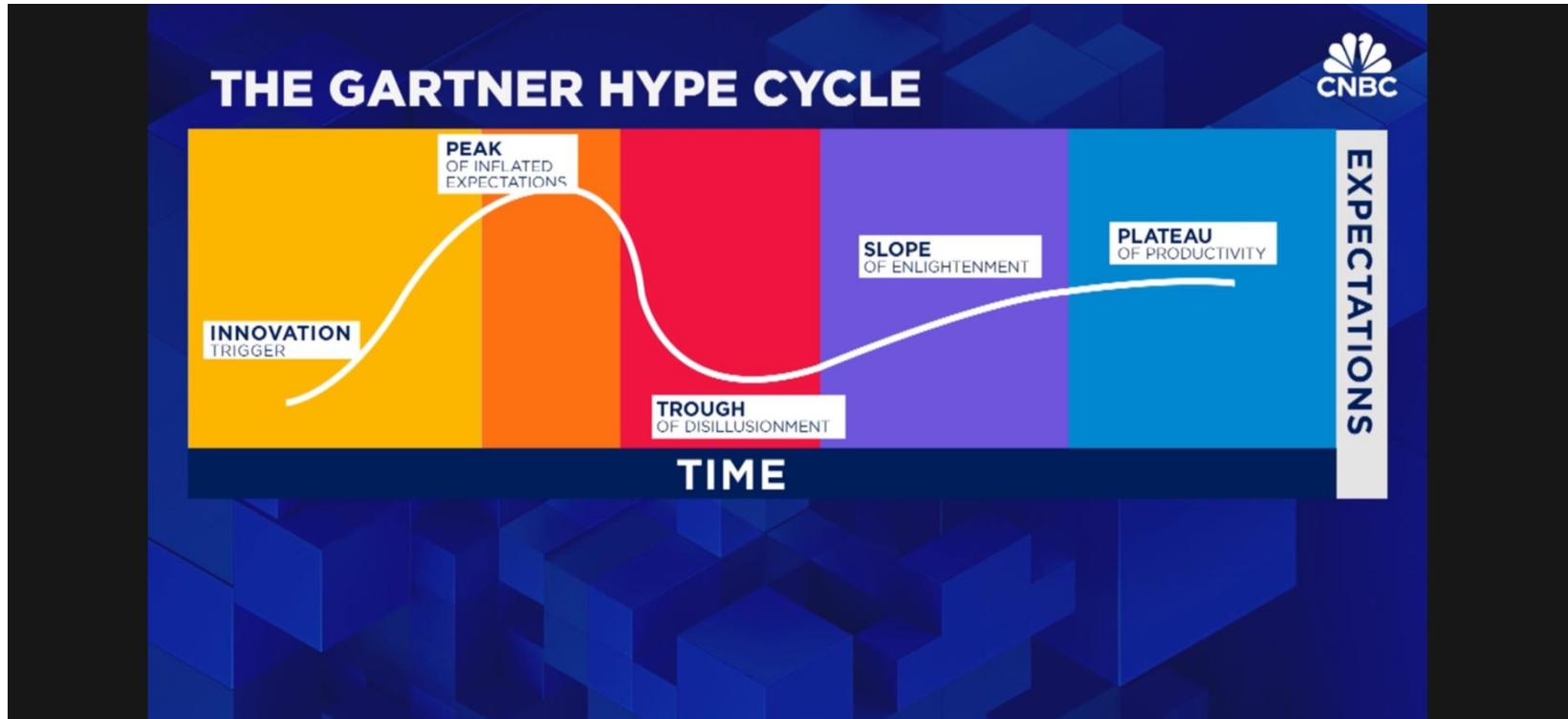


hosts were doubling every 18 months, but growth has slowed

See the survey background at: <http://www.isc.org/network/survey>

It counts the number of IP addresses that have been assigned a name. The survey queries the domain name system for the name assigned to every possible IP address. But rather than sending a query to every one of the 4.3 billion possible IP addresses, the survey starts with a list of all network numbers that have been delegated within the IN-ADDR.ARPA domain. **This survey has been discontinued.**

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**

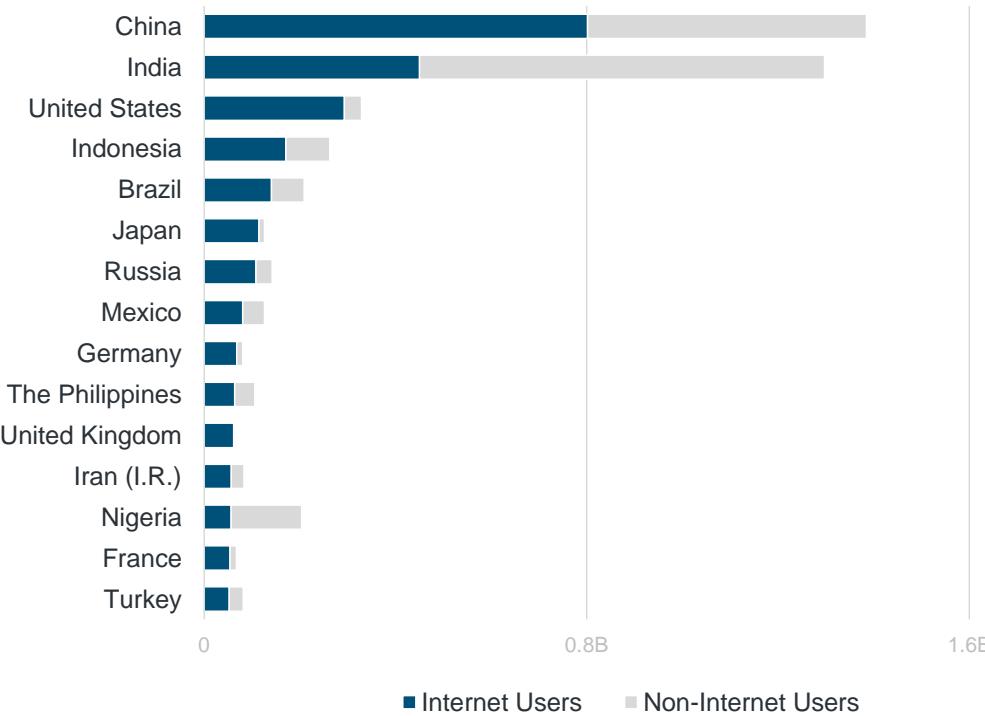
- Mainstream adoption starts to take off. Criteria for assessing provider viability are more clearly defined. The technology's broad market applicability and relevance are clearly paying off.

Source:

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

Global Internet Users =
China @ 21% of Total...India @ 12%...USA @ 8%

Internet Users – Top Countries, 2018



BOND
Internet Trends
2019

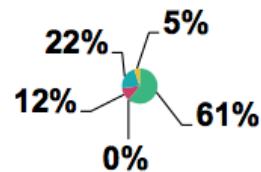
Internet user data is as of mid-year. Source: United Nations / International Telecommunications Union, USA Census Bureau, Pew Research (USA), China Internet Network Information Center (China), Islamic Republic News Agency / InternetWorldStats / Bond estimates (Iran), Bond estimates based on IAMAI data (India), & APJII (Indonesia).

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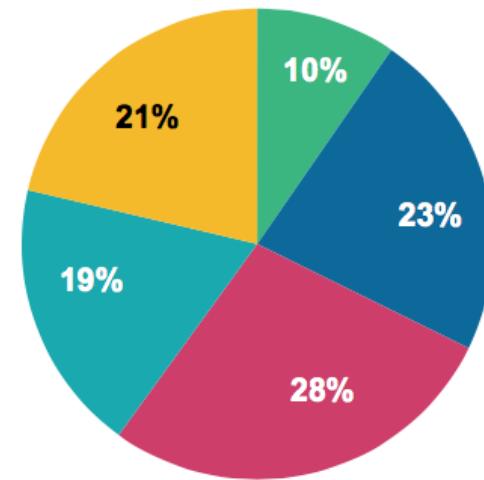
The following slides are based upon a presentation by Mary Meeker of Bond and formerly of Kleiner Perkins Caufield and Byers, see <https://www.bondcap.com/#internettrends>

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

1995
35MM+ Internet Users
0.6% Population Penetration



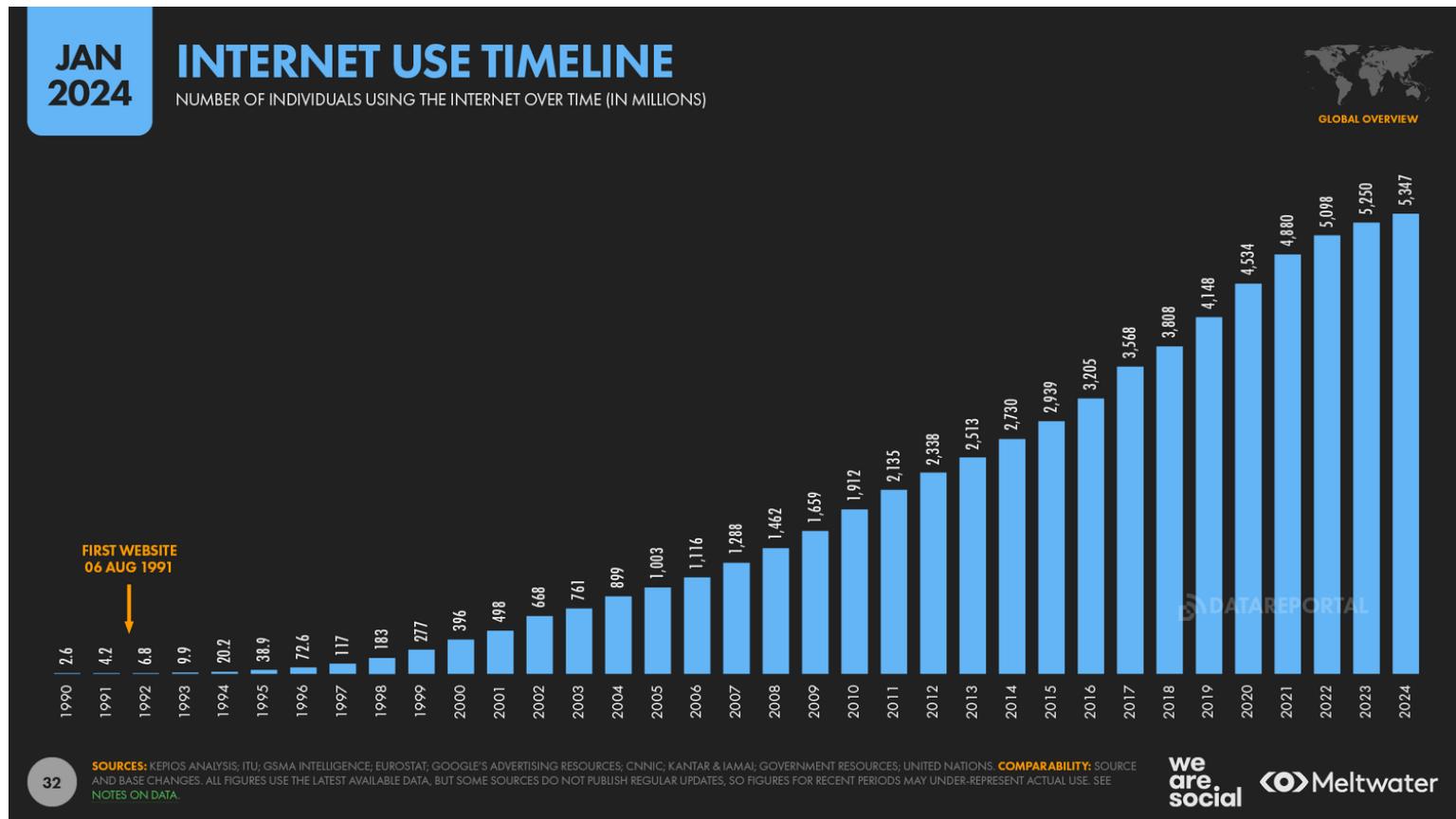
2014
2.8B Internet Users
39% Population Penetration



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

Internet Users 2024

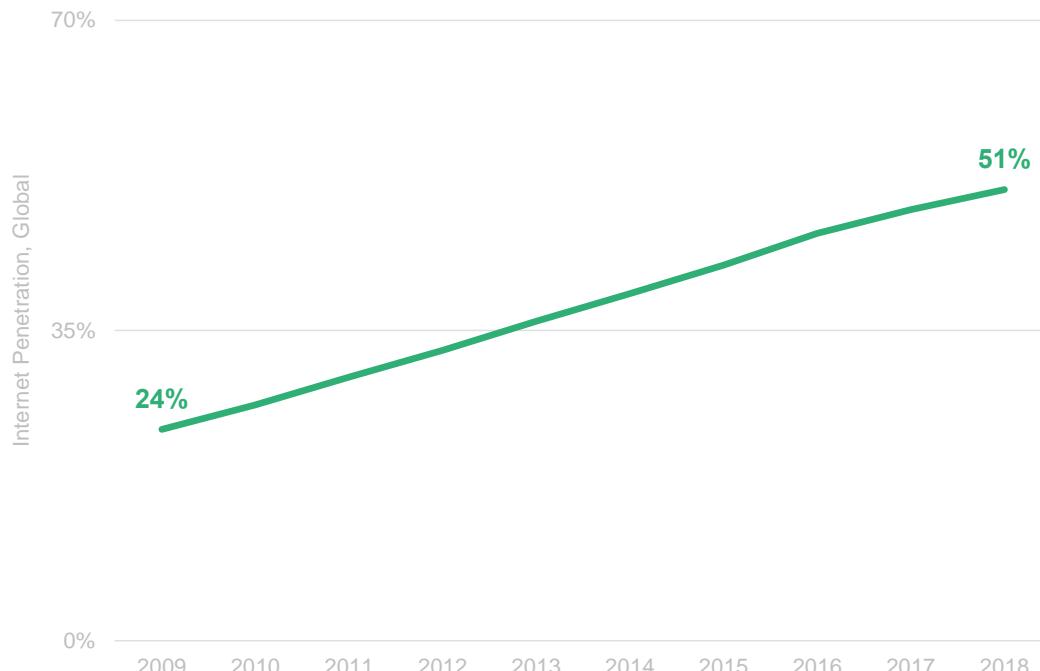
5.35 billions or 66.2% of global population



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

Global Internet Users = 3.8B >50% of Population

Internet Penetration, 2018

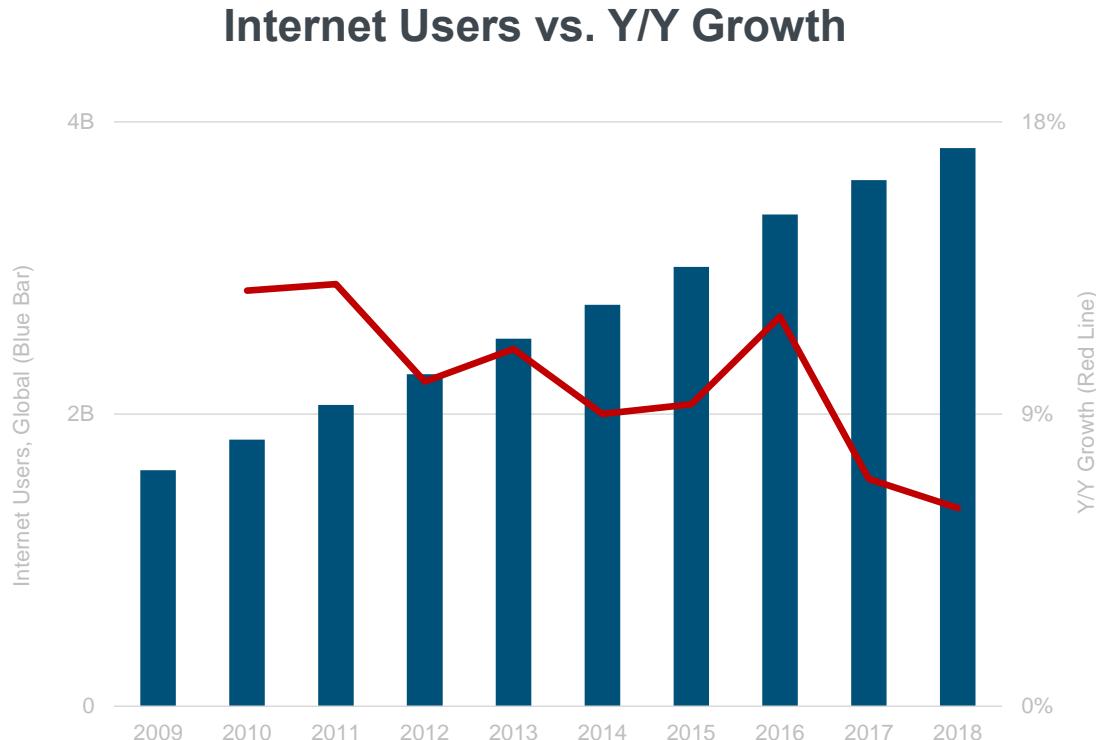


BOND
Internet Trends
2019

Internet user data is as of mid-year. Source: United Nations / International Telecommunications Union, USA Census Bureau, Pew Research (USA), China Internet Network Information Center (China), Islamic Republic News Agency / InternetWorldStats / Bond estimates (Iran), Bond estimates based on IAMAI data (India), & APJII (Indonesia).

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



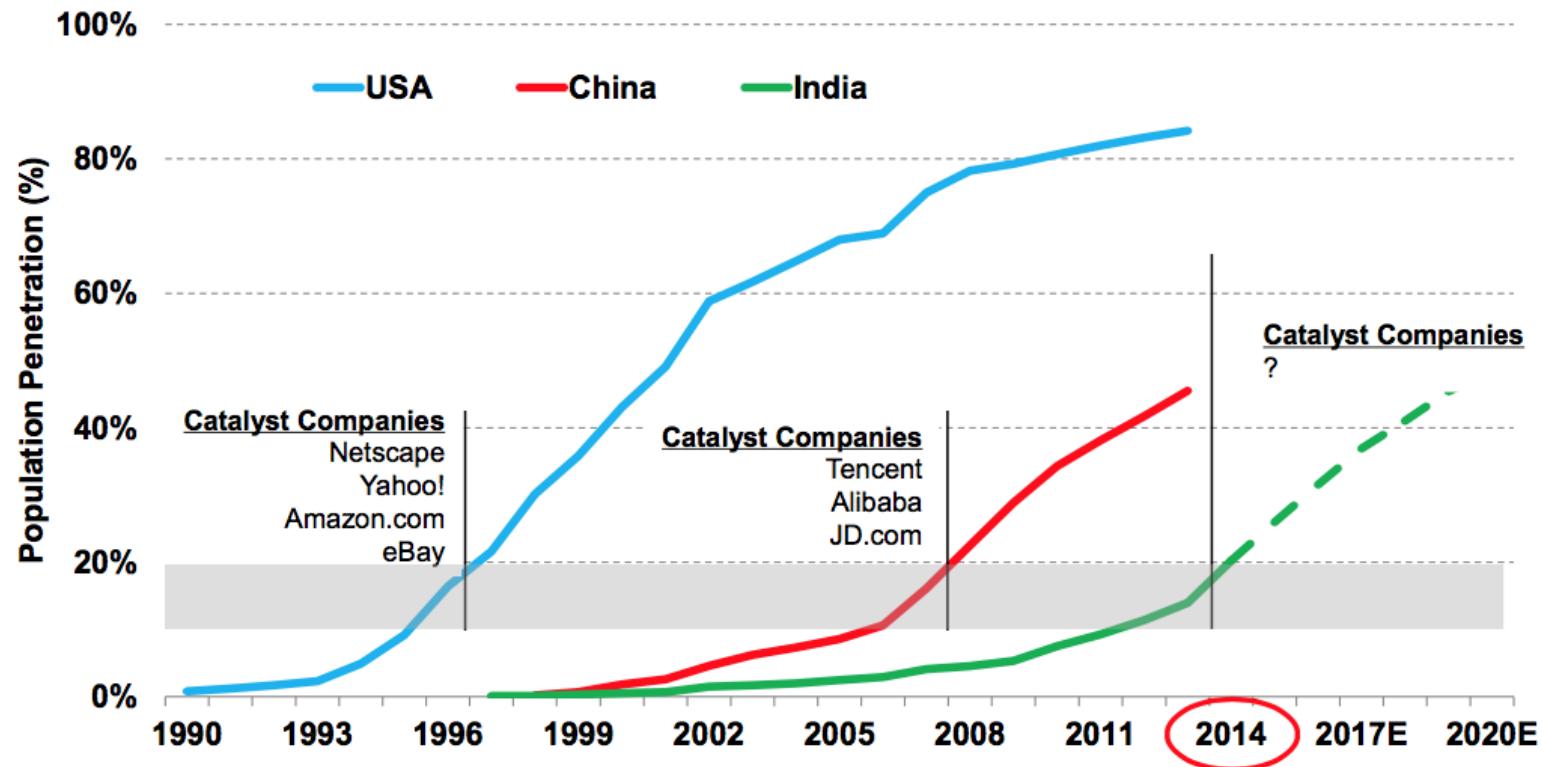
BOND
Internet Trends
2019

Internet user data is as of mid-year. Source: United Nations / International Telecommunications Union, USA Census Bureau, Pew Research (USA), China Internet Network Information Center (China), Islamic Republic News Agency / InternetWorldStats / Bond estimates (Iran), Bond estimates based on IAMAI data (India), & APJII (Indonesia).

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India = Appears to Be @ Internet Penetration Growth Inflection

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



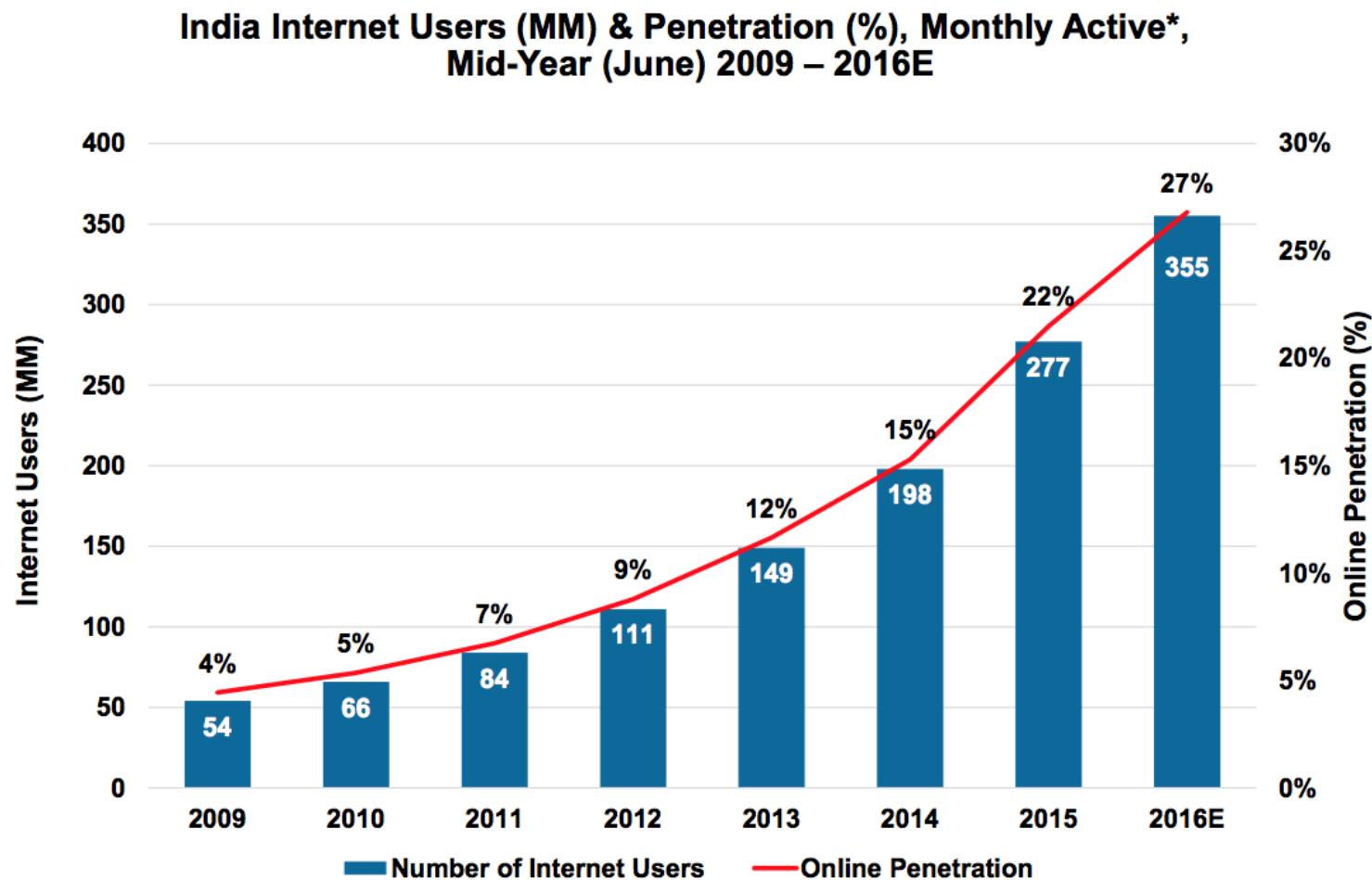
@KPCB

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

Hillhouse Capital

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India Internet Users = +28% (2016-June) vs. 40% Y/Y Growth
 @ 27% Penetration 355MM Users #2 Behind China



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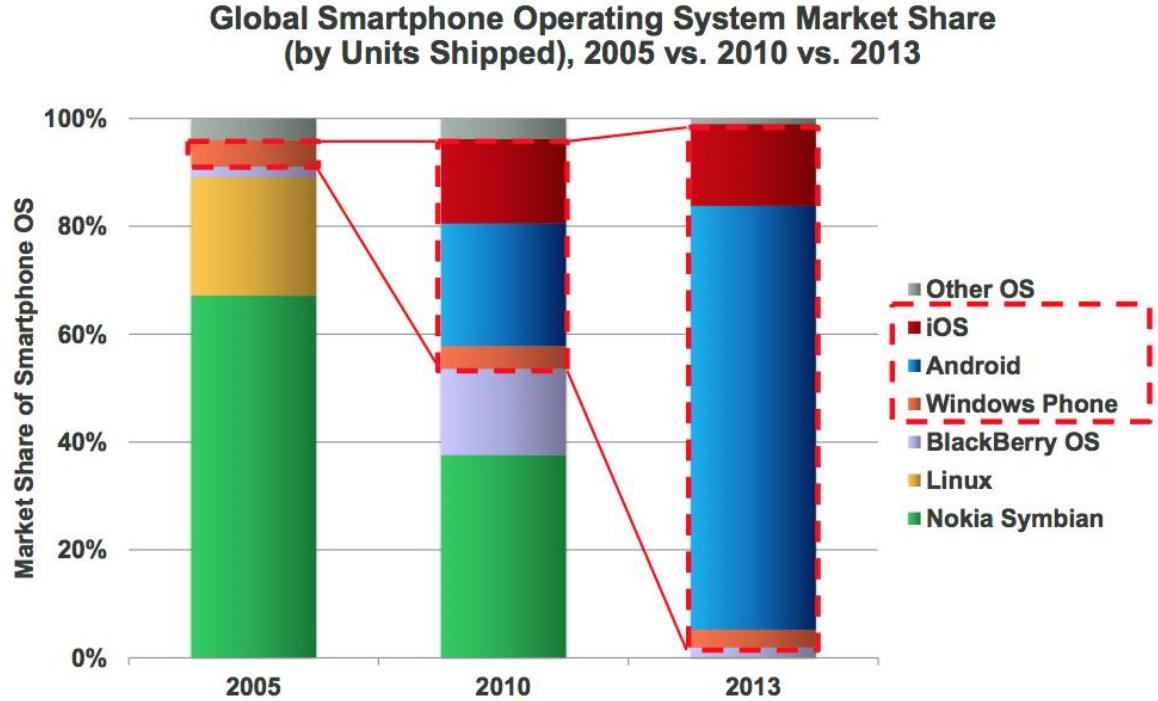
Source: IAMAI, UN Population Division, Worldometer, KPCB estimates based on IAMAI data. Uses mid-year figures.

*Note that "Monthly Active Users" are distinct from "Ever" users, which IAMAI defines as anyone who has ever accessed the internet. Owing to increasing activity levels, the number of "Monthly Active Users" may grow faster than "Ever" users.

KP INTERNET TRENDS 2017 | PAGE 234

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



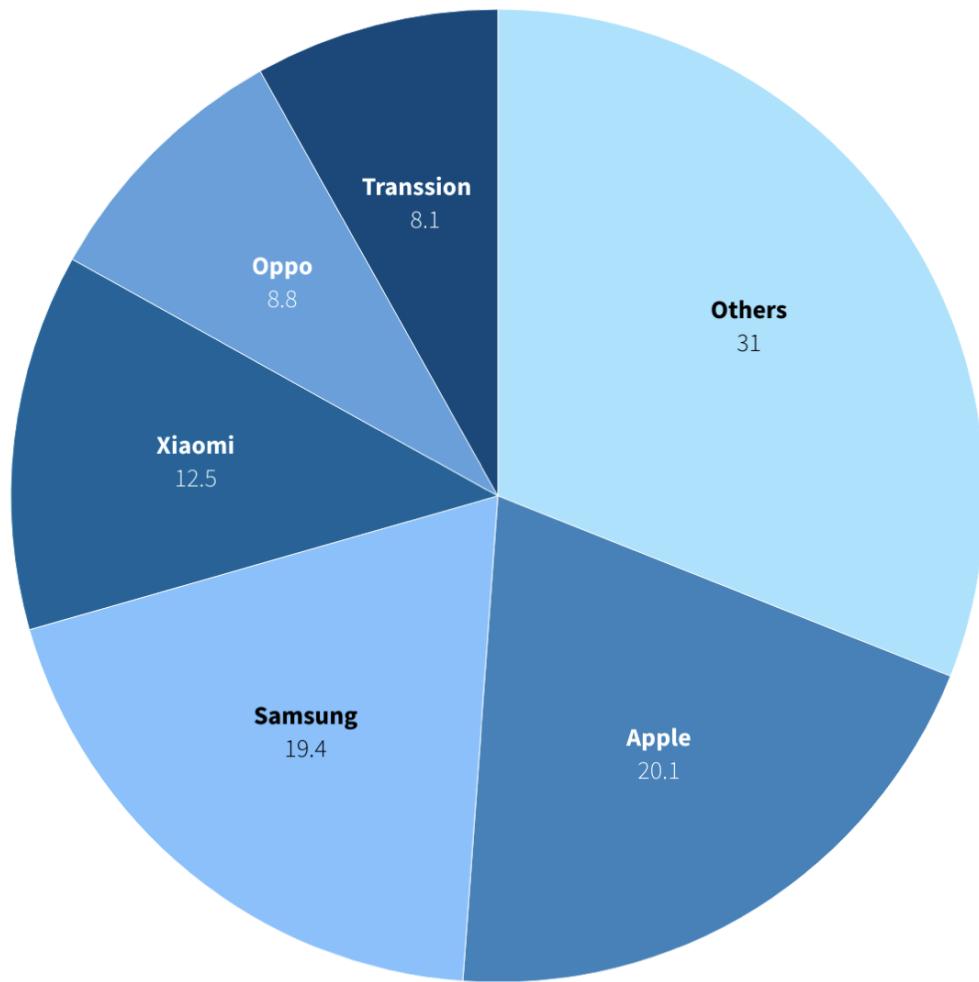
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Source: 2005 & 2010 data per Gartner, 2013 data per IDC.

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Apple overtakes Samsung to become no. 1 smartphone brand

● Others ● Apple ● Samsung ● Xiaomi ● Oppo ● Transision



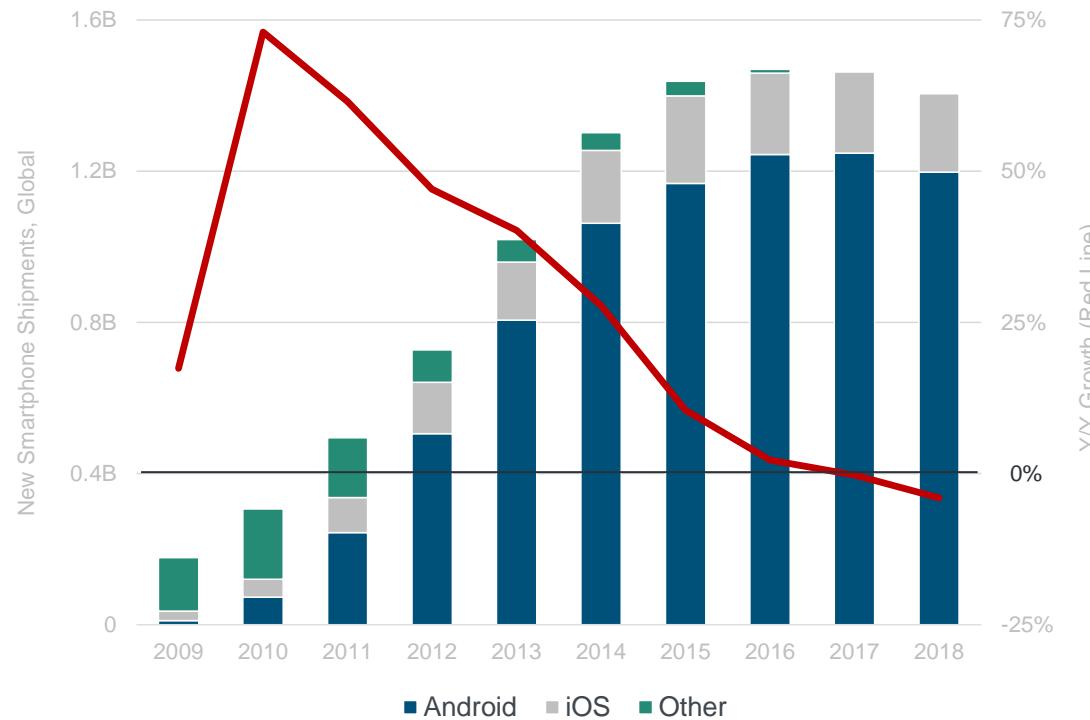
Source: IDC | Figures represent percentage market shares in terms of shipments in 2023

Yuvraj Malik | Reuters

Reuters Graphics

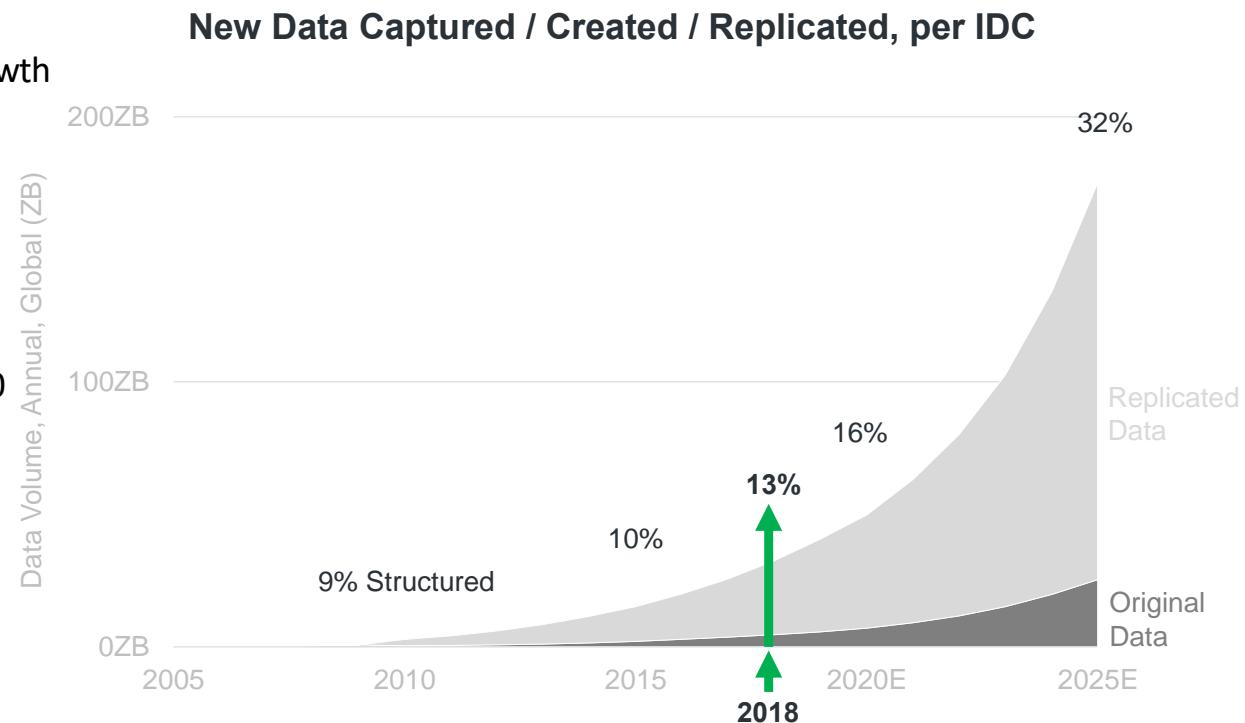
Global New Smartphone Unit Shipments = Declining -4% vs. 0% Y/Y

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



BOND
Internet Trends
2019

Source: IDC 'Digitization of the World From Edge to Core White Paper' developed in collaboration with Seagate (11/18), IDC DataSphere. Note:
1 petabyte = 1MM gigabytes; 1 zeta byte = 1MM petabytes of new data created / captured each year. The grey area in the graph represents
data generated, not stored. Structured data indicates data that has been organized so that it is easily searchable & includes metadata &
machine-to-machine (M2M) data. Replicated data = data that is a copy of the original..

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Photos Alone = 1.8B+ Uploaded & Shared Per Day... Growth Remains Robust as New Real-Time Platforms Emerge

500 million photos are uploaded every day and that number is doubling every year

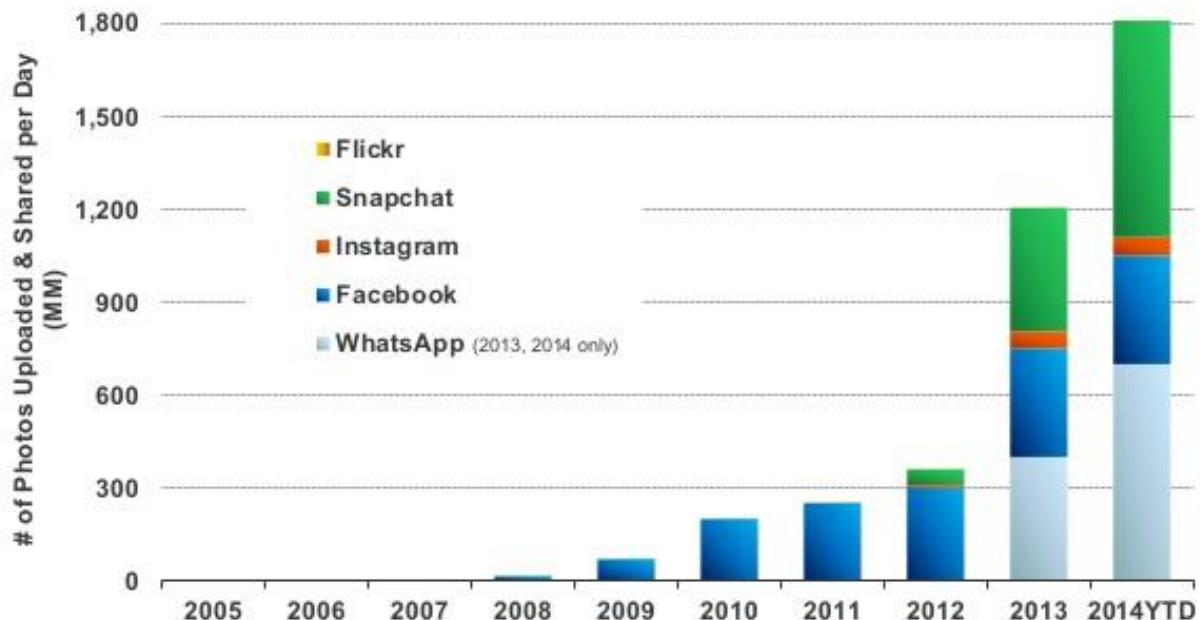
Instagram was recently (2010) purchased by Facebook for \$1 billion

Snapchat is a photo messaging application developed by two Stanford students (IPO March 2017, \$17B valuation);



bobby Murphy - Evan Spiegel

Daily Number of Photos Uploaded & Shared on Select Platforms,
2005 – 2014YTD



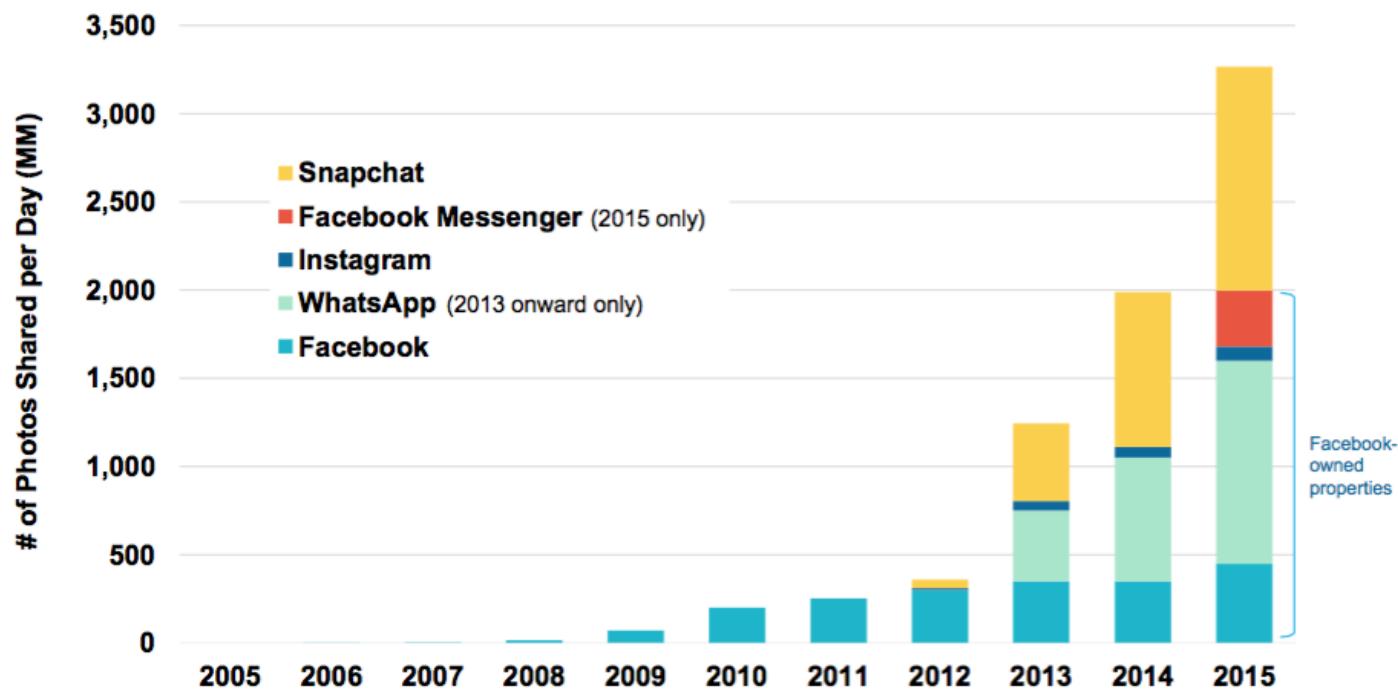
Source: KPCB estimates based on publicly disclosed company data. 2014 YTD data per latest as of 5/14.

@KPCB

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Image Growth Remains Strong

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

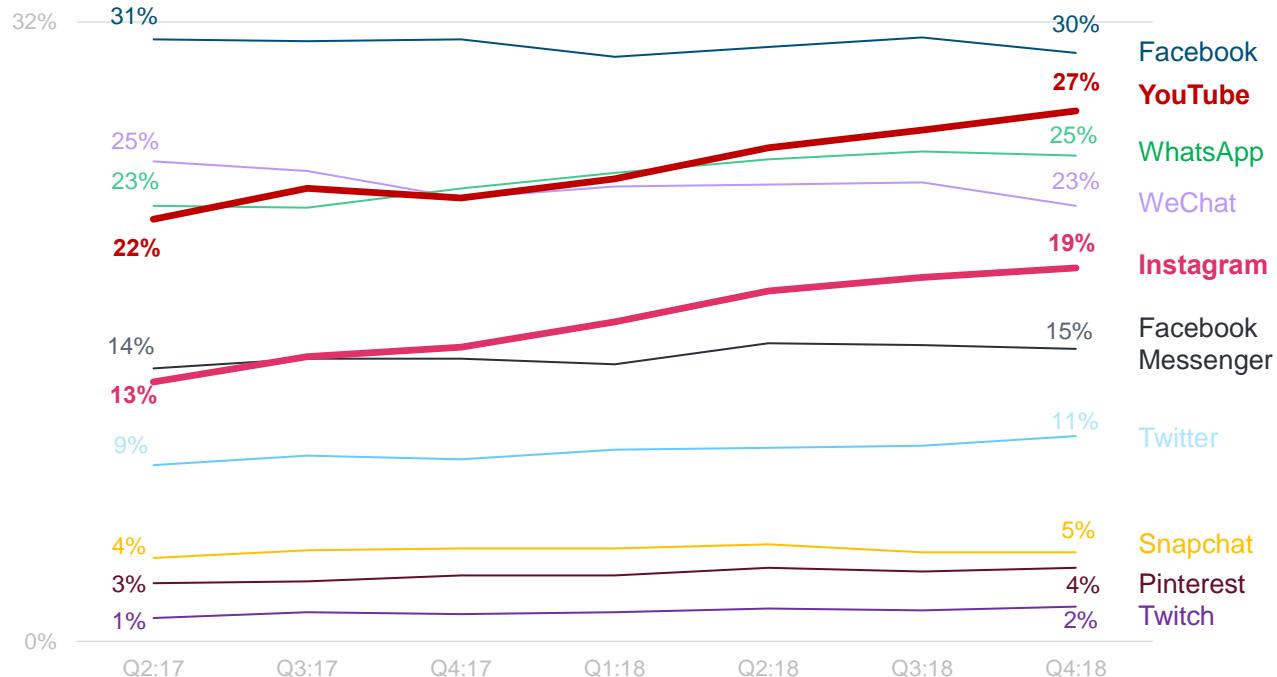


Source: Snapchat, Company disclosed information, KPCB estimates.
Note: Snapchat data includes images and video. Snapchat stories are a compilation of images and video. WhatsApp data estimated based on average of photos shared disclosed in Q1 15 and Q1 16. Instagram data per Instagram press release. Messenger 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

Online Platform Time = YouTube + Instagram Gaining Most

% Internet Users Using Select Platforms > 1x per Day, Global*



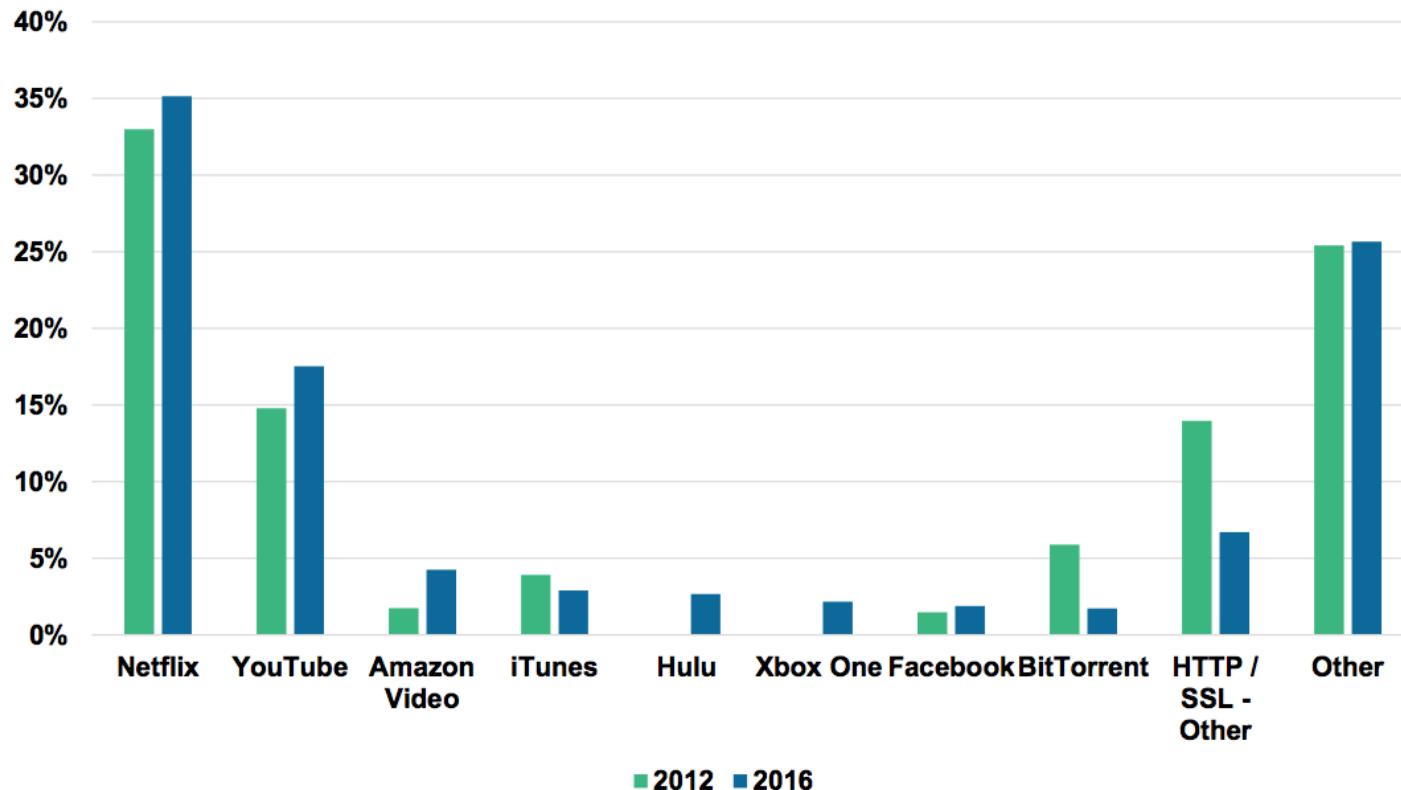
BOND
Internet Trends
2019

Source: Global Web Index Survey of 50K+ Global Internet users aged 16-64 (3/2017-12/2018). Note: WeChat is displayed as "Weixin" in China. *Countries surveyed include major Internet populations – Argentina, Australia, Austria, Belgium, Brazil, Canada, China, Colombia, Denmark, Egypt, France, Germany, Hong Kong, India, Indonesia, Ireland, Italy, Japan, Malaysia, Mexico, Netherlands, New Zealand, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, South Africa, South Korea, Spain, Sweden, Switzerland, Taiwan, Thailand, Turkey, UK, USA, United Arab Emirates, Vietnam. Toutiao estimate = ~4% of Internet users using Douyin in 2018....Not included owing to lack of trend data & regulatory action in period.

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Netflix / YouTube = Fixed-Access Video Traffic Share Leaders

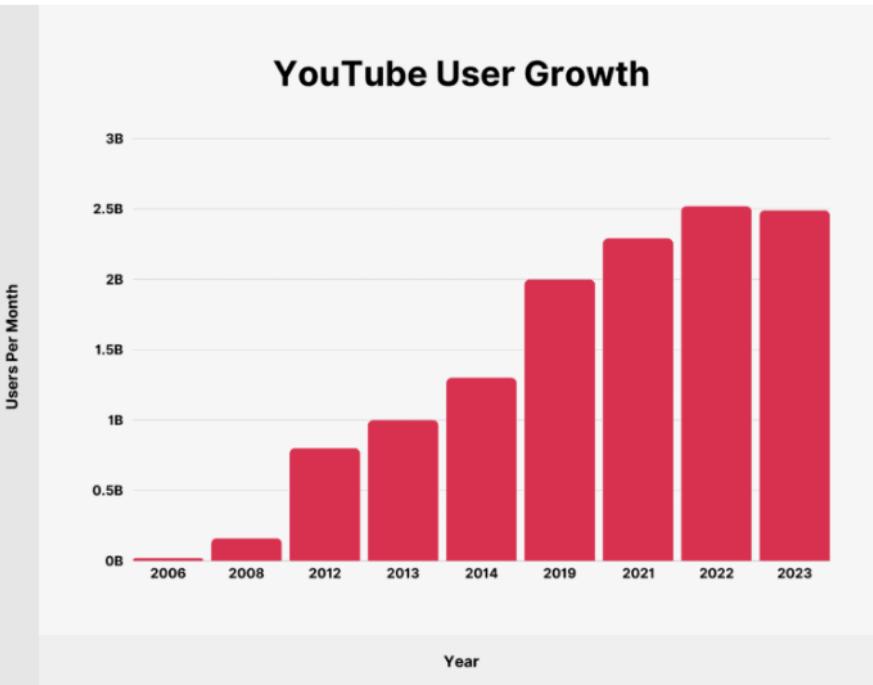
Share of Downstream Video Traffic (%), North America, 2H 2016



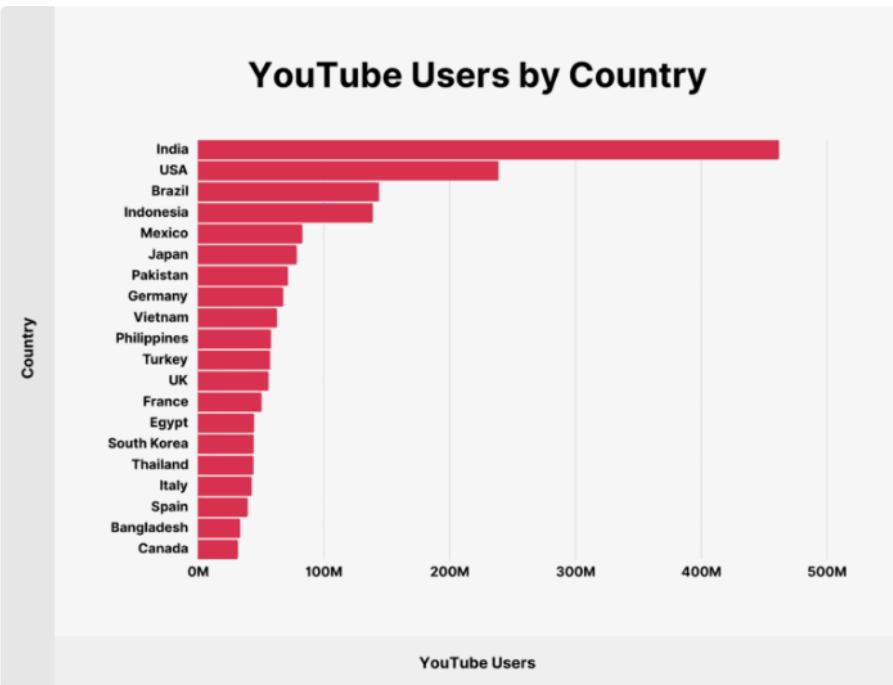
YouTube Users 2024

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

YouTube User Growth



YouTube Users by Country

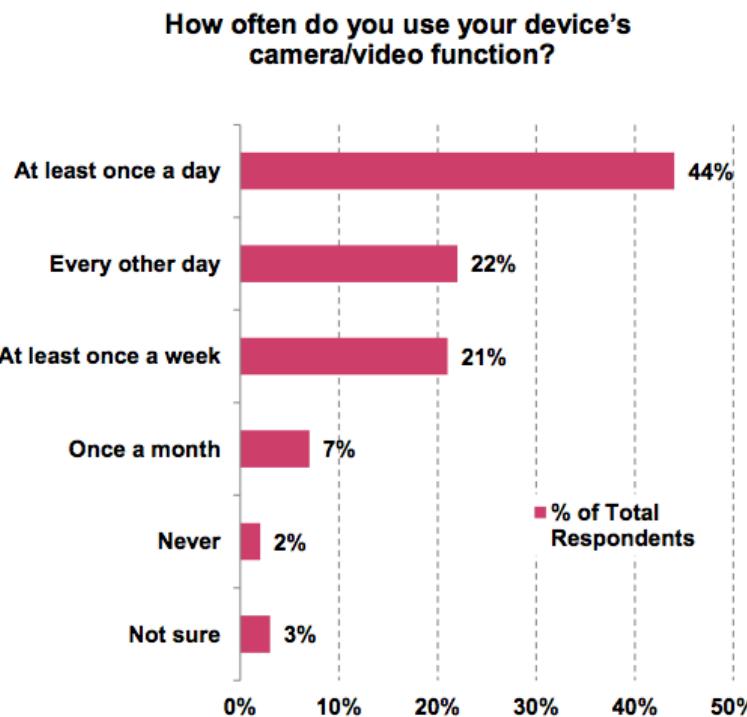


Source; <https://backlinko.com/youtube-users>

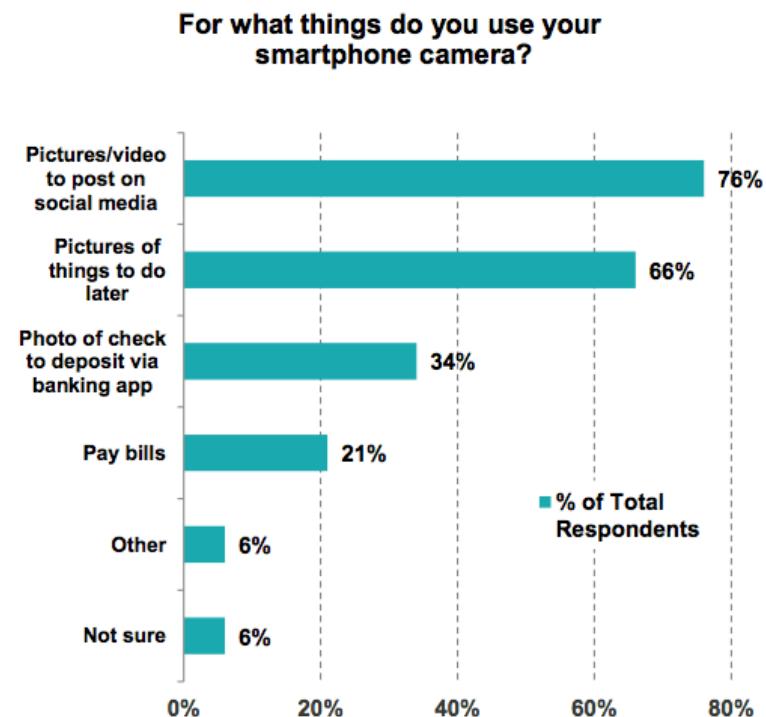
Millennials Love Their Smartphone Cameras...

44% Use Camera / Video Function Daily...76% Post on Social Media

**Millennial Smartphone Camera Usage*,
USA, 2014**



**Millennial Smartphone Camera Use Cases,
USA, 2014**



Source: Zogby Analytics.

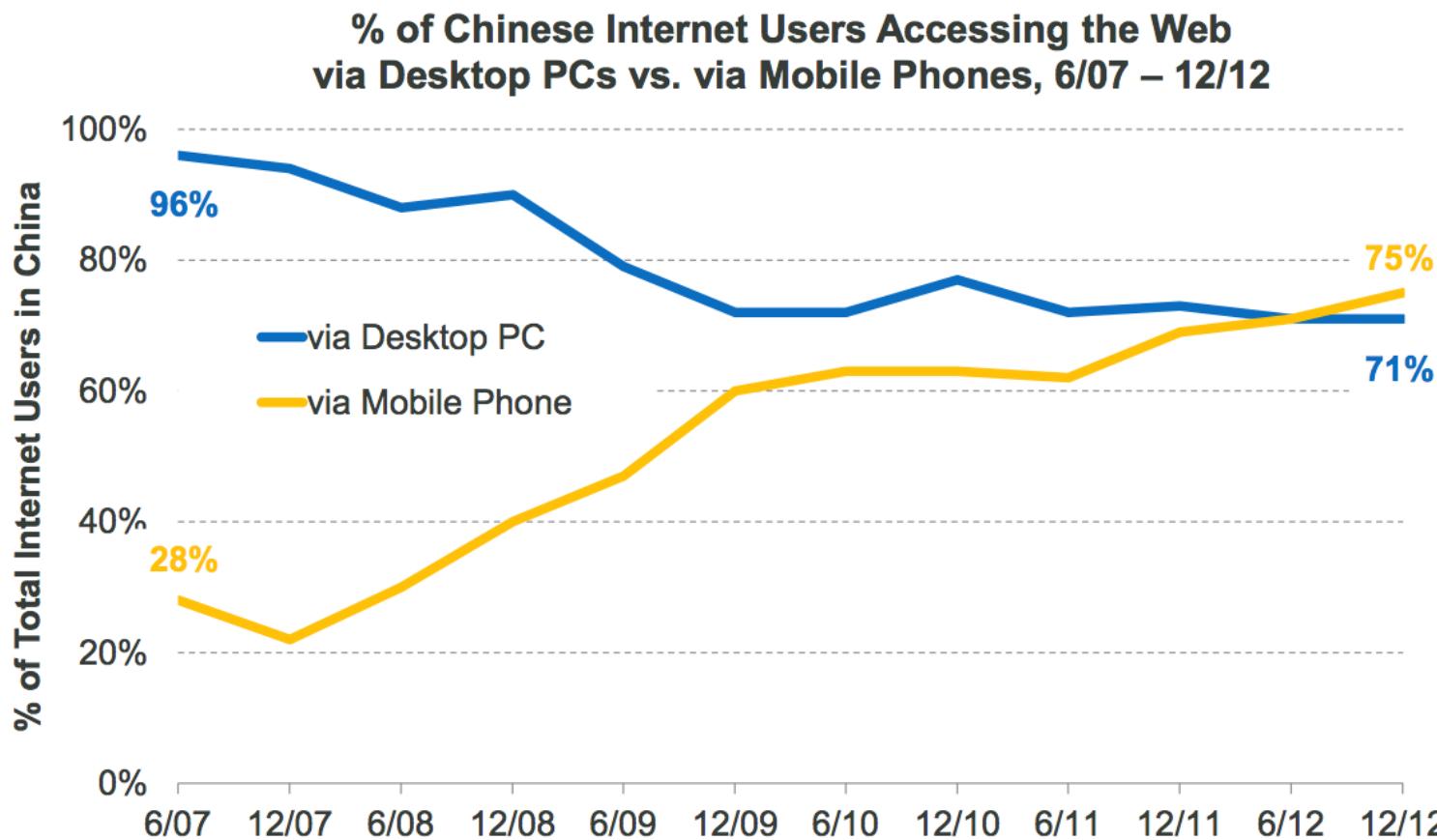
*18-24 year olds.

Note: Zogby Analytics was commissioned by Mitek Systems, Inc. to conduct an online survey of 1,019 millennials who have a smartphone. For the purposes of this survey, "millennials" are defined as adults between the ages of 18-34. All interviews were completed May 30 through June 6, 2014.



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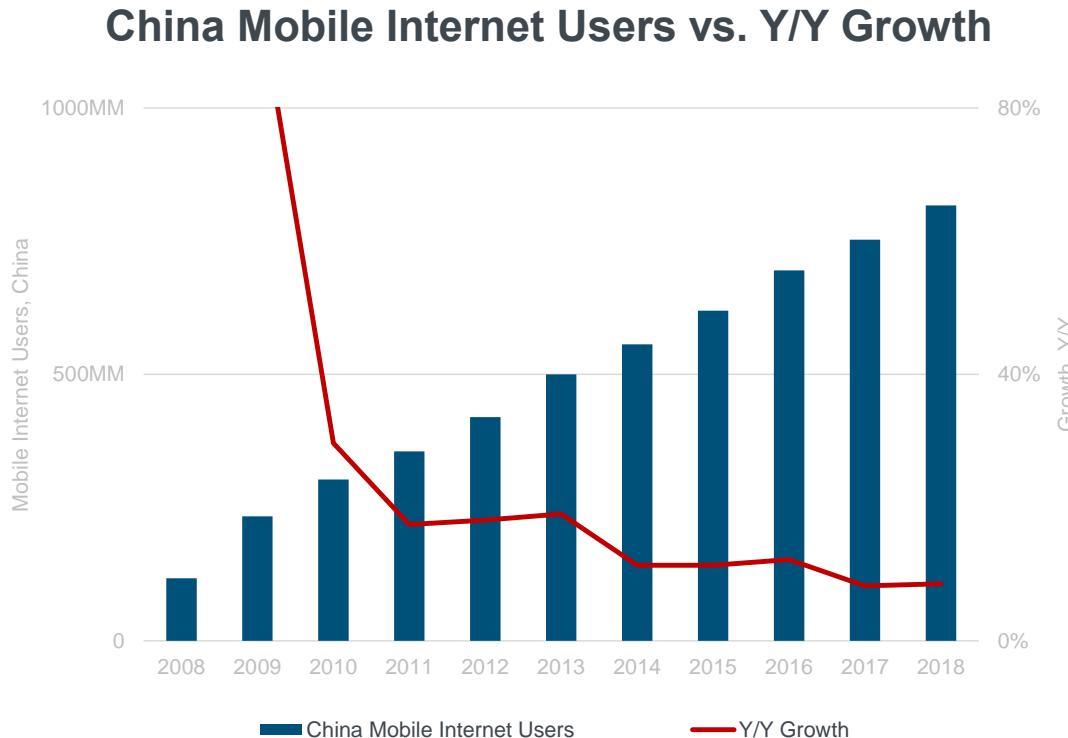
China – Mobile Internet Access Surpassed PC, Q2:12



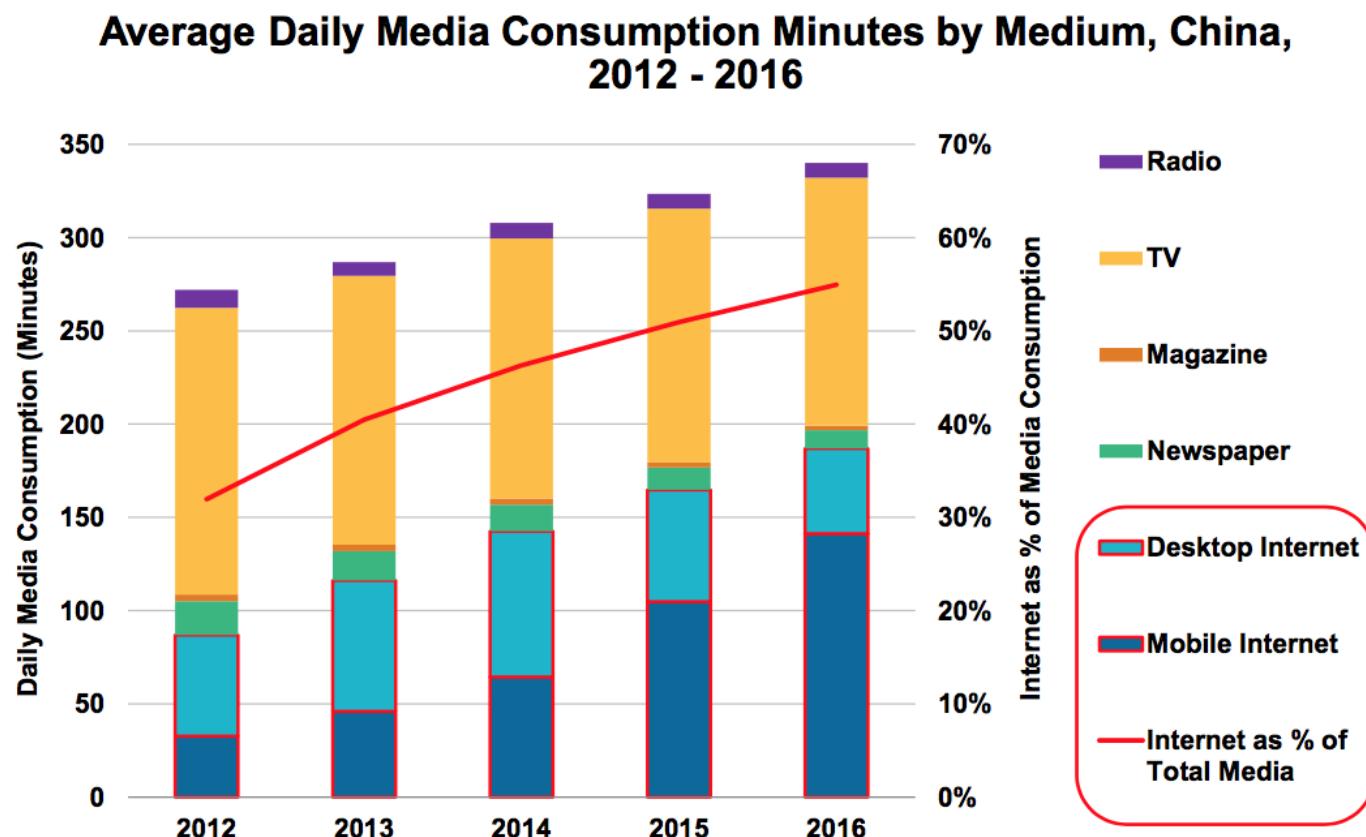
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Source: CNNIC, 1/13. 33

China Mobile Internet Users =
817MM...+9% vs. +8% Y/Y



China Media = Internet @ 55% of Time Spent Mobile > TV (2016)



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Source: Zenith Optimedia



Hillhouse
Capital

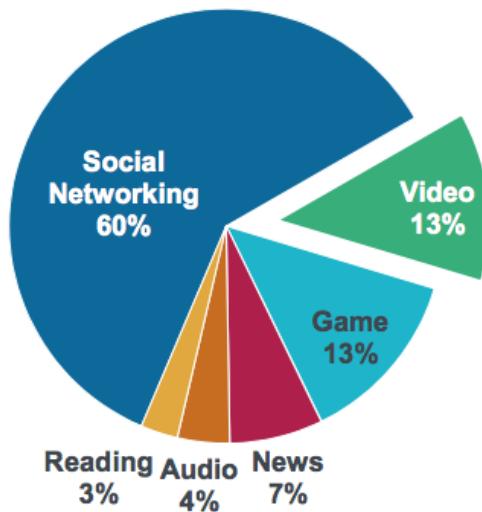
KP INTERNET TRENDS 2017 | PAGE 203

China Mobile Media / Entertainment Time Spent = +22% Y/Y...Mobile Video Growing Fastest

China Mobile Media / Entertainment Daily Time Spent

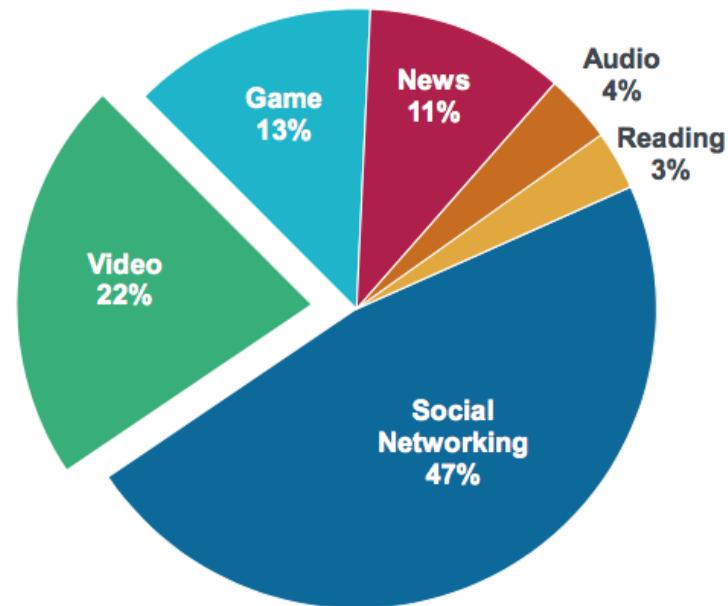
March 2016

2.0B Hours

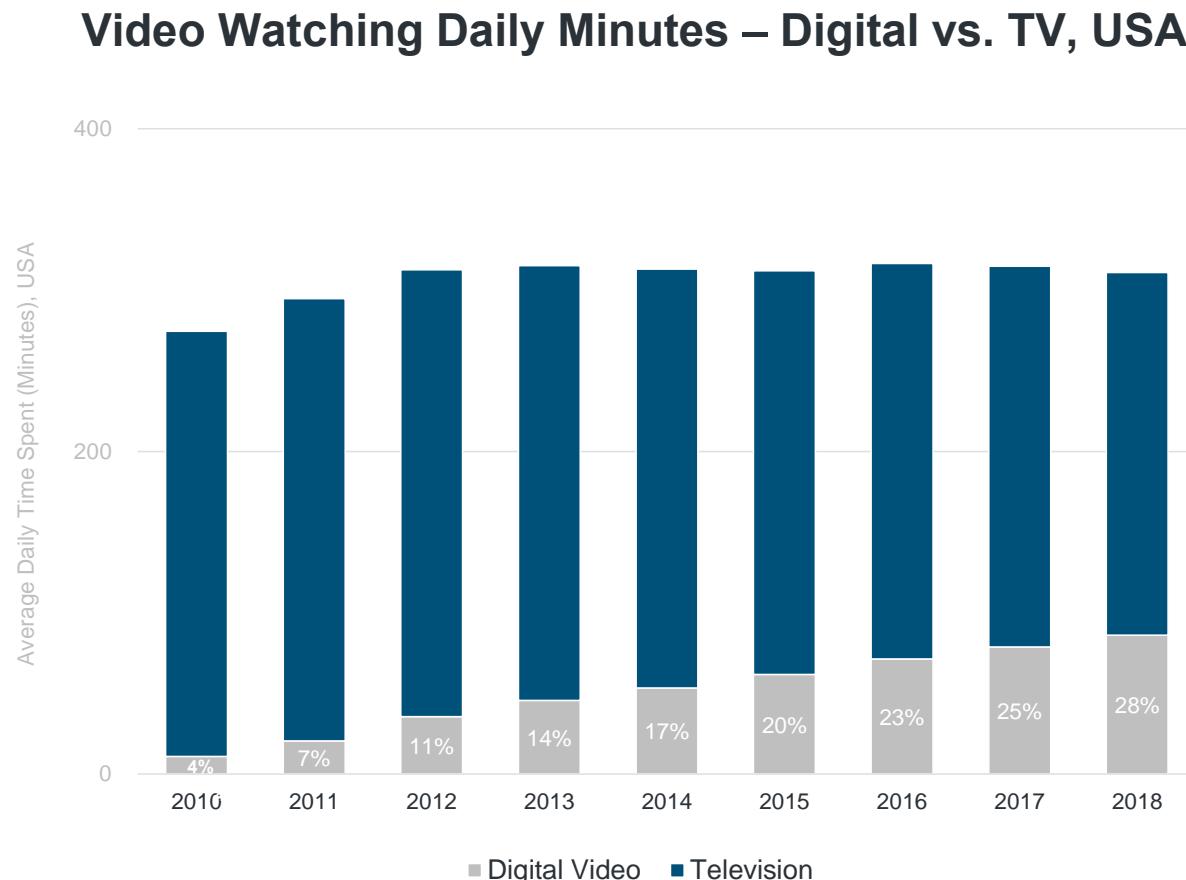


March 2018

3.2B Hours, +22% Y/Y



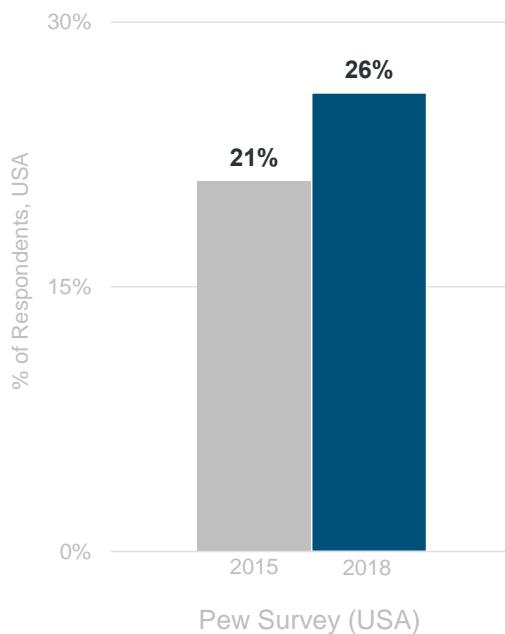
Video Time = Digital +2x in Five Years @ 28% of Total (vs. TV)



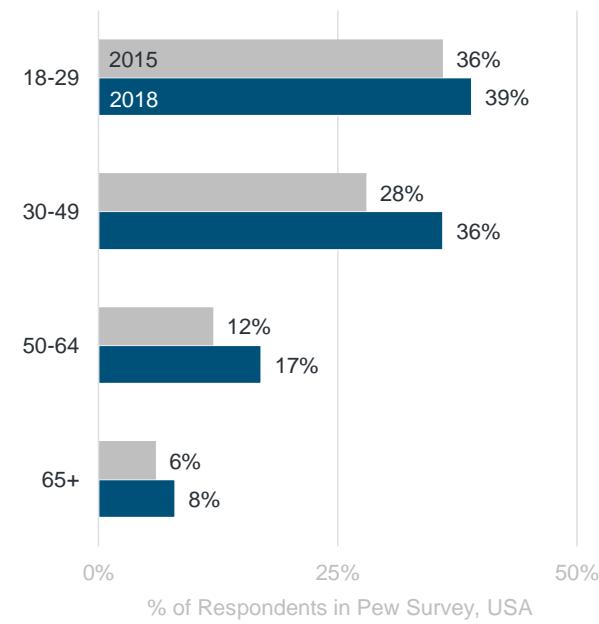
Adults ‘Almost Constantly’ Online = 26% vs. 21% Three Years Ago

% of Adults Online ‘Almost Constantly’

Overall

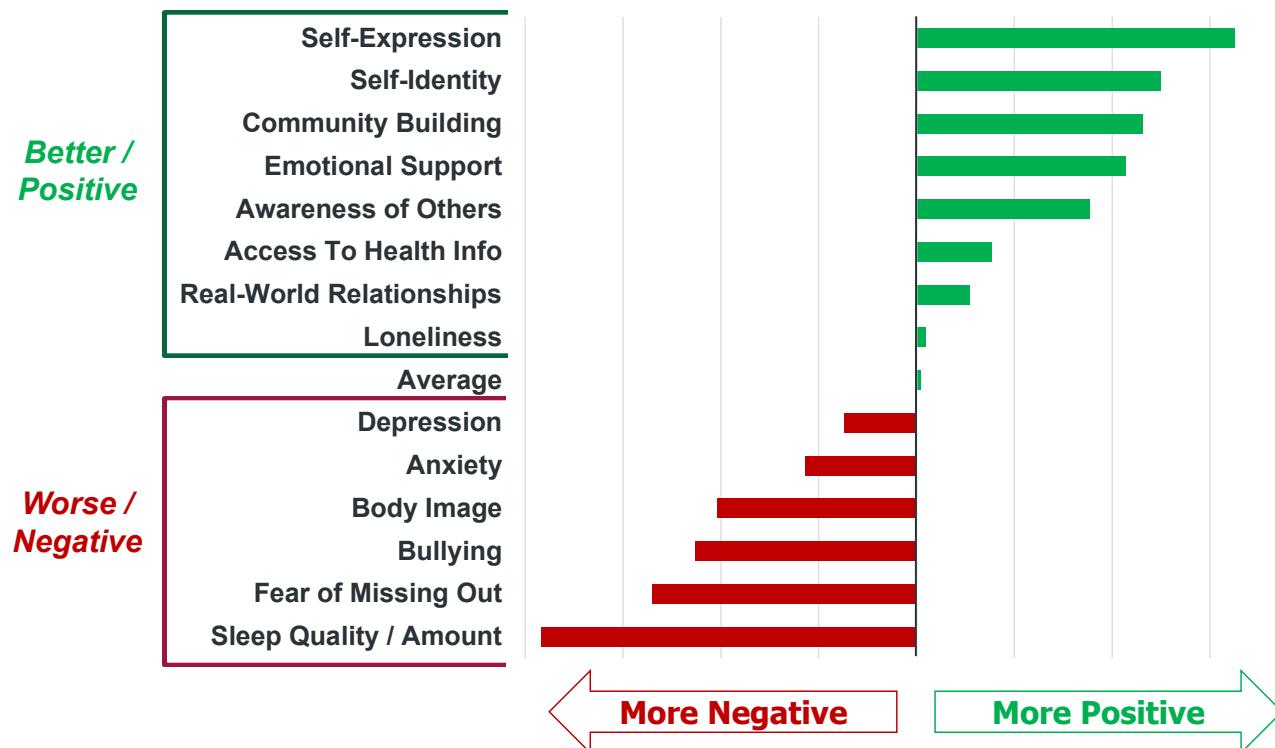


By Age Group



Social Media = Positive & Negative

***Do Social Media Platforms You Use Make These
Health-Related Factors Better or Worse?***

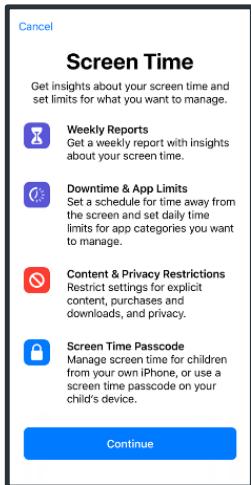


Source: Royal Society For Public Health Survey of 1,479 British teens in 'early-2017'. Each teen was asked to rate 5 of the most popular social networks (YouTube, Facebook, Twitter, Snapchat & Instagram) on each dimension. Data presented = average of scores for each social network.

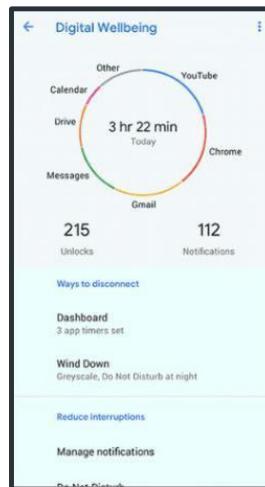
Digital Media = Businesses Taking Action to Help Users Monitor Usage

2018
Major Platforms Launched Wellness / Time Tracking Features

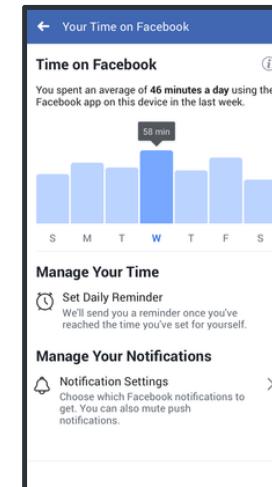
Apple
Screen Time



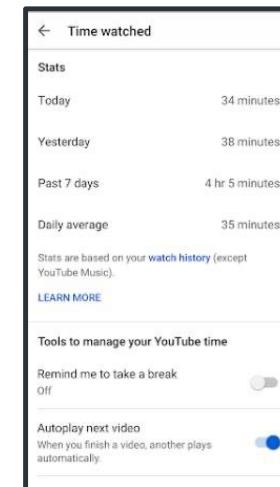
Google
Digital Wellbeing



Facebook
Your Time on Facebook

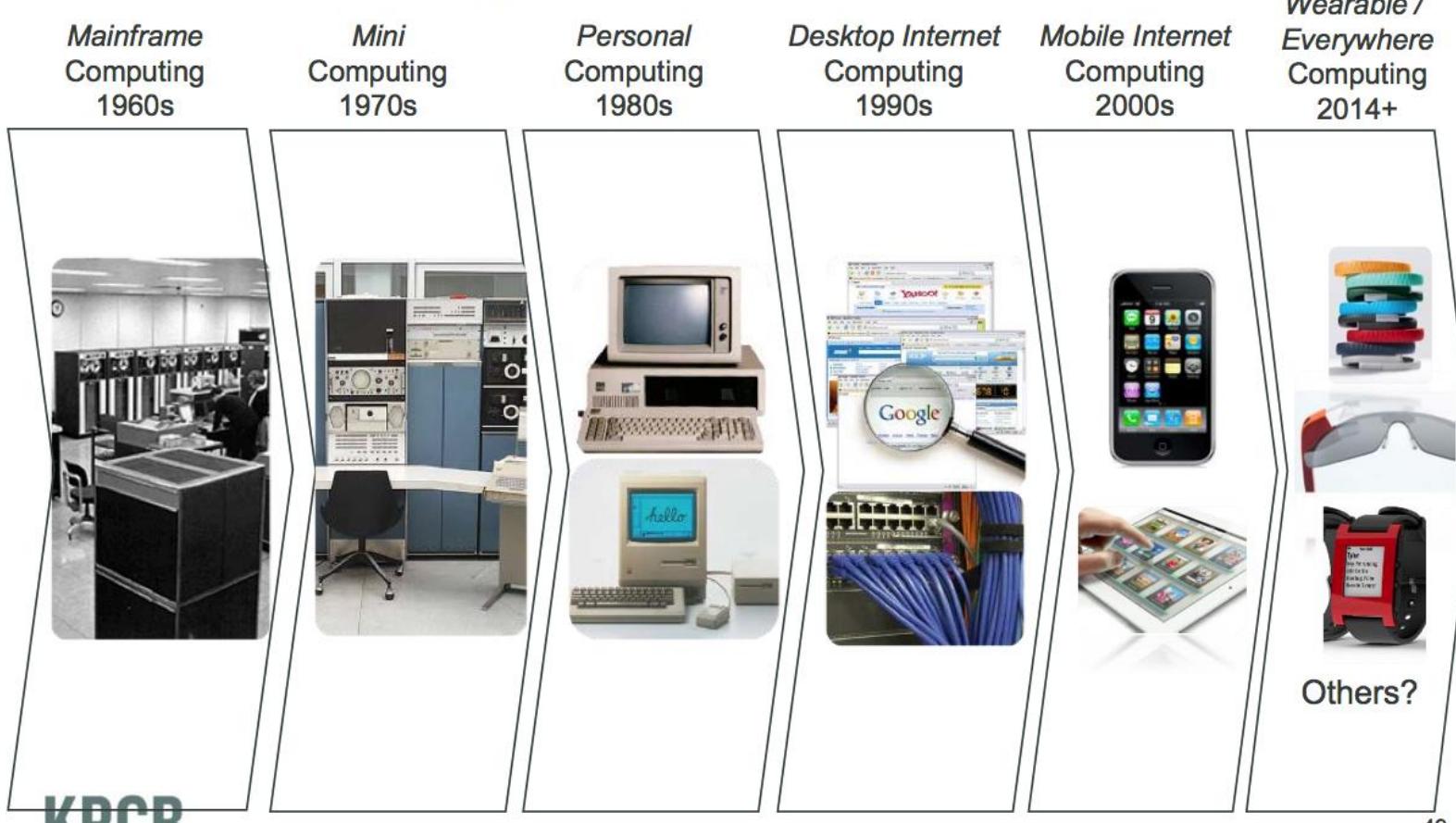


YouTube
Time Watched



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

Technology Cycles Have Tended to Last Ten Years



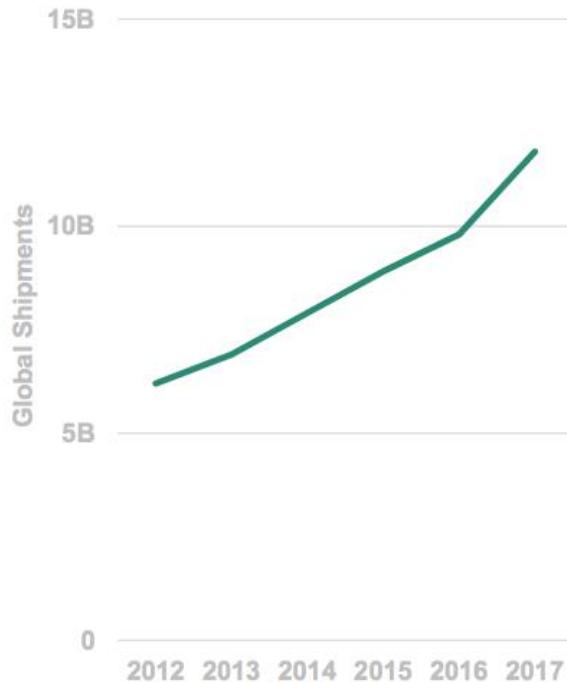
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Image Source: Computersciencelab.com, Wikipedia, IBM, Apple, Google, NTT docomo, Google, Jawbone, Pebble.

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

MEMS Sensor / Actuator Shipments

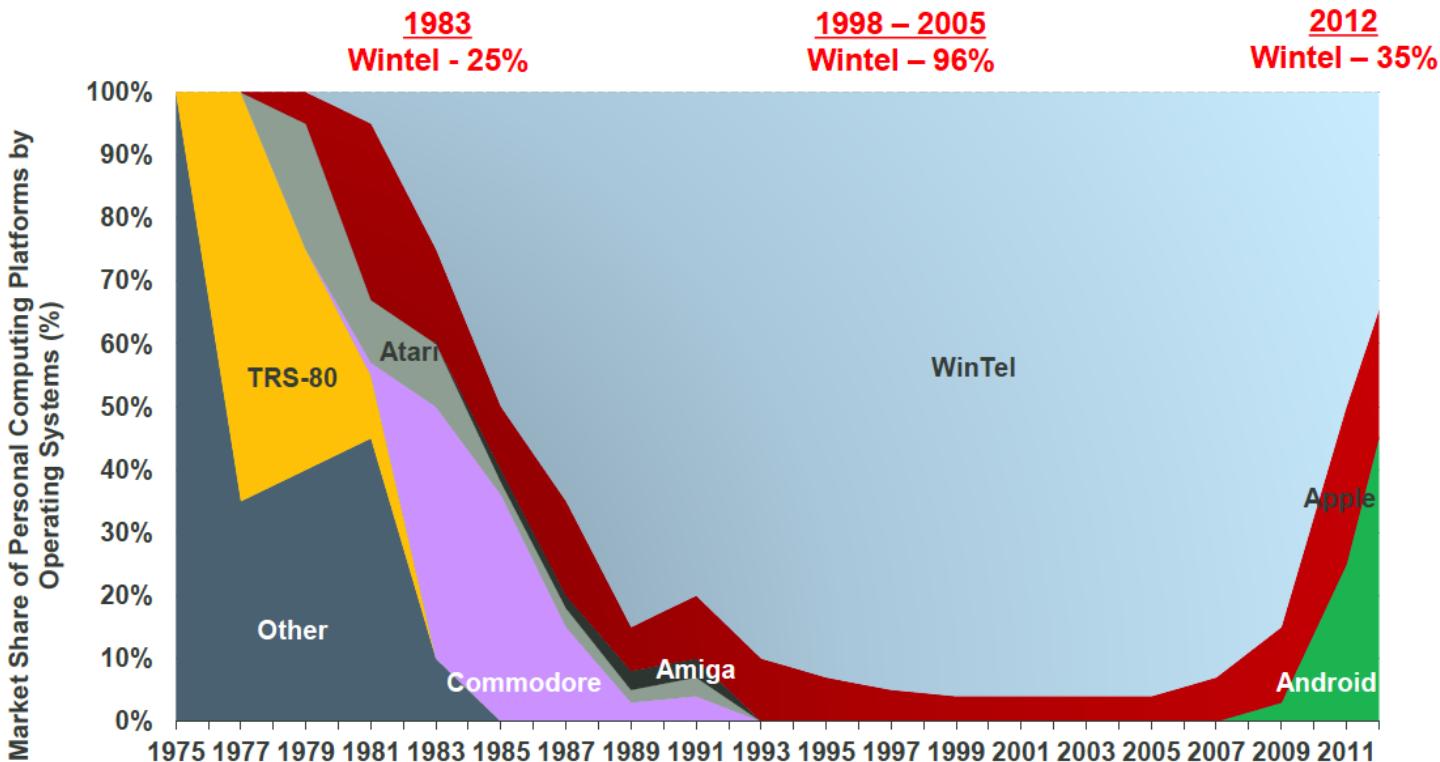


Sensors + Data = In More Places



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.

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...While The Cloud Rises

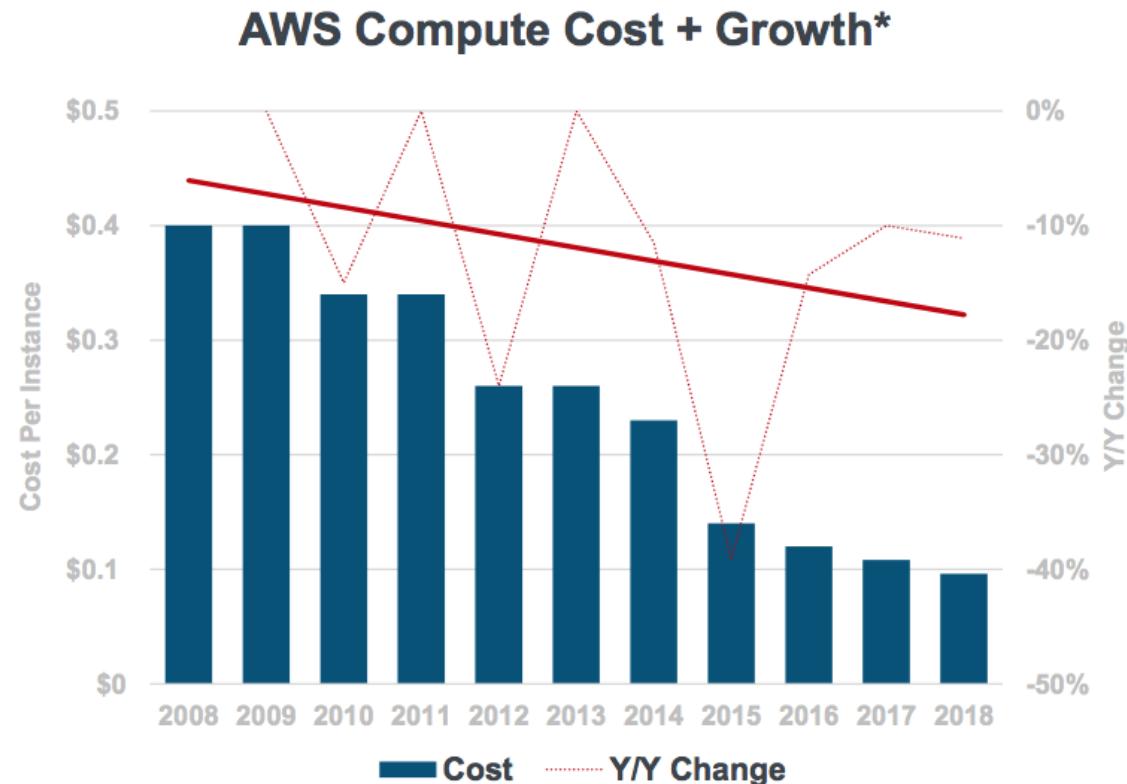
Amazon Web Services (AWS) Leading Cloud Charge...



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

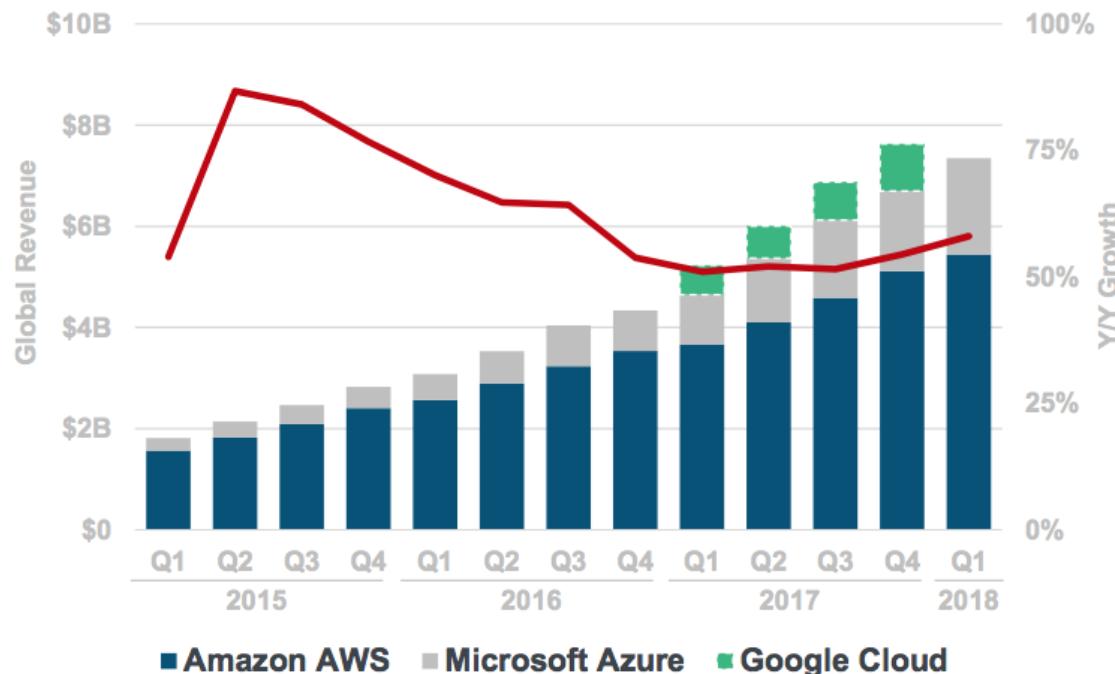
74

...Computing Big Bangs Volume Effects = Cloud Compute Cost Declines Continue -11% vs. -10% Y/Y...



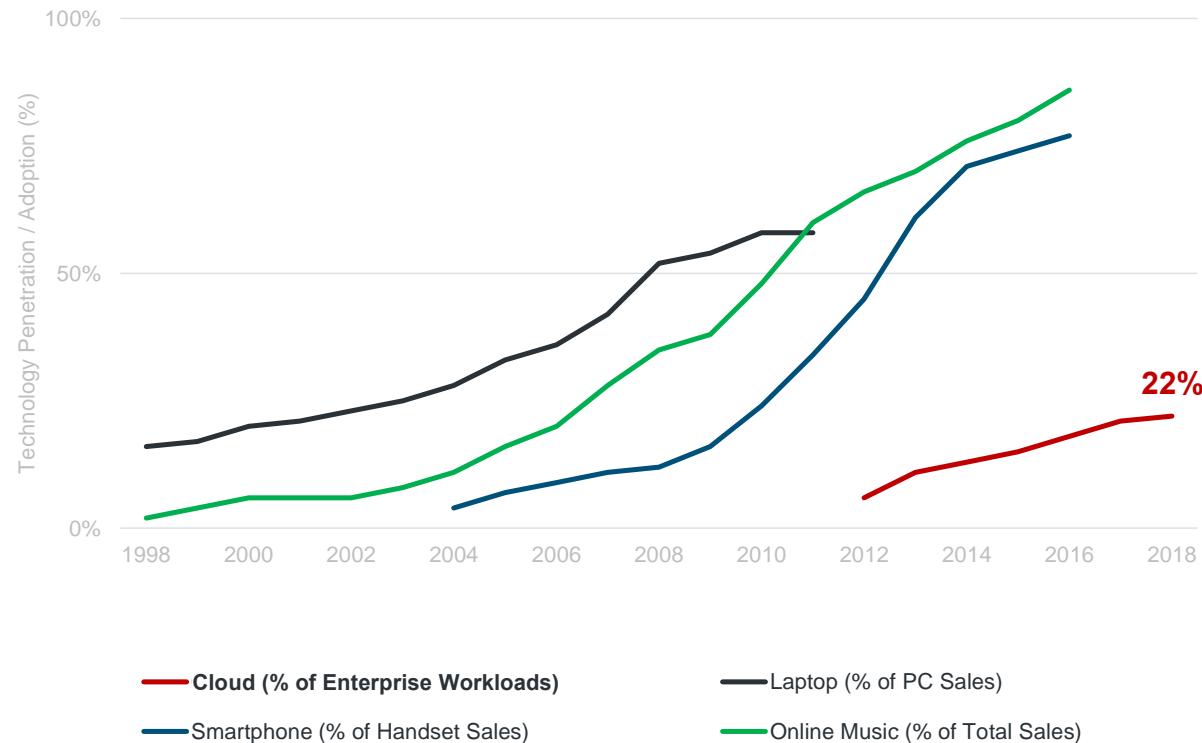
...Computing Big Bangs Volume Effects = Cloud Revenue Re-Accelerating +58% vs. +54% Q/Q

Cloud Service Revenue – Amazon + Microsoft + Google



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

Technology Adoption Rates, Global per Morgan Stanley



Cloud Evolution / Tools = Paving Way for Innovation Across Infrastructure Landscape



New Methods of Software Delivery =

APIs / Browser Extensions creating new wave of capabilities (+ companies) for both companies and end users



Containers / Microservices =

Simplify software development process / improve consistency between testing & production environments / reduce complexity of managing & updating apps due to modular approach



Elastic Analytical Databases =

Likes of Google BigQuery / Snowflake / AWS Redshift Spectrum nearly infinitely scalable / usage based + have minimal maintenance requirements

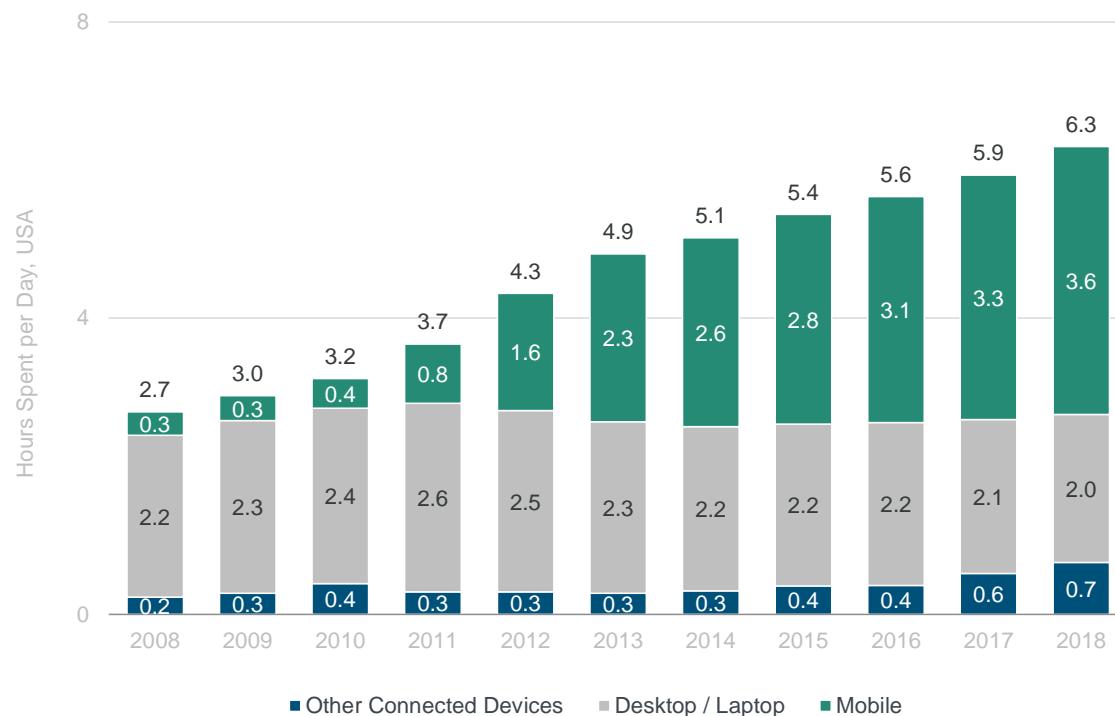


Edge Computing =

Pushing compute away from centralized nodes & closer to sources of data addresses many IT challenges when running data-centric workloads in cloud – reduces latency / can have security + compliance benefits

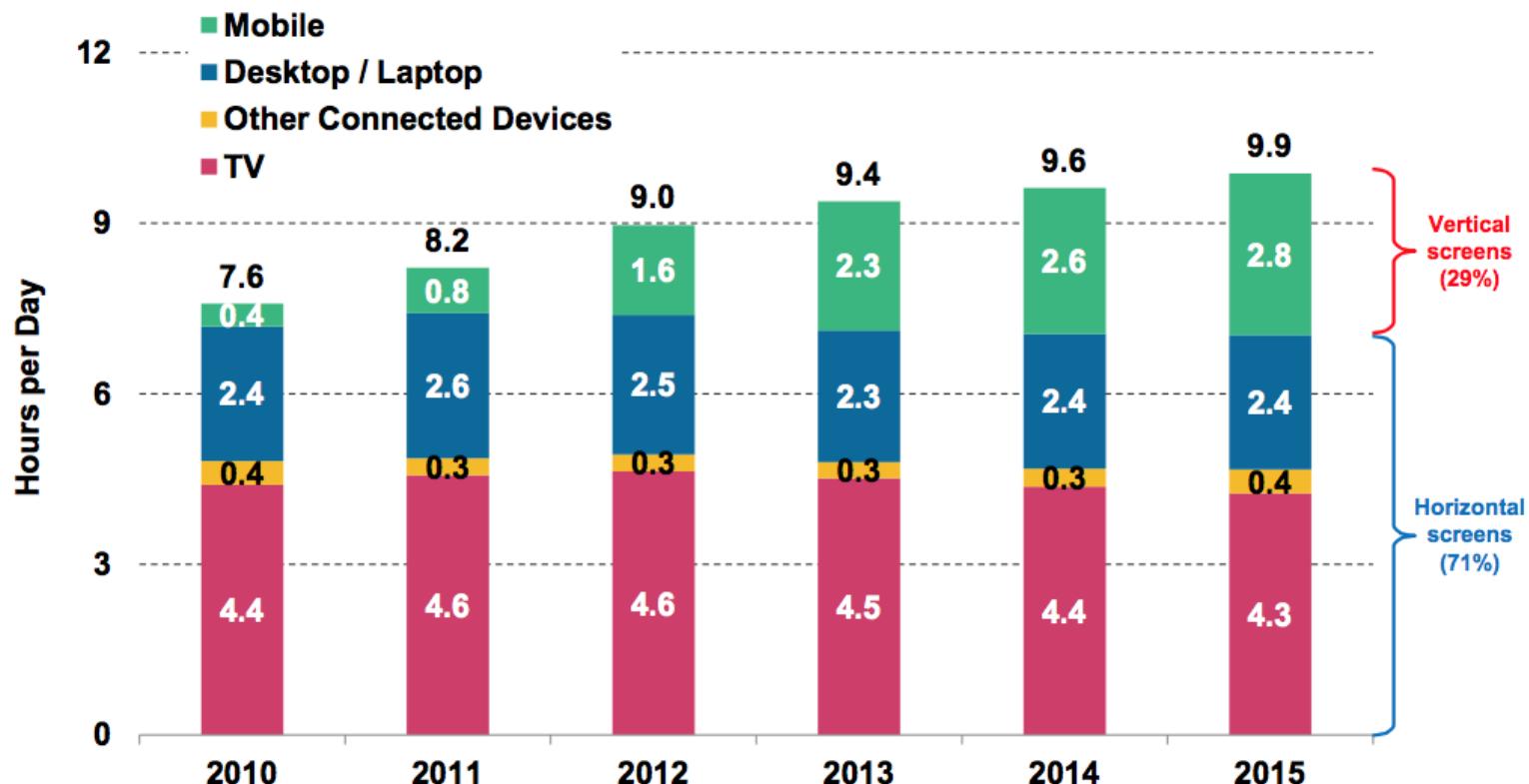
Digital Media Usage = Accelerating +7% vs. +5% Y/Y

Daily Hours Spent with Digital Media per Adult User, USA



...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



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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

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Messaging Apps = Top Global Apps in Usage + Sessions

**6+ of Top 10
most used apps
globally =
Messaging Apps**

Top Apps by Usage

Rank	App	
①		Facebook
②		WhatsApp
③		Messenger
④		Instagram
⑤		LINE
⑥		Viber
⑦		KakaoTalk
⑧		Clash of Clans
⑨		WeChat
⑩		Twitter

Top Apps By Number of Sessions

Rank	App	Sessions	
①		KakaoTalk	55
②		WhatsApp	37
③		WeChat	29
④		VK	29
⑤		LINE	26
⑥		Viber	20
⑦		Facebook	20
⑧		Clash of Clans	16
⑨		Instagram	12
⑩		Messenger	8

Messaging
Apps →
significant app
sessions

Messaging = Extensibility Expanding

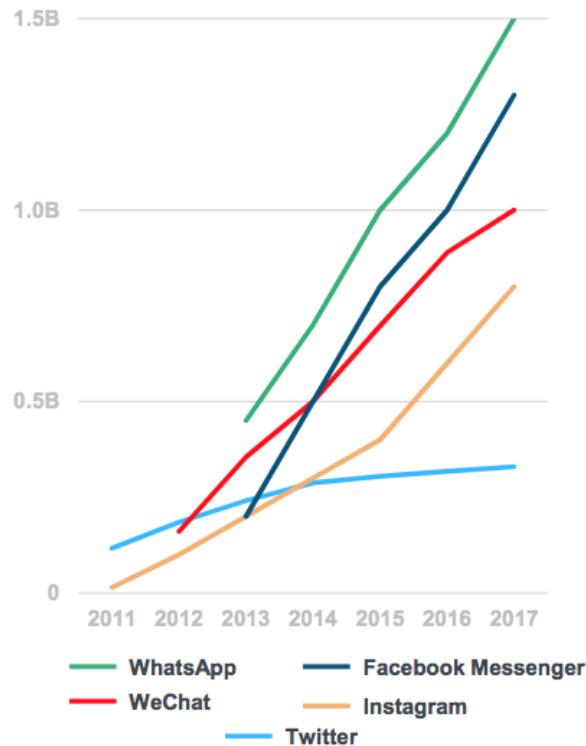
Messaging Tencent (2000 → 2018)



I am on WeChat: marcopapa99

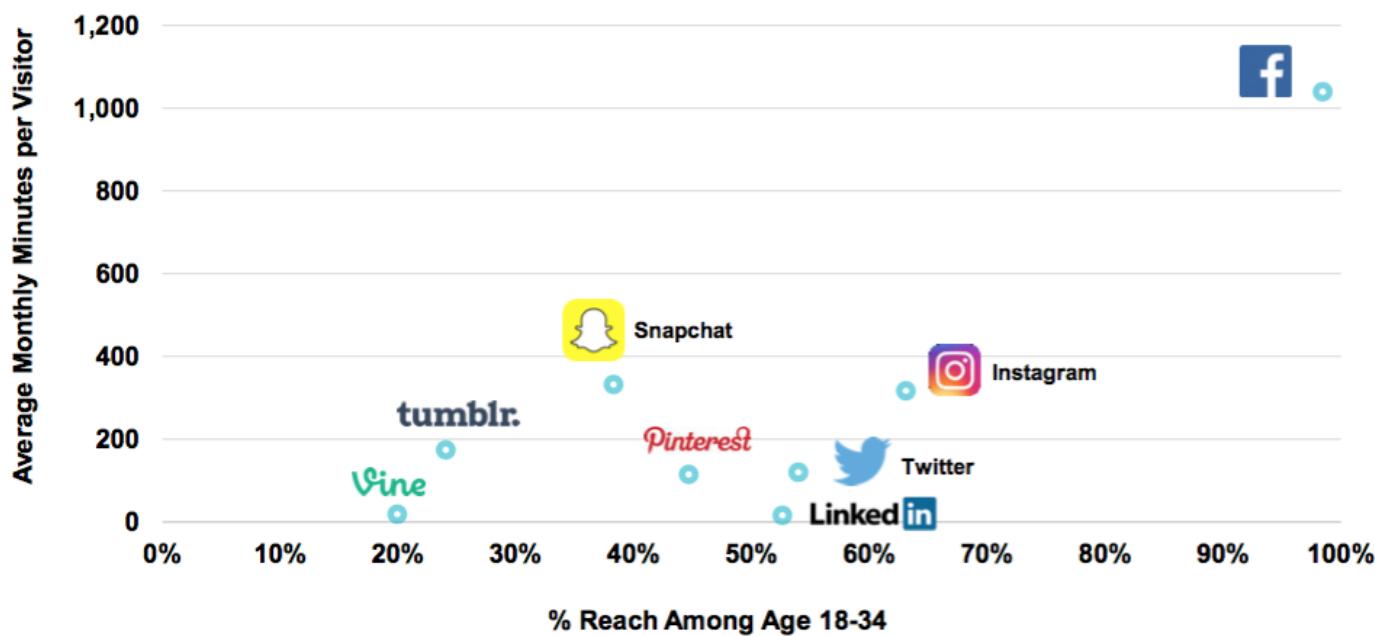
Messenger MAUs

MAU = Monthly Active Users



Millennial Social Network Engagement Leaders = Visual... Facebook / Snapchat / Instagram...

Age 18-34 Digital Audience Penetration vs.
Engagement of Leading Social Networks, USA, 12/15



Asia-Based Messaging Leaders = Continue to Expand Uses / Services Beyond Social Messaging



Name	KakaoTalk	WeChat	LINE
Launch	March 2010	January 2011	June 2011
Primary Country	Korea	China	Japan
Banking / Financial Services	Kakao Bank (11/15)	WeBank (1/15)	Debit Card (2016)
Enterprise	✗	Enterprise WeChat (3/16)	✗
Online-To-Offline (O2O)	Kakao Hairshop (1H:16E) Kakao Driver (1H:16E)	✓	Grocery Delivery (2015)
TV	Kakao TV (6/15)	✓	Line Live & Line TV (2015)
Video Calls / Chat	(6/15)	✓	✓
Taxi Services	Kakao Taxi (3/15)	✓	✓
Messaging	✓	✓	✓
Group Messaging	✓	✓	✓
Voice Calls	Free VoIP calls (2012)	WeChat Phonebook (2014)	✓
Payments	KakaoPay (2014)	(2013)	Line Pay (2014)
Stickers	(2012)	Sticker shop (2013)	(2011)
Games	Game Center (2012)	(2014)	(2011)
Commerce	Kakao Page (2013)	Delivery support w / Yixun (2013)	Line Mall (2013)
Media	Kakao Topic (2014)	✓	✓
QR Codes	✓	QR code identity (2012)	✓
User Stories / Moments	Kakao Story (2012)	WeChat Moments	Line Home (2012)
Developer Platform	KakaoDevelopers	WeChat API	Line Partner (2012)

New Services Added 2015 -16*

Previous Existing Services

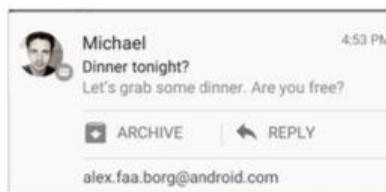
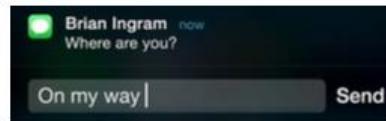
Average Global Mobile User = ~33 Apps...12 Apps Used Daily...
80% of Time Spent in 3 Apps

Day in Life of a Mobile User, 2016

	Average # Apps Installed on Device*	Average Number of Apps Used Daily	Average Number of Apps Accounting for 80%+ of App Usage	Time Spent on Phone (per Day)	Most Commonly Used Apps
USA	37	12	3	5 Hours	Facebook Chrome YouTube
Worldwide	33	12	3	4 Hours	Facebook WhatsApp Chrome

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

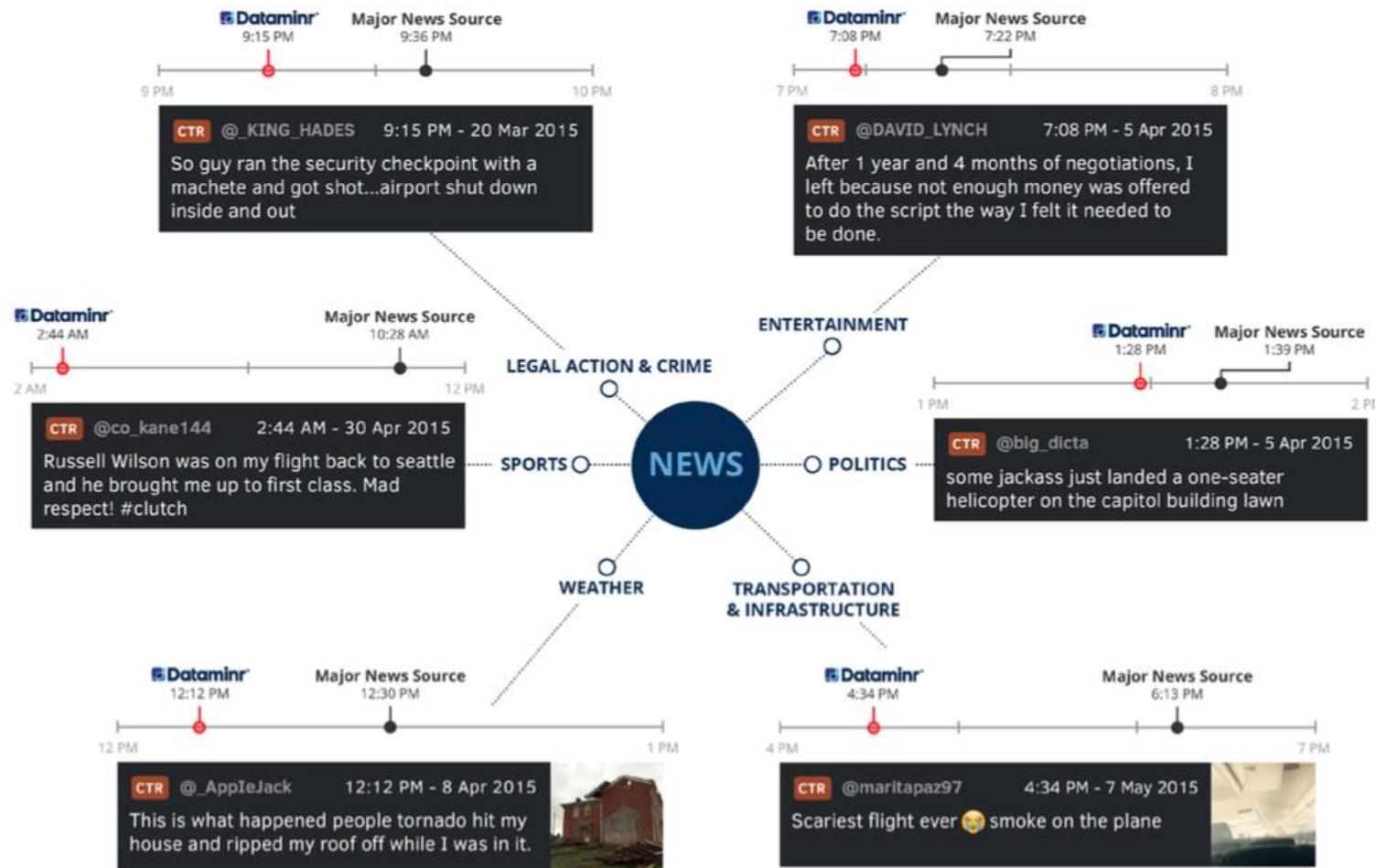
**Direct Interaction
on Notification Panel –**
without users interrupting
what they're doing...



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



Users Increasingly First Source for News via Twitter / Dataminr



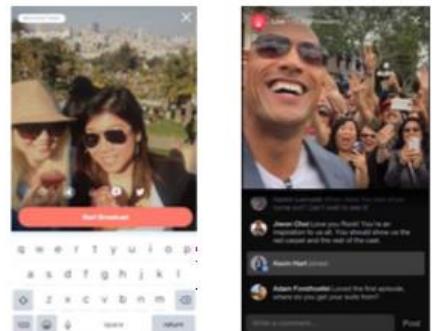
@KPCB

Source: Dataminr, 5/15.

65

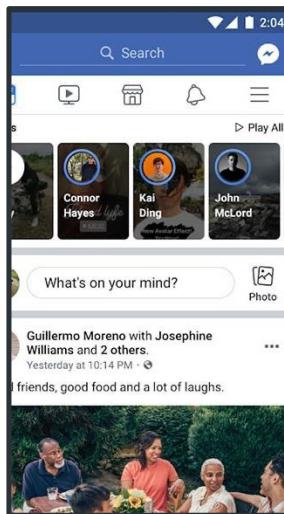
Video Evolution = Accelerating

Live (Linear) → On-Demand → Semi-Live → Real-Live

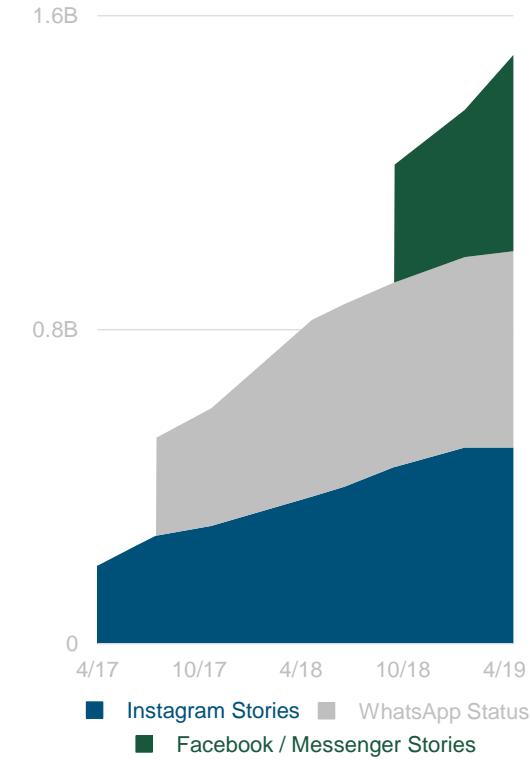
Live (Linear)	On-Demand	Semi-Live	Real-Live
<i>Traditional TV 1926</i>	<i>DVR / Streaming 1999</i>	<i>Snapchat Stories 2013</i>	<i>Periscope + Facebook Live 2015 / 2016</i>
Tune-In or Miss Out	Watch on Own Terms	Tune-In Within 24 Hours or Miss Out	Tune-In / Watch on Own Terms
Mass Concurrent Audience	Mass Disparate Audience	Mostly Personal Audience	Mass Audience, yet Personal
Real-Time Buzz	Anytime Buzz	Anytime Buzz	Real Time + Anytime Buzz
	 		

Video Time (Short-Form – Facebook Platform) = 1.5B DAUs + ~2x in One Year

Facebook Stories

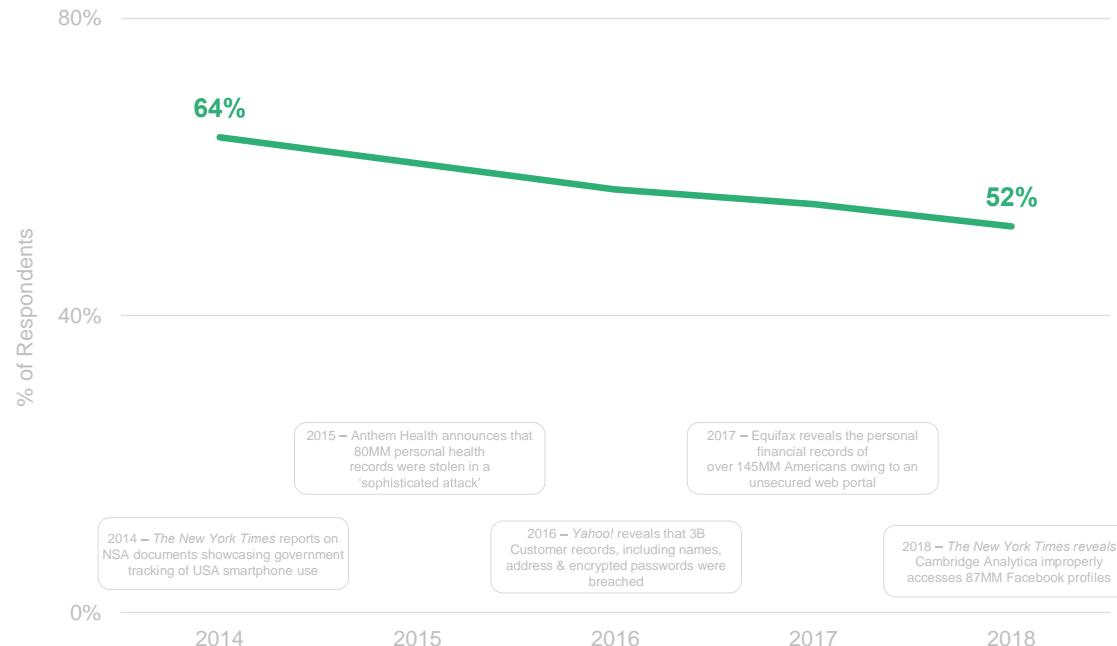


Daily Active Users, Global*

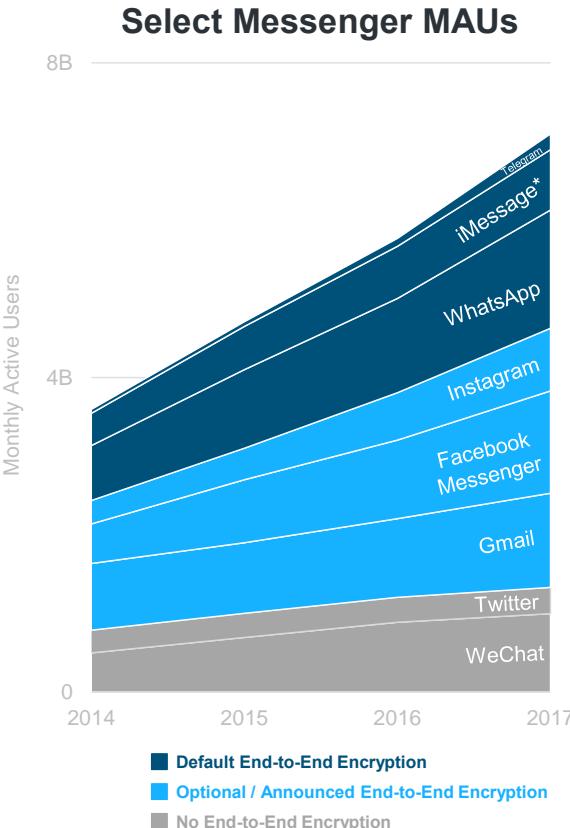


Digital Media = Privacy Concerns High But Moderating

People More Concerned About Internet Privacy vs. One Year Ago, Global



Digital Media = Encrypted Messaging / Traffic Rising Rapidly

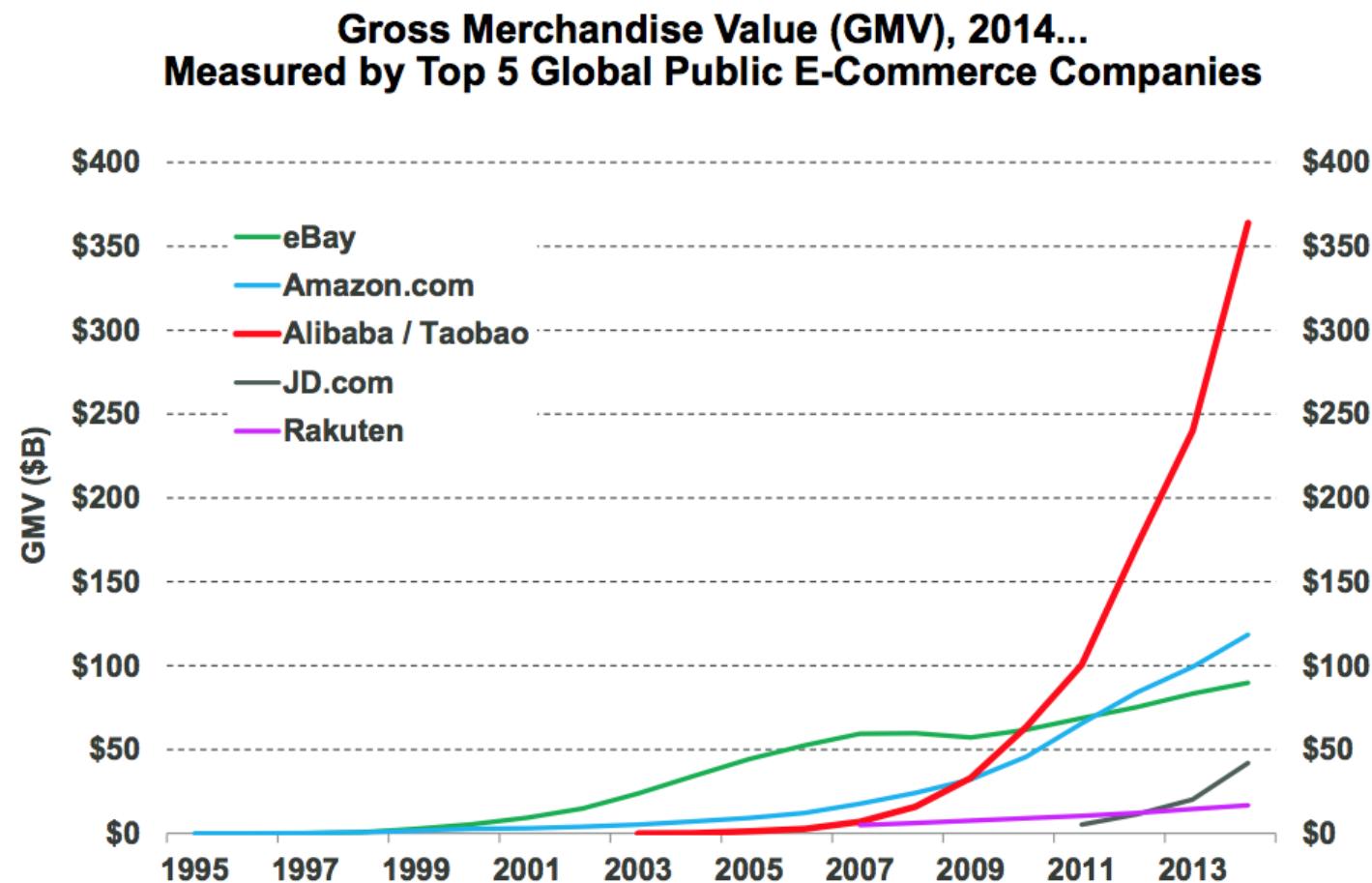


BOND
Internet Trends
2019

Source: Google, Tencent, Twitter, Facebook, Apple, Telegram releases & Morgan Stanley estimates. Note: *iMessage2 MAUs calculated by install base of Apple iPhones, as estimated by Credit Suisse (2014-2017). WhatsApp employs end-to-end encryption by default. Facebook Messenger has end-to-end encryption capabilities but users have to manually enable them. Instagram does not have end-to-end encryption but Facebook is planning to add that feature & make Facebook Messenger encrypted by default (1/19). All Gmail messages are encrypted at rest and in transit. Fortinet Q3:18 Quarterly Threat Landscape Report (11/18). HTTPS = Hyper Text Transfer Protocol Secure is the secure protocol over which data is sent between the browser and the website the user is connected to.

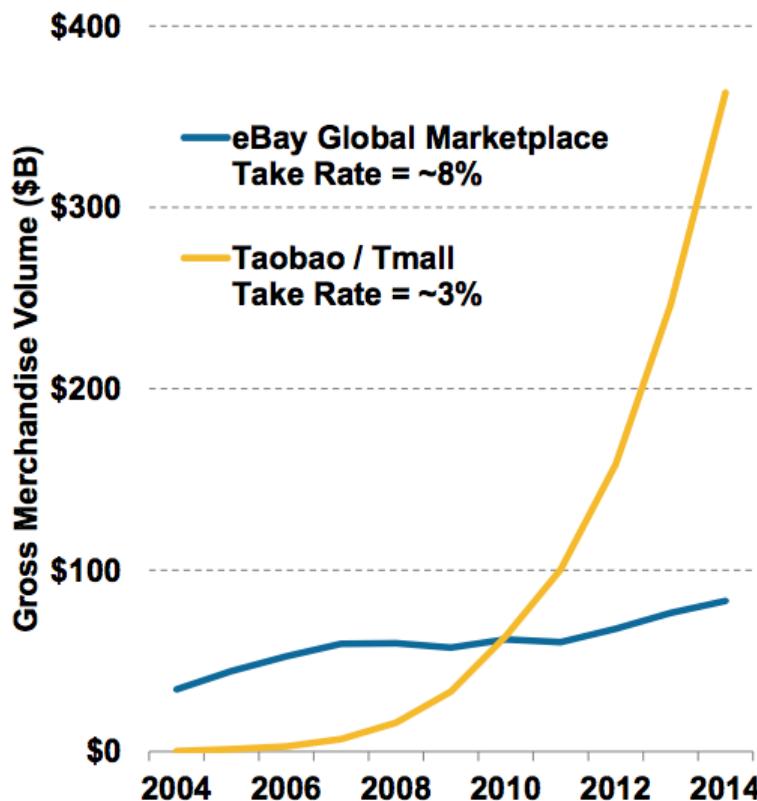
168

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

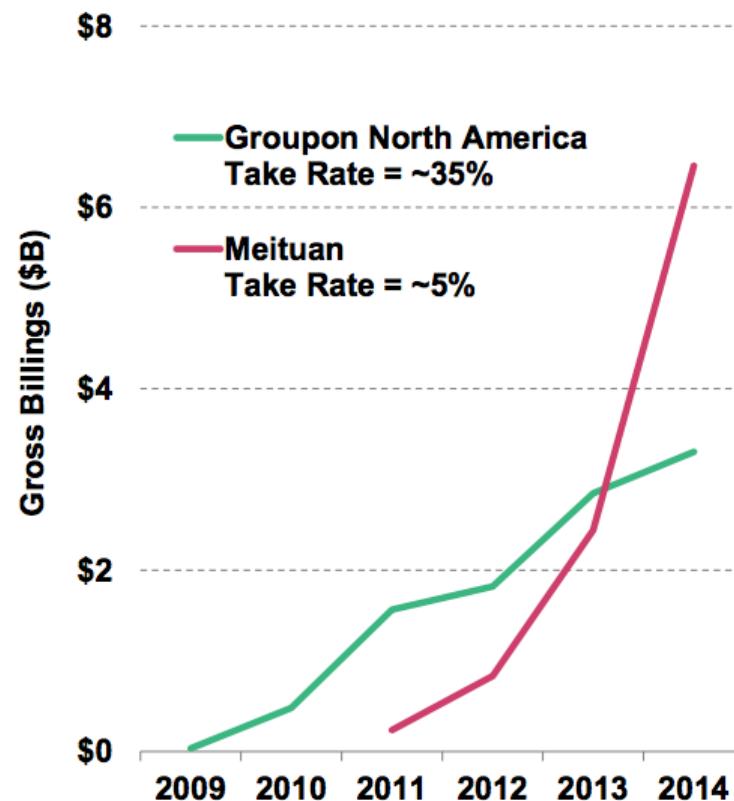


China E-Commerce = Low Take Rates* Helped China Marketplace Leaders Pass USA Peers

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



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



@KPCB

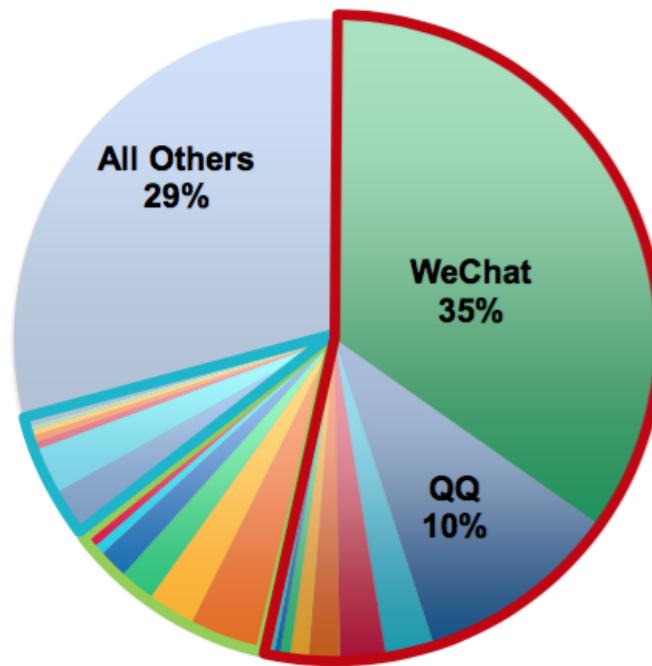
Source: Meituan gross billings data are estimates by Tuan800.com, eBay, Groupon, Alibaba GMV data per company.
Note: Take rate defined as net revenue divided by gross merchandise value or gross billings. eBay marketplace take rate excludes PayPal (~3%),
eBay, Alibaba GMV data per company. Meituan take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

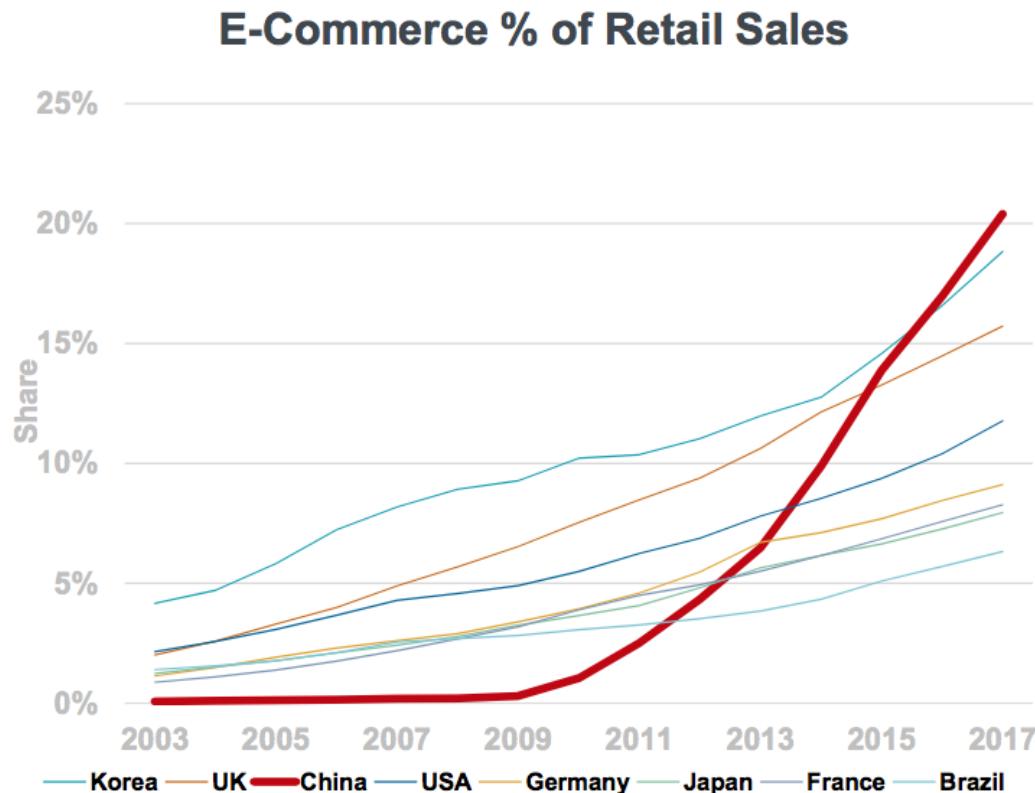
Alibaba

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

Baidu

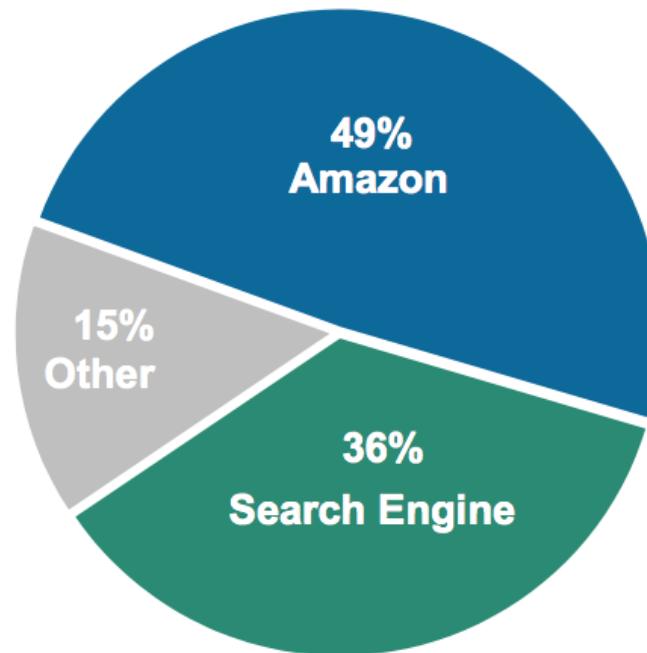
- Mobile Baidu
- iQiyi / PPS Video
- Baidu Browser
- Baidu Tieba
- 91 Desktop
- Baidu Maps
- All Other

Worldwide E-Commerce Share Gains Continue... China @ 20% = Highest Penetration Rate + Fastest Growing



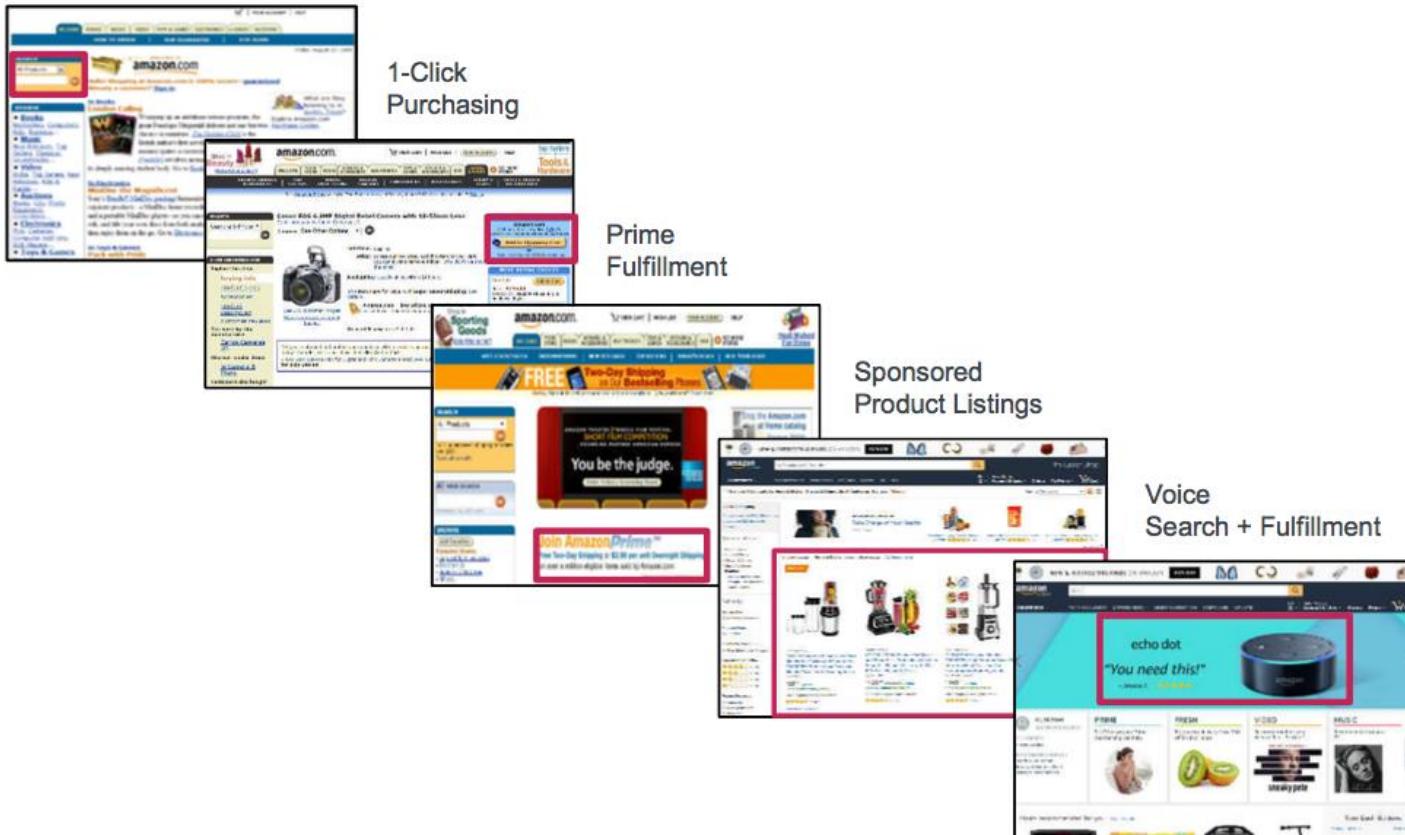
Product Finding = Often Starts @ Search (Amazon + Google...)

Where Do You Begin Your Product Search?



Product Finding (Amazon) = Started @ Search...Fulfilled by Amazon

Product Search

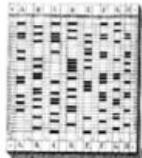


Product Finding (Google) = Started @ Search...Fulfilled by Others

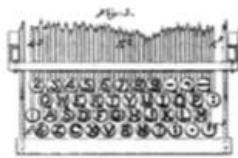
Organic Search



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



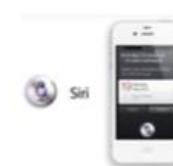
Commercial Use
of Mouse
(Apple Lisa)
1983



Commercial Use
of Mobile
Computing
(PalmPilot)
1996



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



Voice on Mobile
(Siri)
2011

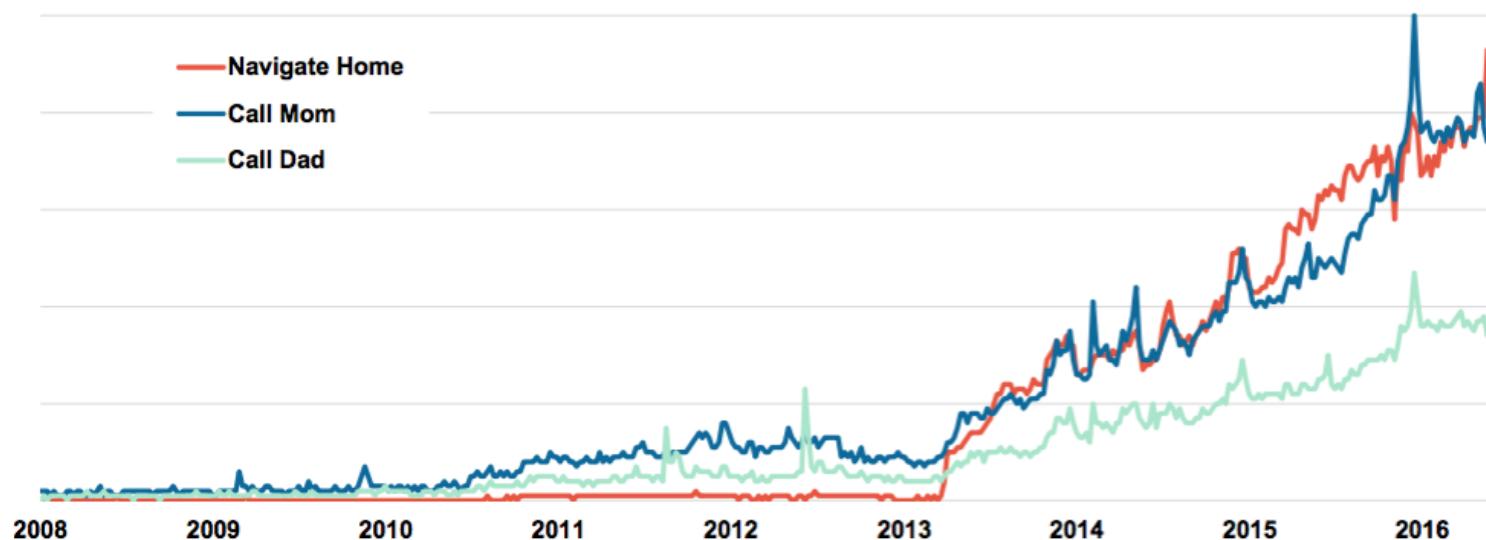


Voice on Connected /
Ambient Devices
(Amazon Echo)
2014

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

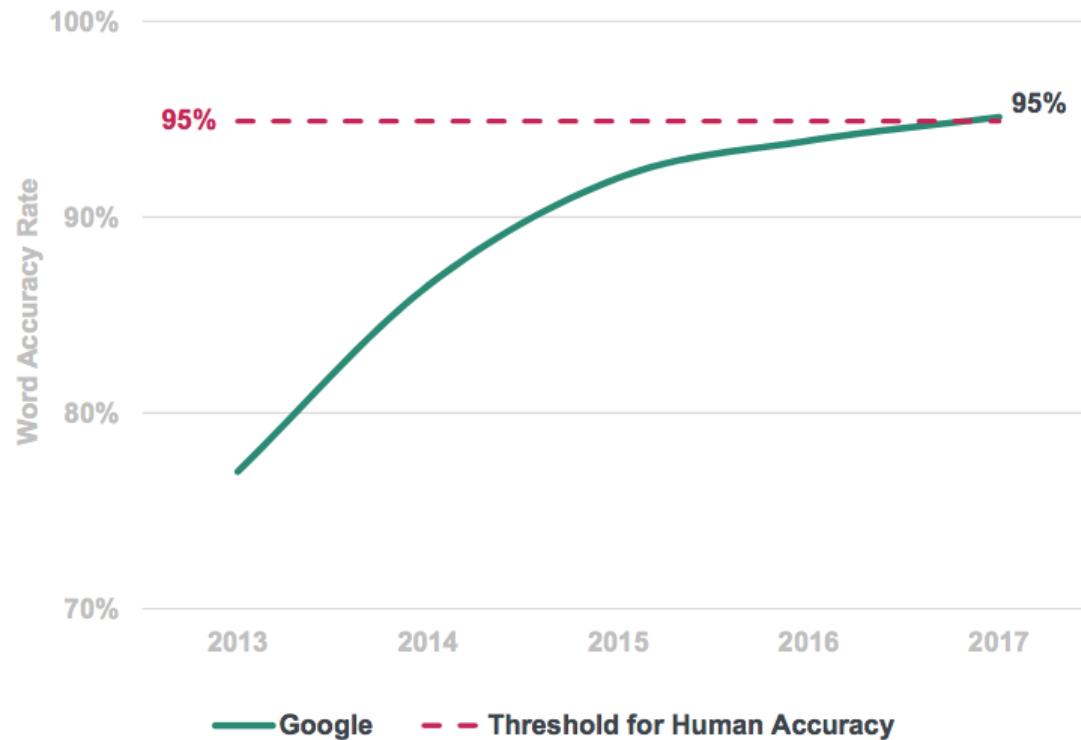
Google Trends imply queries associated with voice-related commands have risen >35x since 2008 after launch of iPhone & Google Voice Search

Google Trends, Worldwide, 2008 – 2016



Voice = Technology Lift Off...

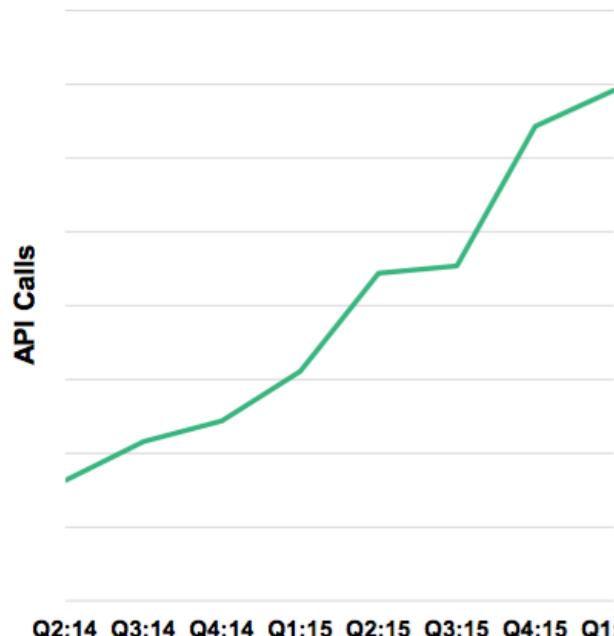
Google Machine Learning Word Accuracy



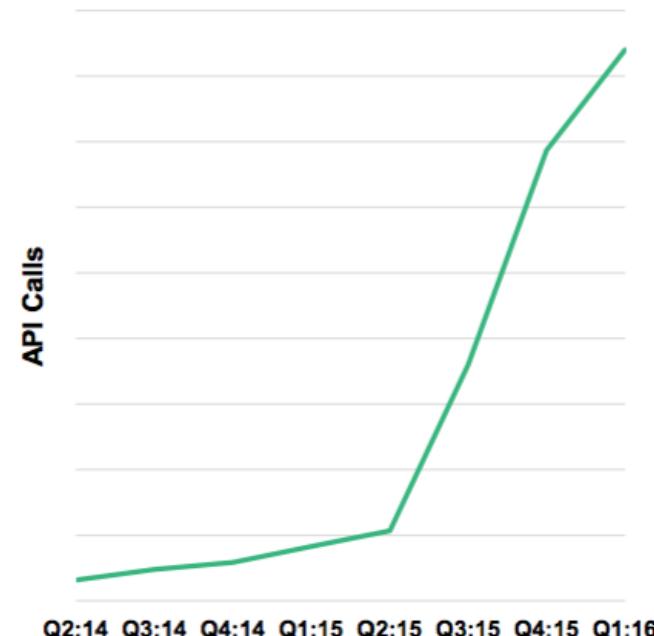
Baidu Voice = Input Growth >4x...Output >26x, Since Q2:14

Usage across all Baidu products growing rapidly...typing Chinese on small cellphone keyboard even more difficult than typing English...Text-to-Speech supplements speech recognition & key component of man-machine communications using voice

**Baidu Speech Recognition Daily Usage by API Calls,
Global, 2014 – 2016¹**



**Baidu Text to Speech (TTS) Daily Usage by API Calls,
Global, 2014 – 2016²**



Source: Baidu

Note: (1) Data shown is growth of speech recognition at Baidu, as measured by the number of API calls to Baidu's speech recognition system across time, from multiple products. Most of these API calls were for Mandarin speech recognition. (2) Data shown is growth of TTS (text to speech) at Baidu, in terms of the total number of API calls to Baidu's TTS system across time, from multiple products. Most of these API calls were for Mandarin TTS.

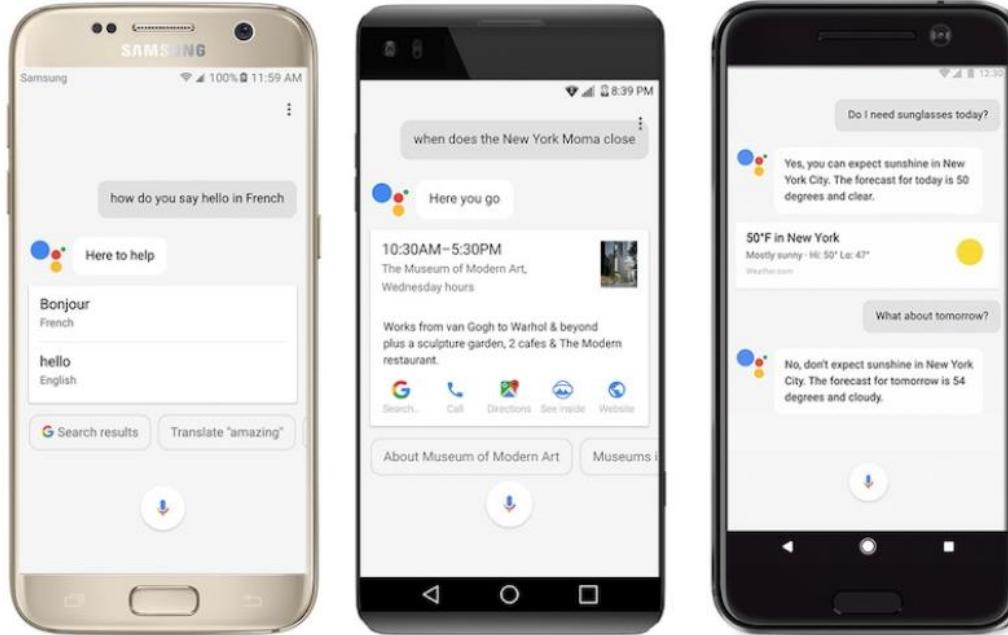


Voice-Based Mobile Platform Front-Ends = Voice Can Replace Typing

Google Assistant

Nearly 70% of Requests are Natural / Conversational Language, 5/17

20% of Mobile Queries Made via Voice, 5/16



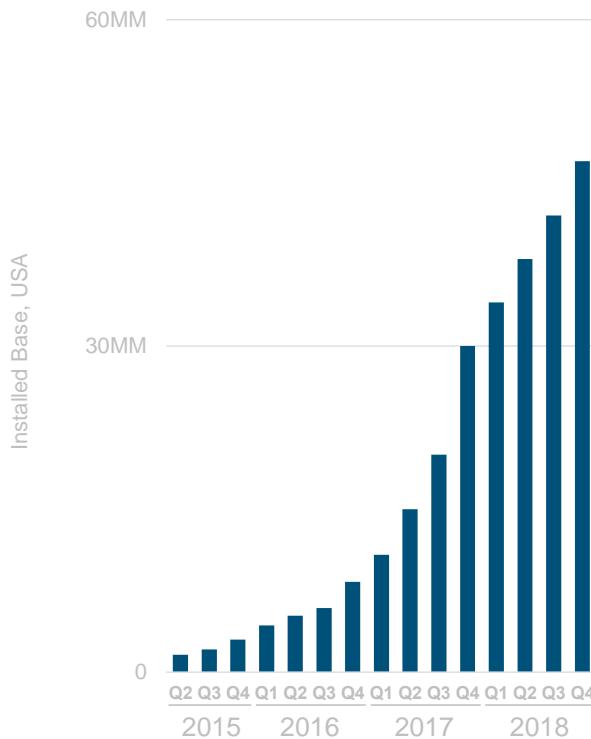
KLEINER
PERKINS

Source: Google I/O (5/16), Image: Macrumors (2/17)

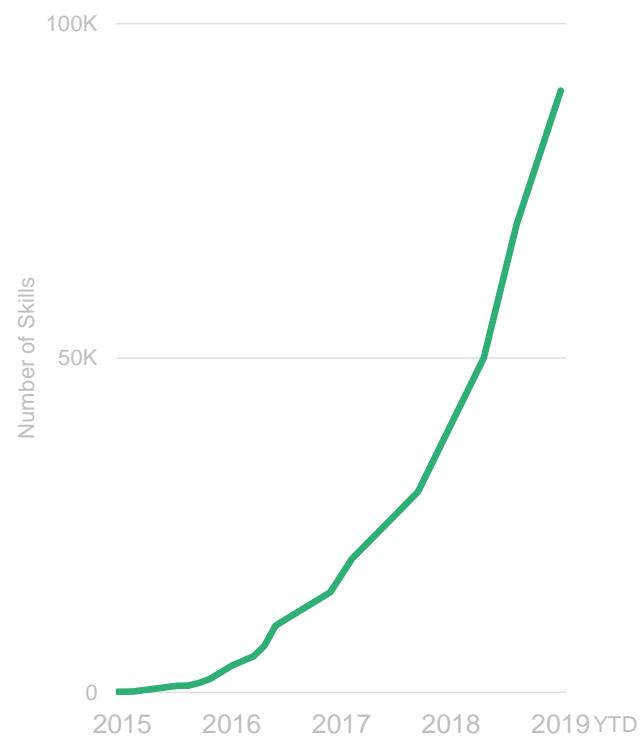
KP INTERNET TRENDS 2017 | PAGE 46

...Voice =
47MM Amazon Echo Base + ~2x in One Year

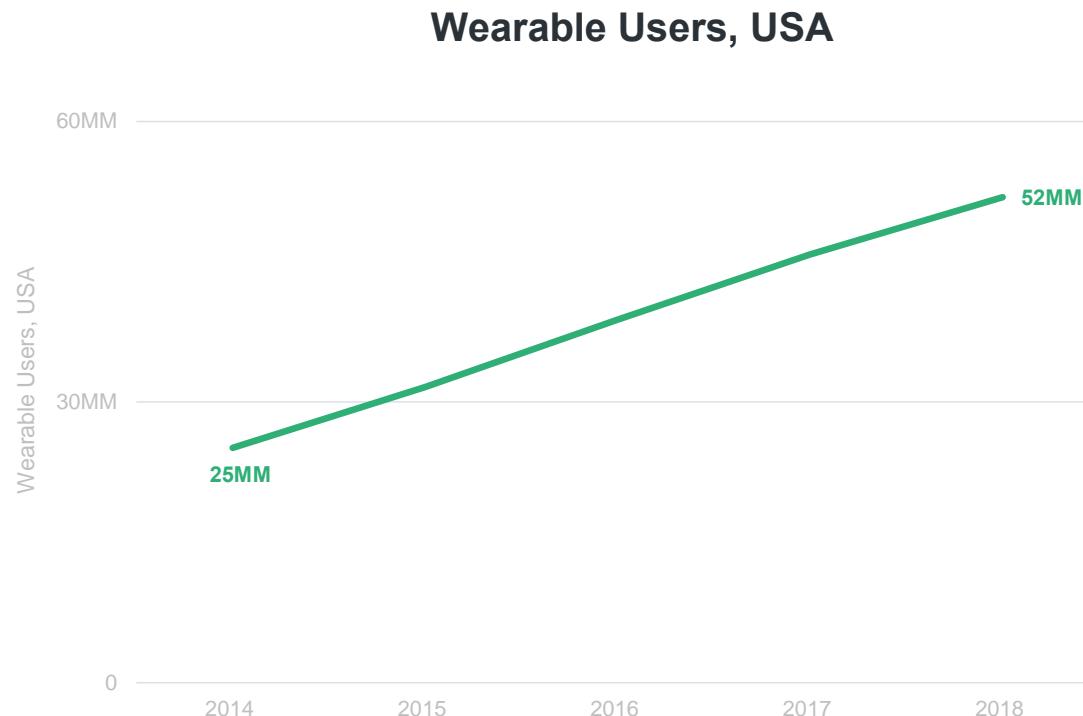
Amazon Echo Installed Base



Amazon Echo Skills



**Wearables =
52MM Users + ~2x in Four Years**



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 - Made by Ellis Horowitz & Marco Papa

View only

https://teslavoice.glideapp.io

1 Tesla Voice Commands - V10.2 and Beyond Add by using this form: https://forms.gle/eBugENRJDyPiYgh7

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

V10.2 Tesla Voice Commands - Made by Ellis Horowitz & Marco Papa

https://teslavoice.glideapp.io

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/>

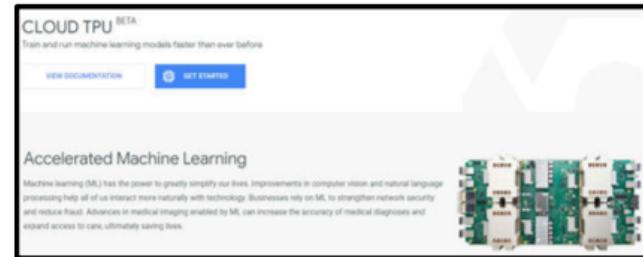
...Google = AI Platform Emerging from Google Cloud... Enabling Easier Data Processing / Collection for Others

Google Cloud AI Services / Infrastructure

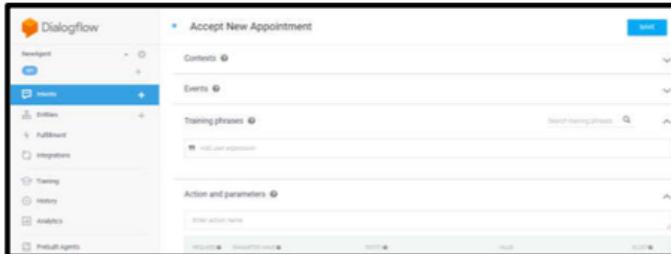
Google Cloud Vision API



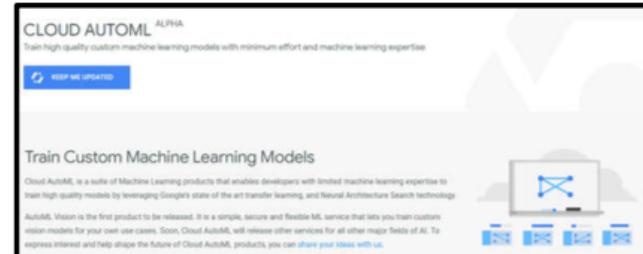
AI Hardware – Tensor Processing Units



Dialogflow Conversational Platform

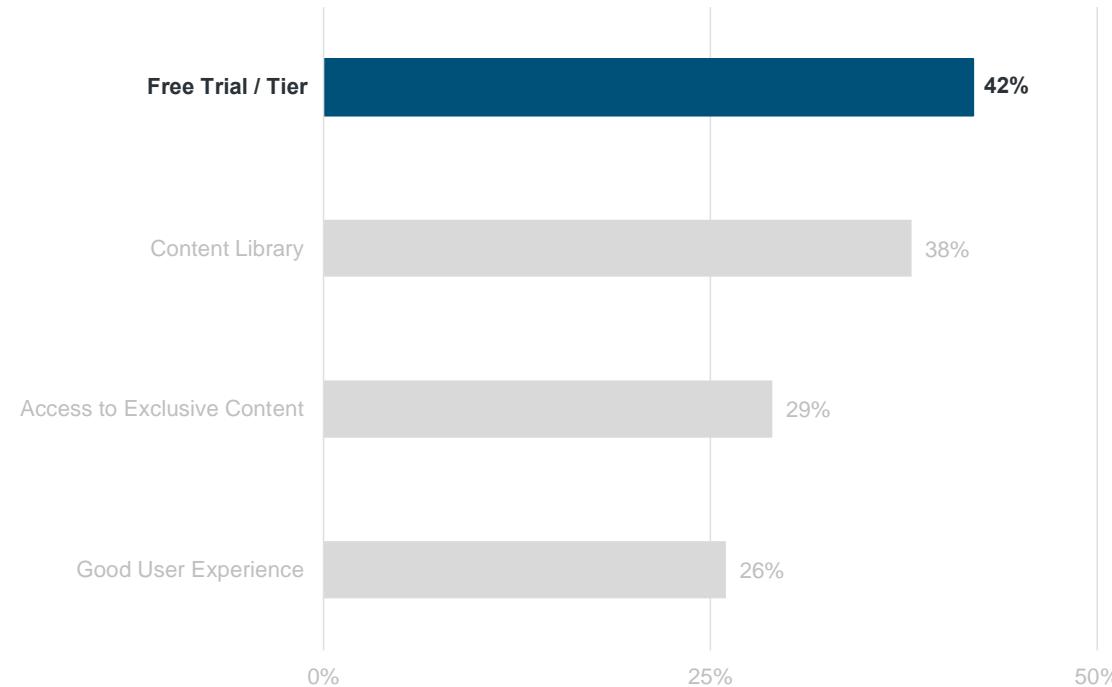


Cloud AutoML – Custom Models



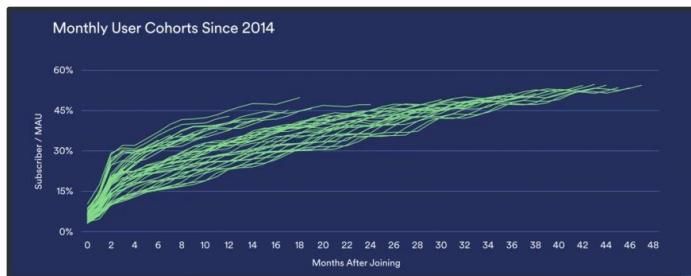
Effective + Efficient Marketing = Can Be Free Trial / Tier

Online Streaming – Reasons For Trying New Service



Happy Customers... Spotify = Free User Conversion to Paid Subscribers...

Free Ad-Supported Product...

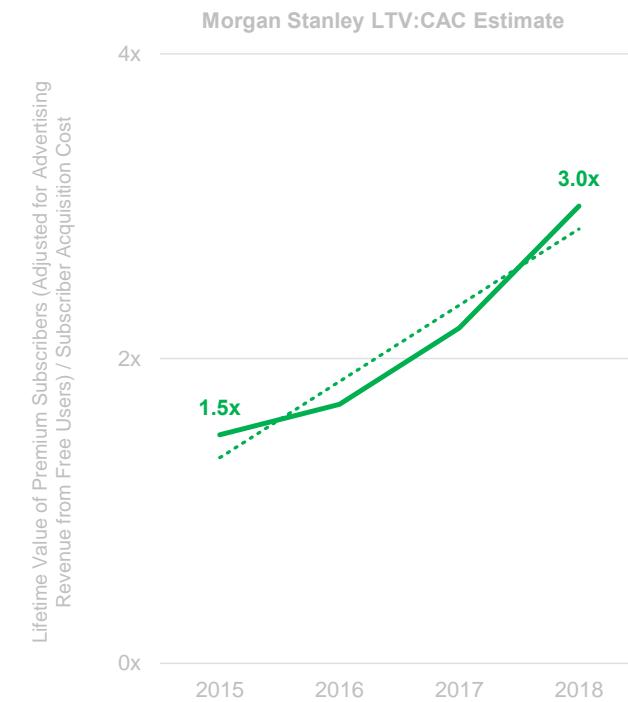


Our freemium model accounts for ~60% of our gross added premium subscribers... the ad-supported service is a subsidy program that offsets costs of new subscriber acquisition.

Developing a better user experience produces by far the most viral effect & impact when investing in growth.
Engagement drives conversion from free consumption to paid subscription.

Barry McCarthy – CFO, Spotify, 3/18

...Rising LTV / Subscriber Acquisition Cost Ratio



...Happy Customers...

Zoom = Free User Conversion to Paid Subscribers

Free to Join, When Paid User Hosts...



..we really want to get customers to test our product...

It's really hard to get customers to try Zoom without a freemium product...

We make our freemium product work so well...

If they like our product, very soon they are going to pay for the subscription.

The most important thing is to make sure the existing customer [is] happy rather than chasing after new prospects.

Our NPS is in the 67-69 range vs. our peers in the 20's...

We do not want to spend money on [the] marketing side to generate leads.

Eric Yuan – Founder / CEO, Zoom, 8/17

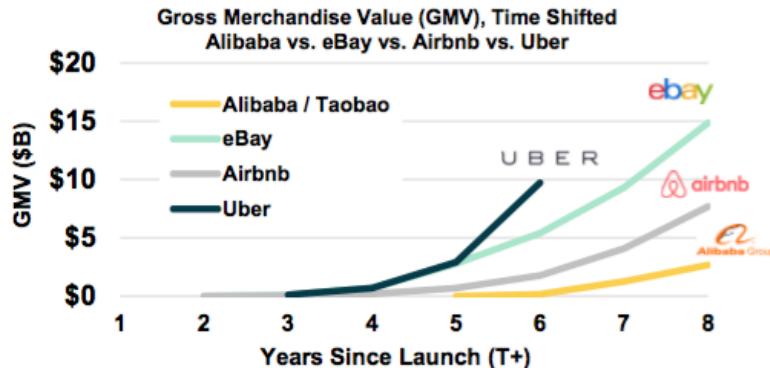
...High LTV / CAC Ratio*

Goldman Sachs Investment Research LTV:CAC Estimate



Current Generation of Internet Leaders = Growing Faster than Previous Generation

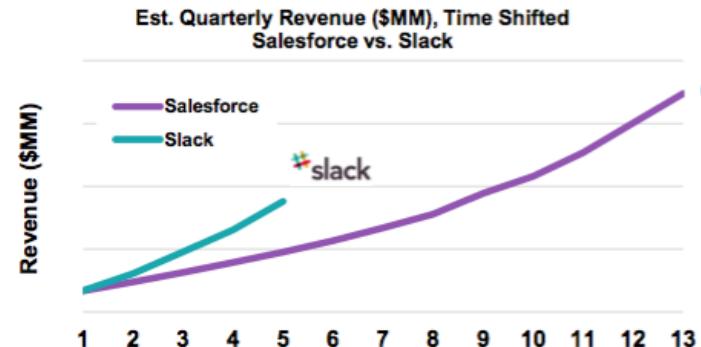
Marketplaces



Commerce



Enterprise



@KPCB

Marketplaces Source: Company data, Morgan Stanley Research. eBay founded in 1995. Amazon founded in 1995. Alibaba.com founded in 1999 as B2B portal connecting Chinese manufacturers and overseas buyers. Uber launched 2009, gave first ride in 2010. Airbnb founded in 2008.

Commerce Source: Publicly available company data, Morgan Stanley Research. JD.com launched B2C shipments in 2004, founded 1998 as an online magneto-optical store. Amazon founded in 1995.

Enterprise Source: Slack. Graph starting point based on similar est. revenue figures. Salesforce quarterly revenue approximated from publicly disclosed annual GAAP revenues.

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Global Internet Market Capitalization Leaders = USA Stable @ 18 of 30...China Stable @ 7 of 30

Rank 2019	Company	Region	Market Cap Value (\$B)		
			6/7/19	6/7/16	% Change
1	Microsoft	USA	\$1,007B	\$410B	+146%
2	Amazon	USA	888	343	+159%
3	Apple	USA	875	540	+62%
4	Alphabet	USA	741	497	+49%
5	Facebook	USA	495	340	+46%
6	Alibaba	China	402	195	+106%
7	Tencent	China	398	206	+93%
8	Netflix	USA	158	43	+266%
9	Adobe	USA	136	50	+174%
10	PayPal	USA	134	46	+190%
11	Salesforce	USA	125	56	+123%
12	Booking.com	USA	77	67	+15%
13	Uber	USA	75	--	--
14	Recruit Holdings	Japan	52	20	+167%
15	ServiceNow	USA	51	12	+316%
16	Workday	USA	48	16	+197%
17	Meituan Dianping	China	44	--	--
18	JD.com	China	39	32	+22%
19	Baidu	China	38	60	(36%)
20	Activision Blizzard	USA	35	28	+25%
21	Shopify	Canada	34	2	+1,297%
22	NetEase	China	33	23	+44%
23	eBay	USA	33	28	+19%
24	Atlassian	Australia	32	5	+509%
25	MercadoLibre	Argentina	30	6	+388%
26	Twitter	USA	29	11	+173%
27	Square	USA	29	3	+808%
28	Electronic Arts	USA	29	23	+25%
29	Xiaomi	China	28	--	--
30	Spotify	Sweden	25	--	--
Total			\$6,119	\$3,064	

USA stable at 18 of 30 refers to the fact that 19 USA companies were in the top 30 using same parameters in 2018. China in 2018 = 8 of 30. Source: CapitalIQ data collected 6/7/19.
Note: % change only applies to companies that were publicly traded on 6/7/16, private valuations not taken into account. Reflects a global list of publicly traded companies, some companies (e.g., Meituan Dianping) derive the majority of their revenue from one country. Companies selected are considered to be 'pureplay' Internet companies that do not derive a significant portion of revenues / profits from other business lines. Example companies that would be included otherwise = Reliance Industries (Refining), AT&T (Telecom), & Naspers (Television).

12

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	

USA stable at 23 of 30 refers to the fact that 21 USA companies were in the top 30 using same parameters in 2018. Technology in 2018 = 10 of 30.

Source: CapitalQ data collected 6/7/19. Reflects a global list of publicly traded companies, some companies (e.g., ICBC) derive the majority of their revenue from one country.

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USA = 60% of Most Highly Valued Tech Companies Founded By... 1st or 2nd Generation Americans...1.9MM Employees, 2018

Immigrant Founders / Co-Founders of Top 25 USA Valued Public Tech Companies, Ranked by Market Capitalization

Rank	Company	Mkt Cap (\$B)	LTM Rev (\$B)	Employees (K)	Founder / Co-Founder (1st or 2nd Gen Immigrant)	Generation
1	Microsoft	\$1,007B	\$122B	131K	--	--
2	Amazon	888	242	648	Jeff Bezos	2nd, Cuba
3	Apple	875	258	132	Steve Jobs	2nd, Syria
4	Alphabet / Google	741	142	99	Sergey Brin	1st, Russia
5	Facebook	495	59	36	Eduardo Saverin	1st, Brazil
6	Cisco	239	51	74	--	--
7	Intel	206	71	107	--*	--
8	Oracle	182	40	137	Larry Ellison / Bob Miner	2nd, Russia / 2nd, Iran
9	Netflix	158	17	7	--	--
10	Adobe	136	10	21	--	--
11	PayPal	134	16	22	Max Levchin / Luke Nosek / Peter Thiel / Elon Musk***	1st, Ukraine / 1st, Poland / 1st, Germany / 1st, South Africa
12	Salesforce	125	14	35	--	--
13	IBM	118	79	351	Herman Hollerith	2nd, Germany
14	Texas Instruments	104	16	30	Cecil Green / J. Erik Jonsson	1st, UK / 2nd, Sweden
15	NVIDIA	89	11	13	Jensen Huang	1st, Taiwan
16	Qualcomm	84	21	35	Andrew Viterbi	1st, Italy
17	Booking.com	77	14	25	--	--
18	Uber	75	12	22	Garrett Camp	1st, Canada
19	Automatic Data Processing	73	14	57	Henry Taub	2nd, Poland
20	VMware	69	9	23	Edouard Bugnion	1st, Switzerland
21	Intuit	67	7	9	--	--
22	ServiceNow	51	3	8	--	--
23	Workday	48	3	11	Aneel Bhusri	2nd, India
24	Micron	38	30	36	--	--
25	Cognizant	36	16	282	Francisco D'Souza / Kumar Mahadeva	1st, India** / 1st, Sri Lanka

Source: CapIQ as of 6/7/19. *While Andy Grove (from Hungary) is not a co-founder of Intel, he joined as COO on the day it was incorporated. **Francisco D'Souza is a person of Indian origin born in Kenya. ***Max Levchin / Luke Nosek / Peter Thiel's startup Confinity merged with Elon Musk's startup X.com to form PayPal in 3/00.

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

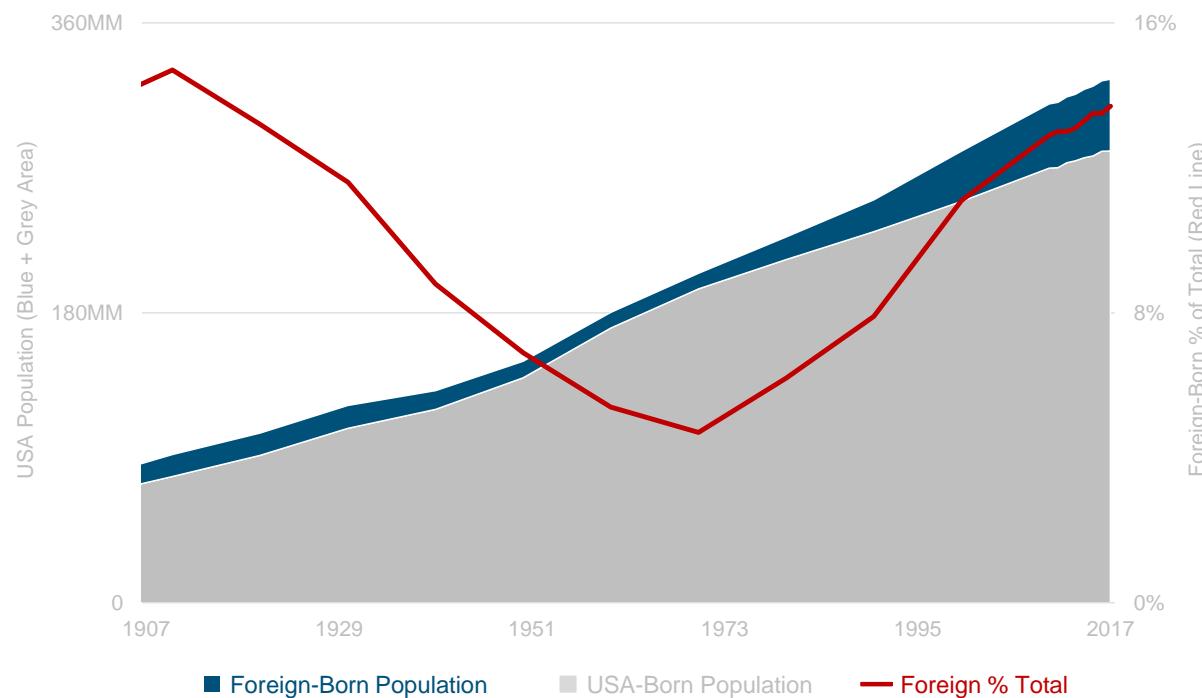
Company	Founder / Co-Founder	Country of Origin	Valuation (\$B)
WeWork	Adam Neumann	Israel	\$47B
SpaceX	Elon Musk	South Africa	31
Stripe	John Collison Patrick Collison	Ireland	23
Palantir	Peter Thiel	Germany	21
Epic Games	Mark Rein	Canada	15
DoorDash	Tony Xu	China	13
Wish	Peter Szulczewski Danny Zhang	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	India India India	3
Zoox	Soham Mazumdar	India	
Oscar Health	Tim Kentley-Klay	Australia	3
	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 Ankur Kothari	New Zealand China India	3
Automation Anywhere	Mihir Shukla Neeti Mehta Shukla Rushabh Parm	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 Winerger Daniel Schreiber	Israel	2
LegalZoom	Brian Lee	South Korea	2
Avant	Al Goldstein John Sun Paul Zhang	Uzbekistan China China	2
Apttus	Krik Krappe	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 Vahe Kuzoyan	Iran Armenia	2
Segment	Ilya Volodarsky	Russia	2
Quanergy	Tianyue Yu	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.

USA = 14% of Population Foreign-Born & Rising...
Near All-Time High (1910) @ 15%

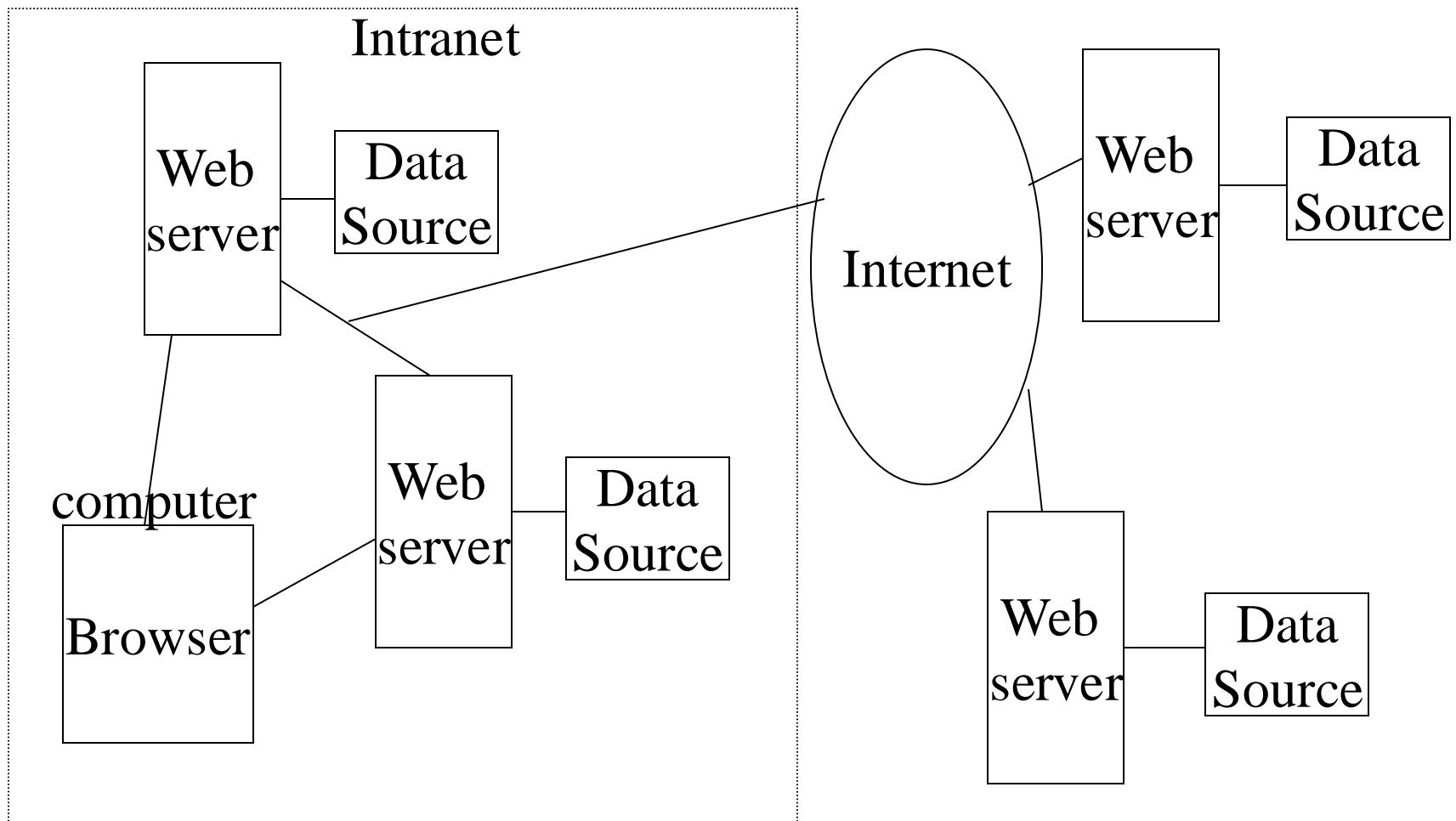
USA Population vs. Foreign-Born % of Total Population



The World Wide Web (WWW)

- Material relevant to exams starts HERE with this slide.

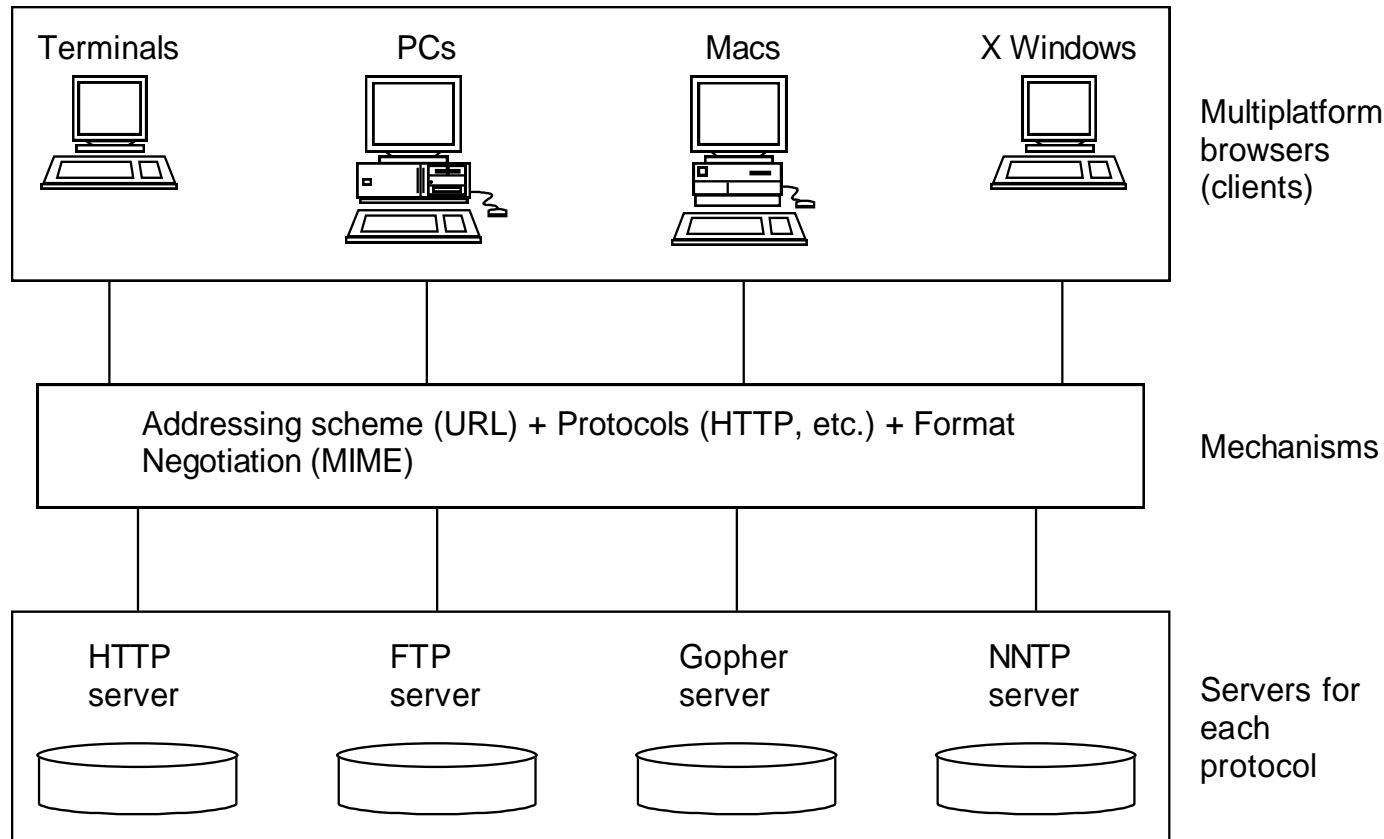
Graphical View of the WWW



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

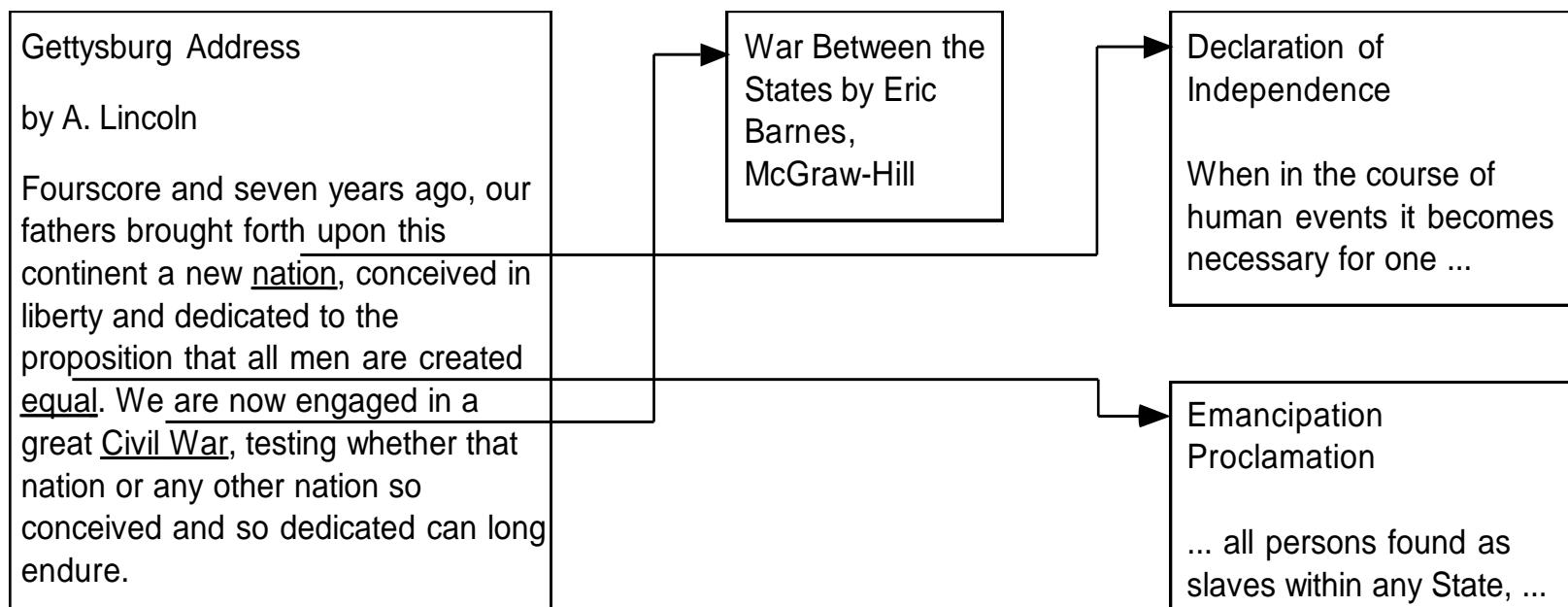
~	%7E		%7C
SPACE	%20	\	%5C
%	%25	^	%5E
&	%26	[%5B
=	%3D]	%5D
?	%3F	#	%23
{	%7B	>	%3E
}	%7D	<	%3C

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

What is HyperText?

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

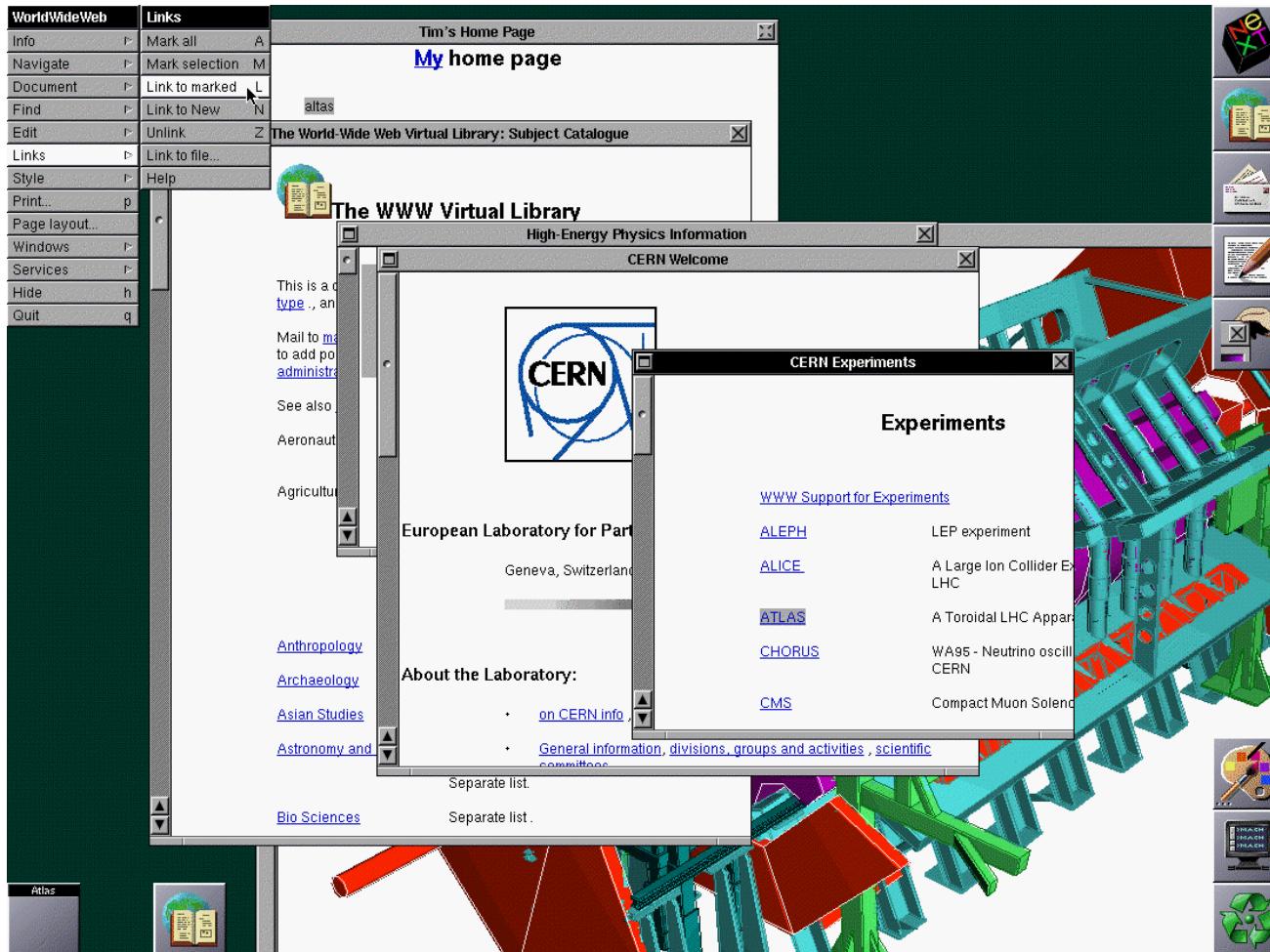


Early History of the WWW

- 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. It mentions 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 also lists various links such as "What's out there?", "Help", "Software Products", "Technical", "Bibliography", "People", "History", "How can I help?", and "Getting code".

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.

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[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.