

Lecture

Internet Trends and Web Basics

The Internet and the WWW are Different

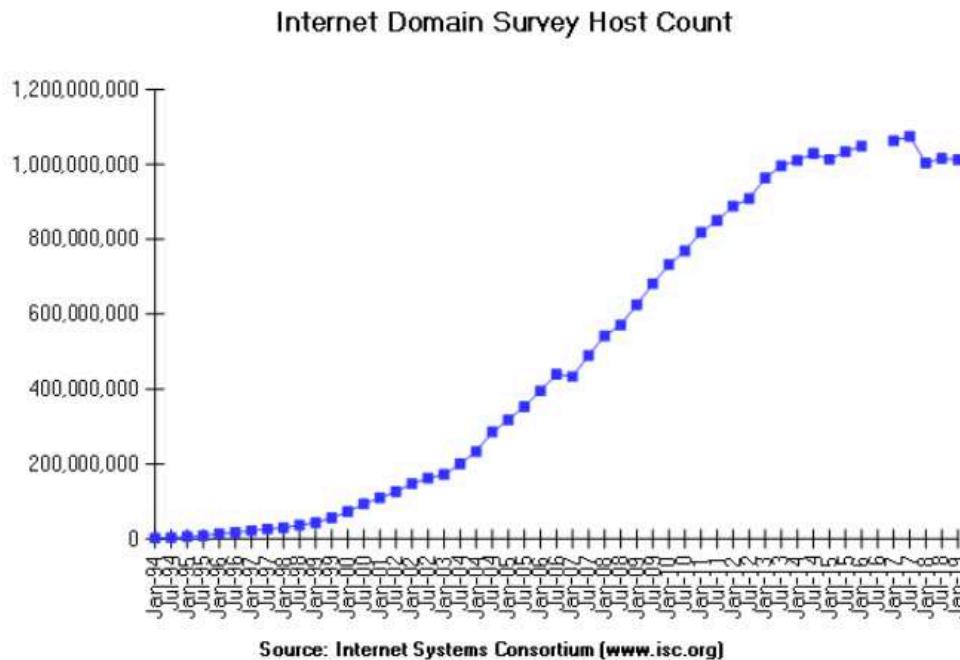
- The *Internet* is a global digital infrastructure that connects hundreds of millions of computers and people
- The *World Wide Web* is a mechanism that unifies the retrieval and display of a subset of data on the Internet
- An *intranet* is a local/global information structure that connects an organization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

Date	HostCount
Jan 93	1,313,000
Jul 93	1,776,000
Jan 94	2,217,000
Jul 94	3,212,000
Jan 95	4,852,000
Jul 95	6,642,000
Jan 96	9,472,000
Jul 96	12,881,000
Jan 97	16,146,000
Jul 97	19,540,000
Jan 98	29,670,000
Jul 98	36,739,000
Jan 99	43,230,000
Jul 99	56,218,000
Jan 00	72,398,092
Jul 00	93,047,785
Jan 01	109,574,429
Jul 01	125,888,197
Jan 02	147,344,723
Jul 02	162,128,493
Jan 03	171,638,297
Jul 03	183,284,187
Jan 04	233,101,481
Jul 04	285,139,107
Jan 05	317,646,084
Jul 05	394,991,609
Jan 06	439,286,364
Jul 06	433,193,199
Jan 07	489,774,269
Jul 07	541,677,360
Jan 08	570,937,778
Jul 08	625,226,456
Jan 09	681,064,561
Jul 09	732,740,444
Jan 10	768,913,036
Jul 10	818,374,269
Jan 11	849,869,781
Jul 11	888,239,420
Jan 12	908,585,739
Jul 12	963,518,598
Jan 13	996,230,757
Jul 13	1,010,251,829
Jan 14	1,028,544,414
Jul 14	1,048,766,623
Jan 15	1,062,660,523
Jul 15	1,074,971,748
Jan 16	1,096,230,757
Jul 16	1,012,706,608
Jan 17	1,012,695,272
Jul 17	1,015,787,389
Jan 18	1,012,695,272
Jul 18	1,003,604,363
Jan 19	1,012,695,272

Countries with Internet Penetration >45%, 2014

As of 2014 there are 2.8 billion Internet users, with yearly growth at 8%; China and the USA have the largest number of Internet users and the penetration of the population in China remains small

Rank	Country	2014 Internet Users (MM)	2014 Internet User Growth	2013 Internet User Growth	Population Penetration	Total Population (MM)	Per Capita GDP (\$000)
1	China	632	7%	10%	47%	1,356	\$13
2	United States	269	2	2	84	319	\$55
3	Japan	110	0	9	86	127	\$37
4	Brazil	105	4	12	52	203	\$16
5	Russia	87	15	9	61	142	\$25
6	Germany	68	0	1	84	81	\$46
7	United Kingdom	57	4	1	90	64	\$40
8	France	54	-1	5	82	66	\$40
9	Iran (I.R.)	49	8	16	60	81	\$17
10	Egypt	43	15	13	50	87	\$11
11	Korea (Rep.)	42	1	1	85	49	\$35
12	Turkey	38	4	6	46	82	\$20
13	Italy	36	1	2	58	62	\$35
14	Spain	34	0	7	72	48	\$34
15	Canada	30	0	5	86	35	\$45
Top 15		1,653	5%	7%	59%	2,800	
World		2,793	8%	10%	39%	7,176	



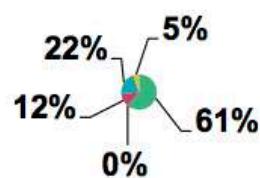
Source: United Nations / International Telecommunications Union, US Census Bureau. Internet user data is as of mid-year. Internet user data for: China from CNNIC, India from IAMAI, Iran from Islamic Republic News Agency, citing data released by the National Internet Development Center, Indonesia from APJII / eMarketer.

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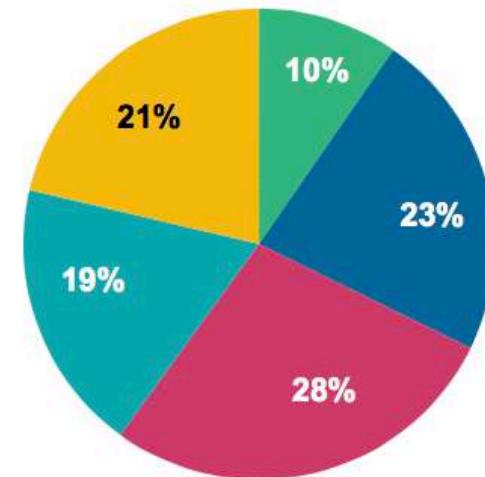
The following slides are based upon a presentation by Mary Meeker of Kleiner Perkins Caufield and Byers, see <http://www.kpcb.com/insights/2014-internet-trends> and <http://www.kpcb.com/insights/2015-internet-trends>, <http://www.kpcb.com/internet-trends>

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

1995
35MM+ Internet Users
0.6% Population Penetration

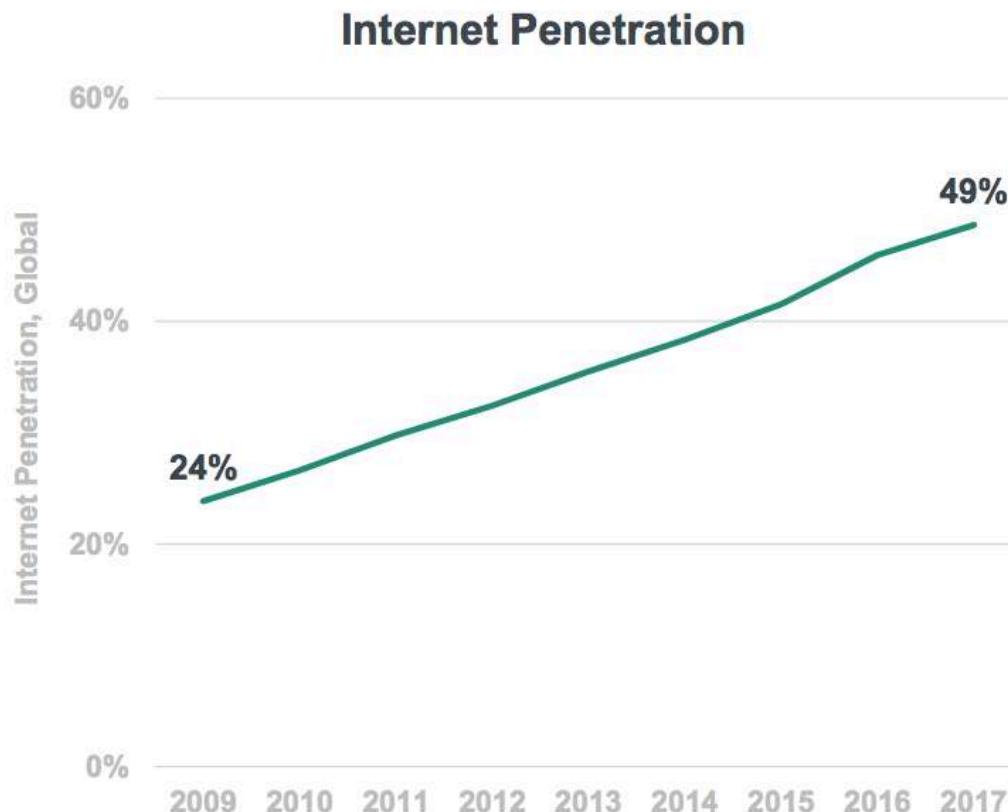


2014
2.8B Internet Users
39% Population Penetration



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

Global Internet Users = 3.6B @ >50% of Population (2018)

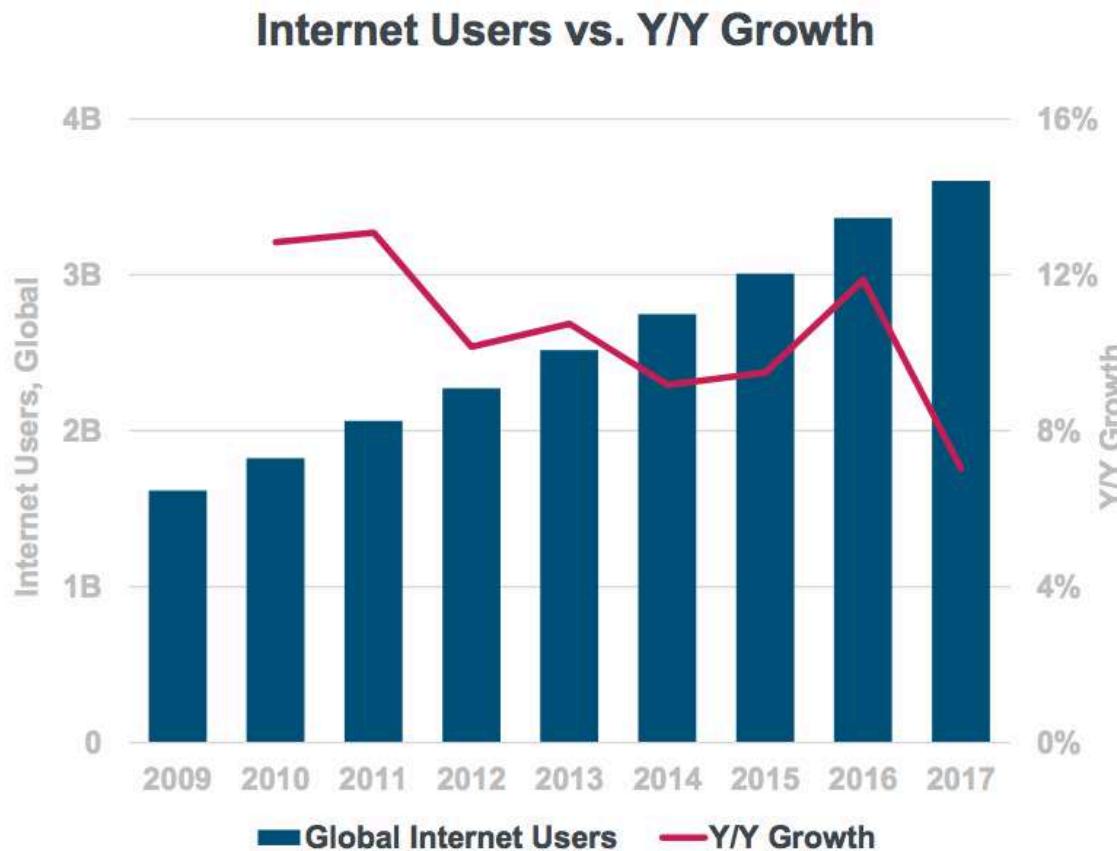


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2018
INTERNET TRENDS

Source: CIA World Factbook, United Nations / International Telecommunications Union, USA Census Bureau. Internet user data is as of mid-year.
Internet user data: Pew Research (USA), China Internet Network Information Center (China), Islamic Republic News Agency / InternetWorldStats
/ KP estimates (Iran). KP estimates based on IMAI data (India), & APJII (Indonesia). Note: Historical data (particularly in Sub-Saharan Africa)
revised by ITU in 2017 to better account for dual-SIM subscriptions (i.e. two Internet subscriptions per single smartphone user).

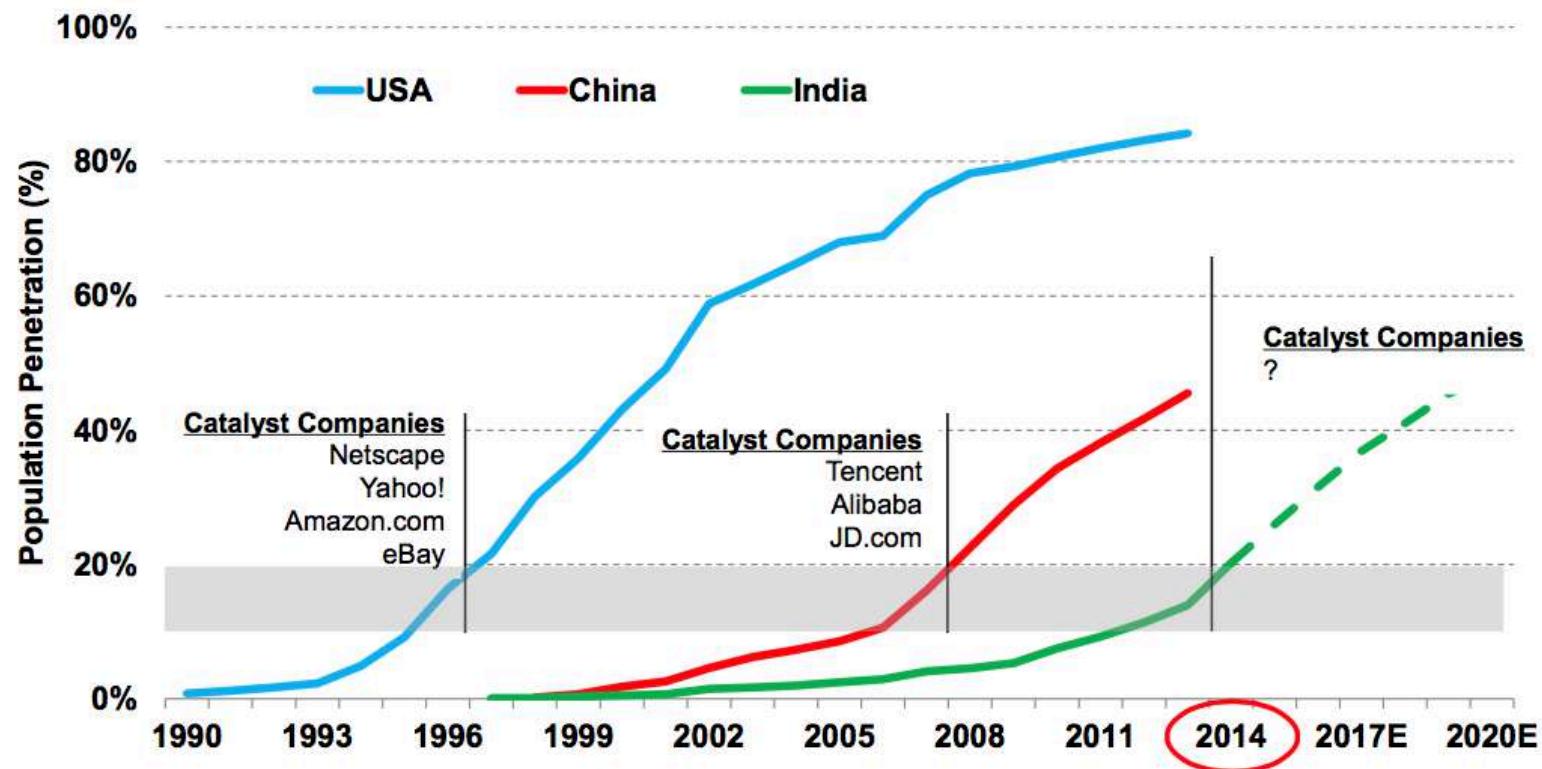
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Global Internet Users = Slowing Growth @ +7% vs. +12% Y/Y



India = Appears to Be @ Internet Penetration Growth Inflection

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



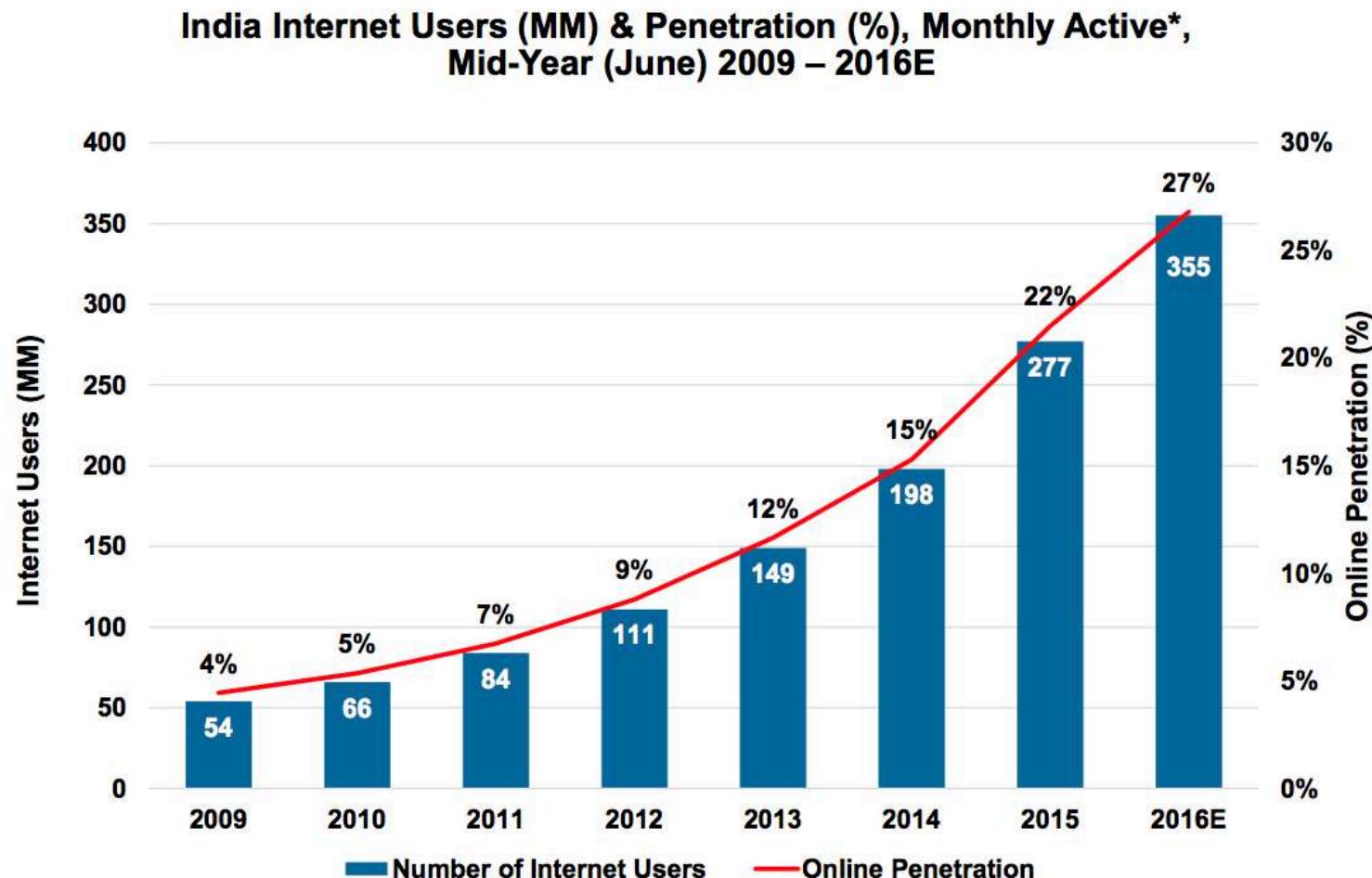
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Source: World Bank, Hillhouse Capital forecast for India beyond 2014.

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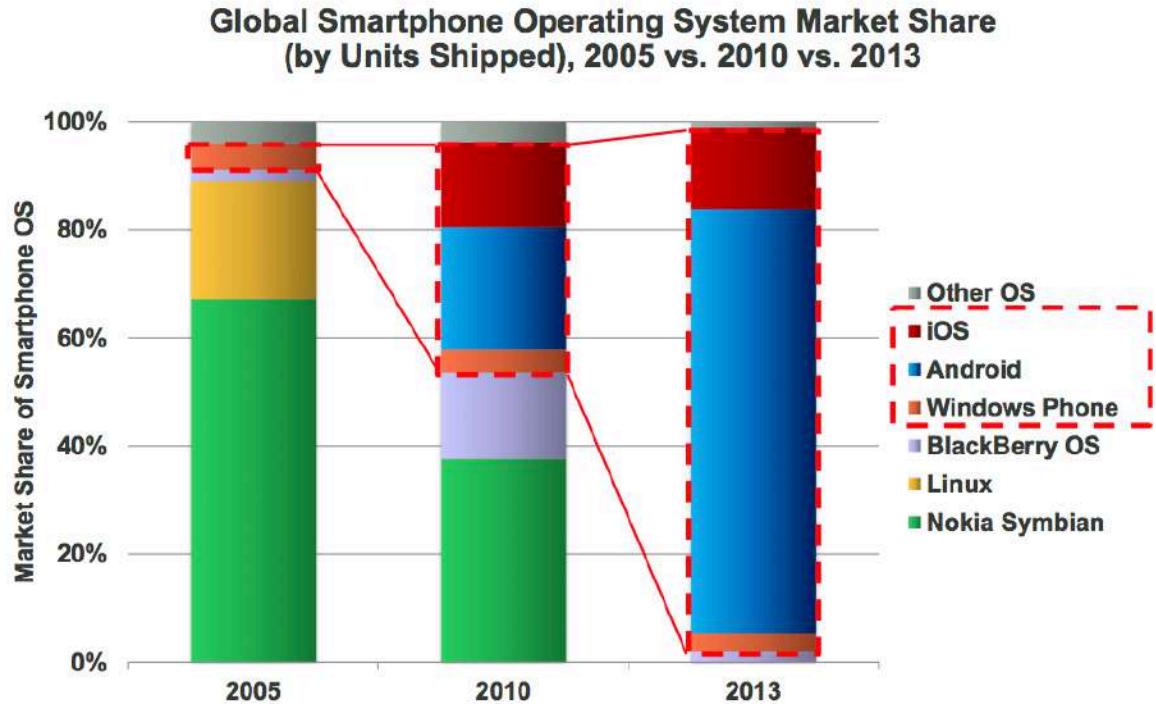
Source: IAMAI, UN Population Division, Worldometer, KPCB estimates based on IAMAI data. Uses mid-year figures.

*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.

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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

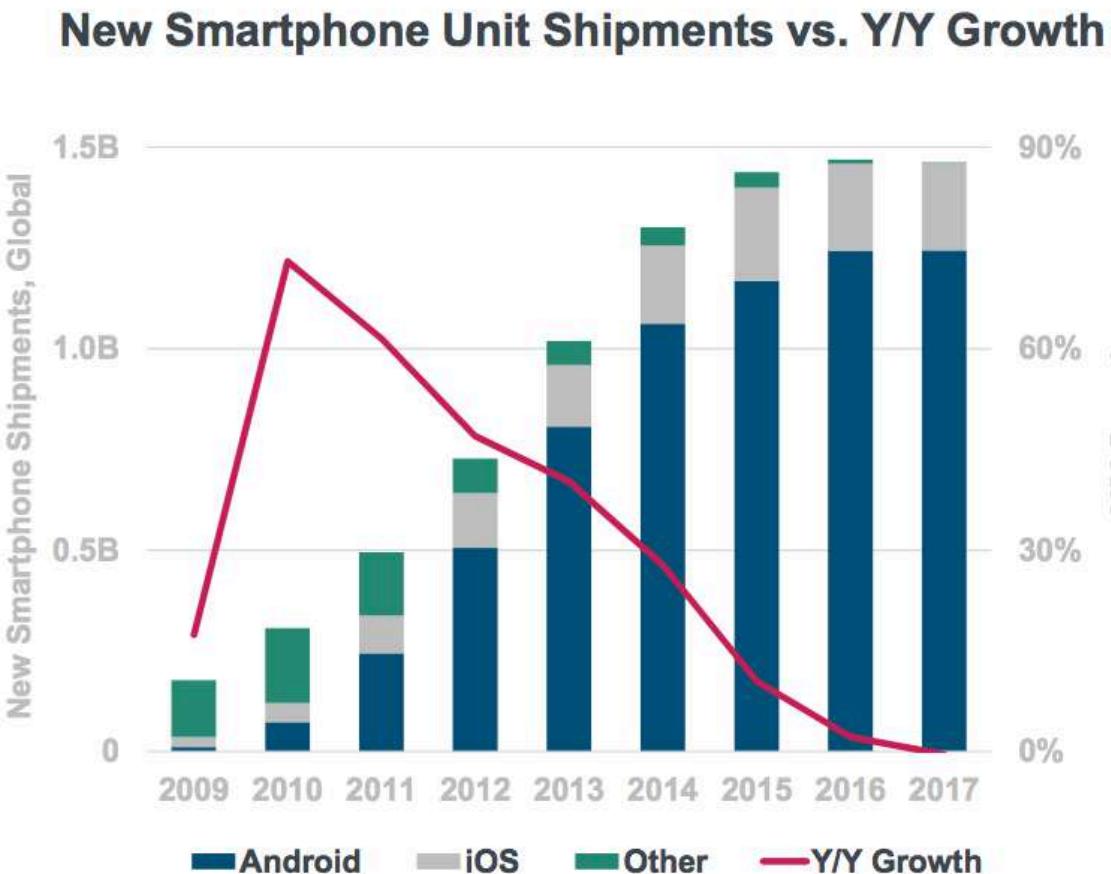


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Source: 2005 & 2010 data per Gartner, 2013 data per IDC.

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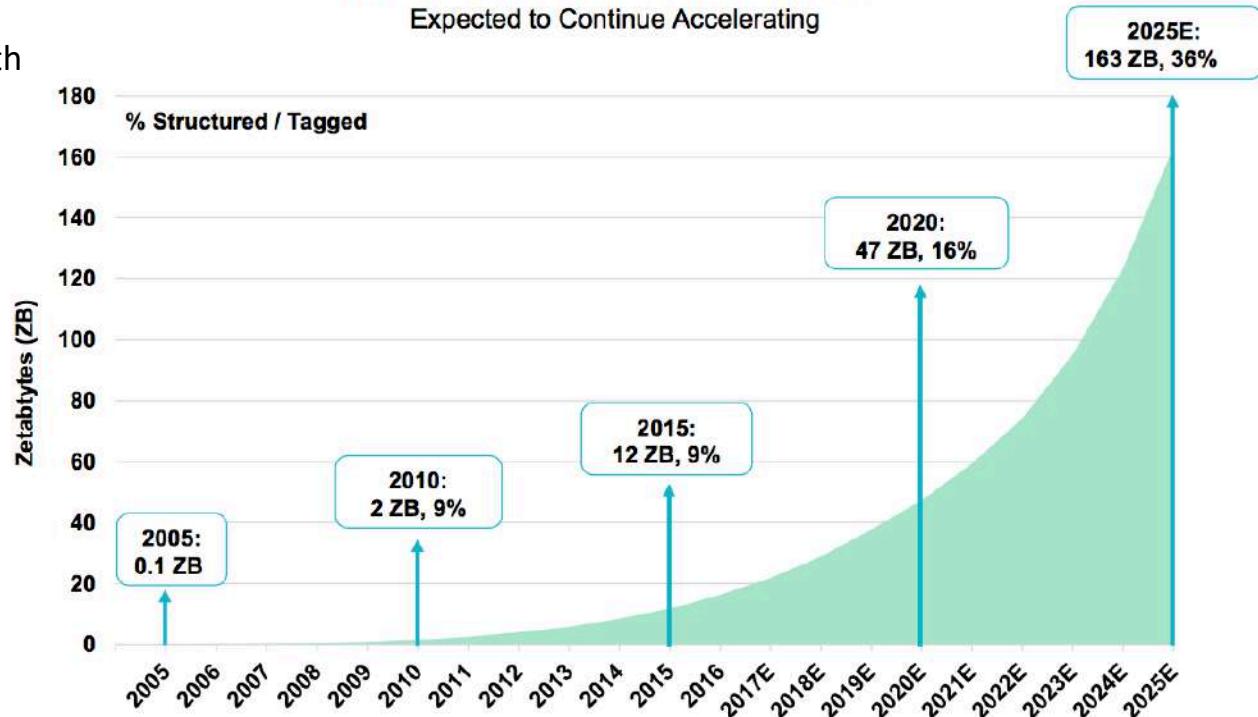
Global New Smartphone Unit Shipments = No Growth @ 0% vs. +2% Y/Y



Data Volume Growth Continues @ Rapid Clip % Structured / Tagged (~10%) Rising Fast

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

Information Created Worldwide =
Expected to Continue Accelerating



Source: IDC DataAge 2025 Study, sponsored by Seagate (3/17)
Note: 1 petabyte = 1MM gigabytes, 1 zeta byte = 1MM petabytes

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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

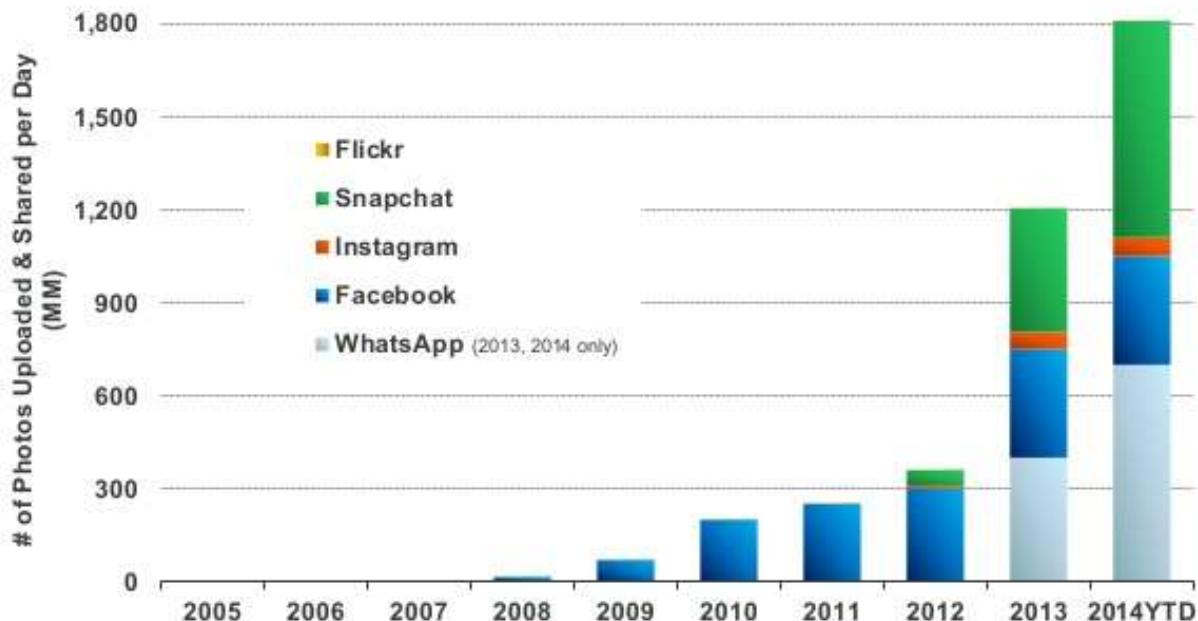
Instagram was recently (2010) purchased by Facebook for \$1 billion

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



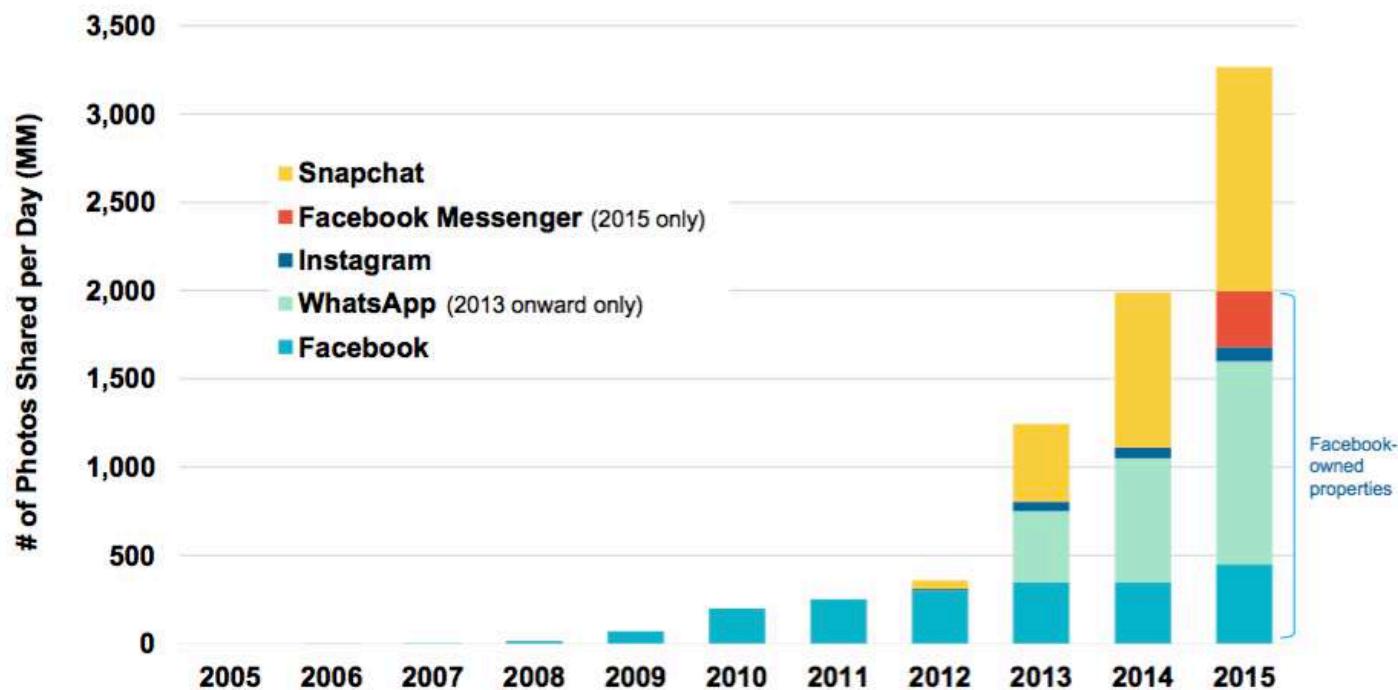
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Source: KPCB estimates based on publicly disclosed company data. 2014 YTD data per latest as of 5/14.

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Image Growth Remains Strong

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



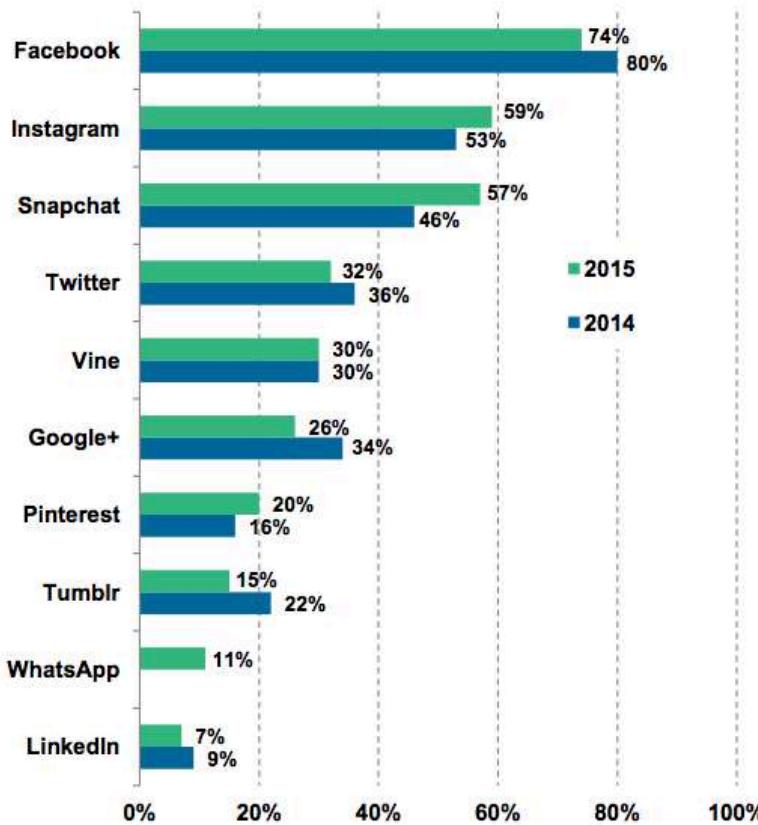
Source: Snapchat, Company disclosed information, KPCB estimates.

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).

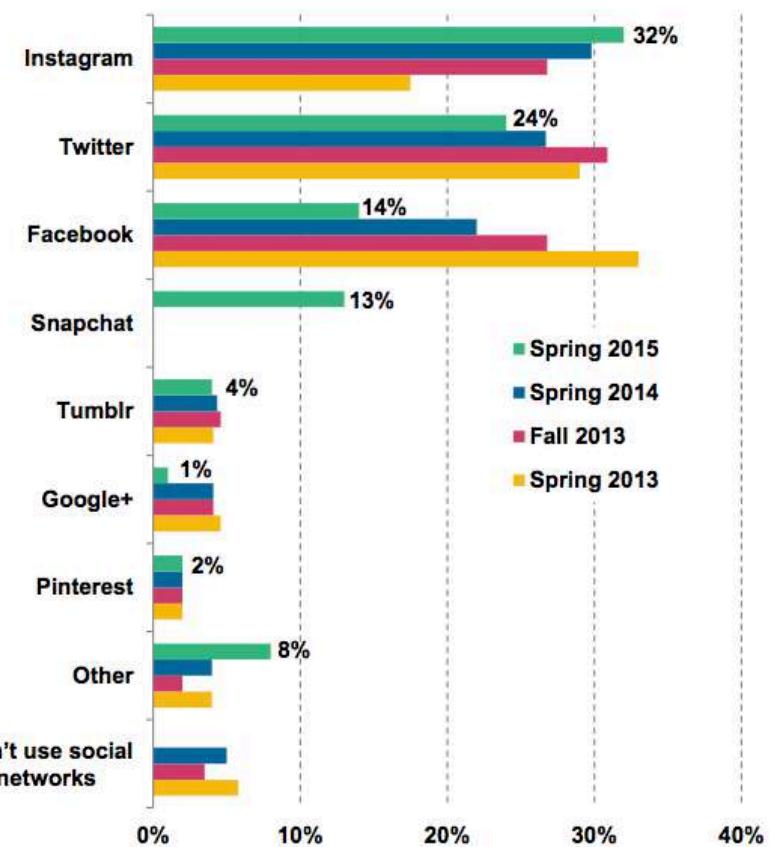
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12-24 Year Olds Internet Usage = Visual Stuff (In & Out) Rules... Instagram + Snapchat + Pinterest = Continue to Rise

**Social Media Usage Among American Youth
(Age 12-24)¹, USA, 3/15**



Teens' Most Important Social Network², USA, 4/15



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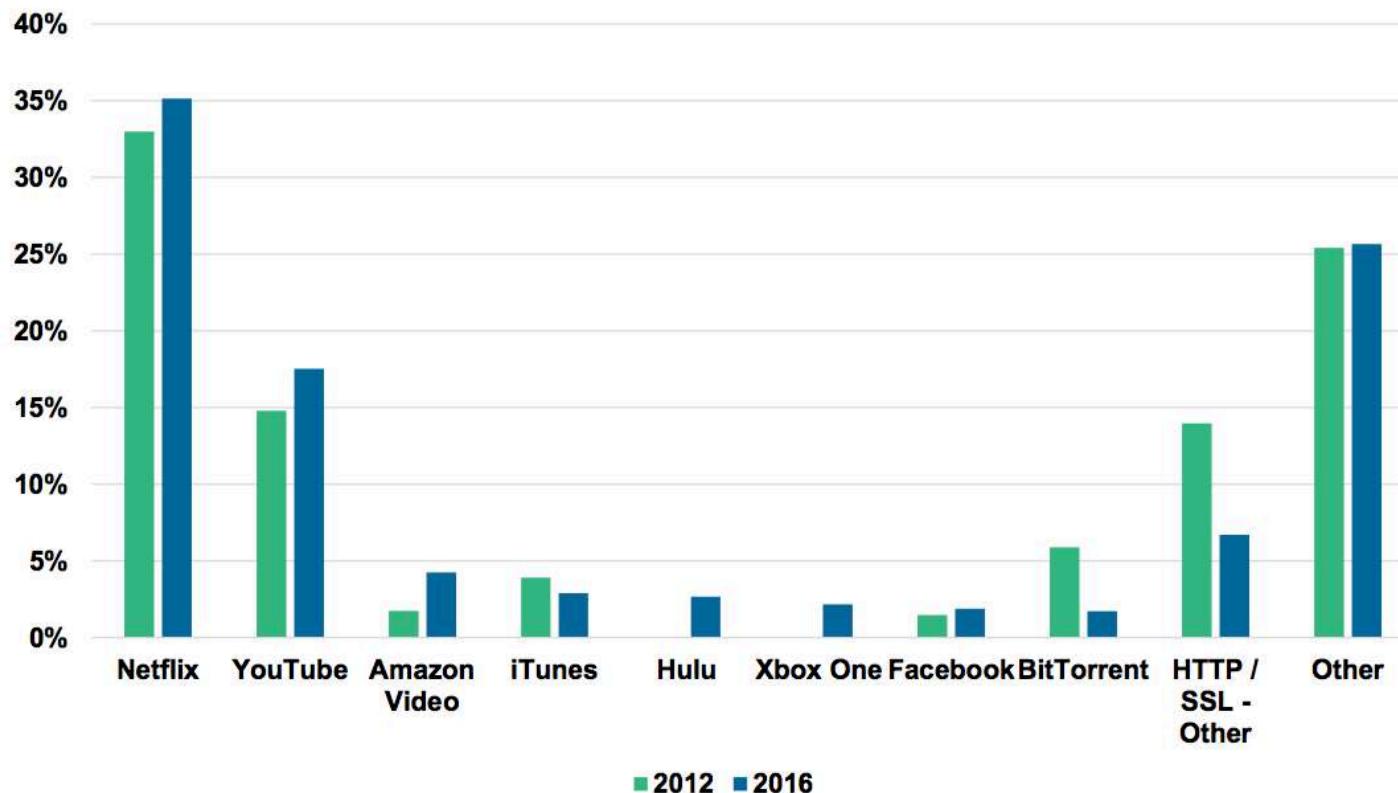
Source: Edison Research / Triton Digital, Piper Jaffray.

Note: (1) 12-24 year olds who currently ever use social networking sites/services. (2) Based on survey of US teens with an average age of 16.3 years.

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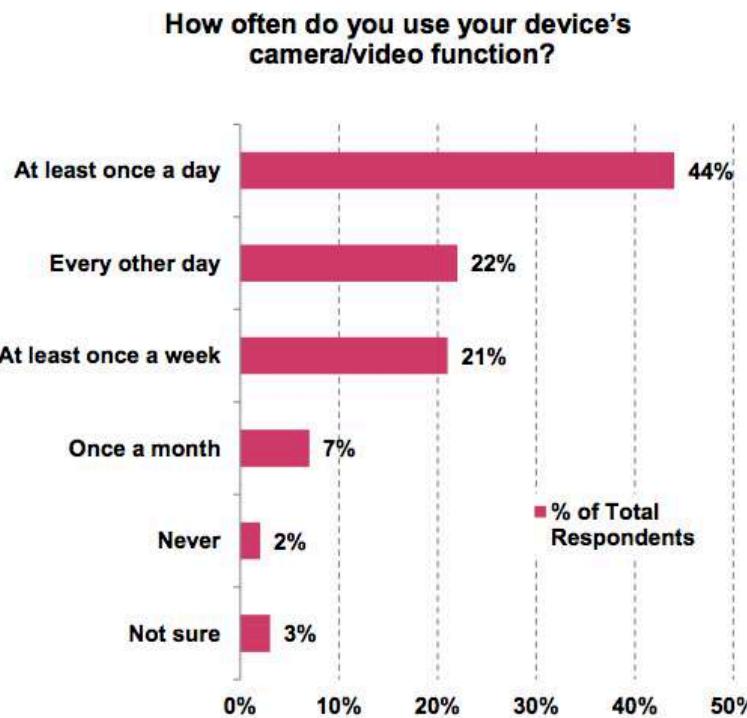
Netflix / YouTube = Fixed-Access Video Traffic Share Leaders

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

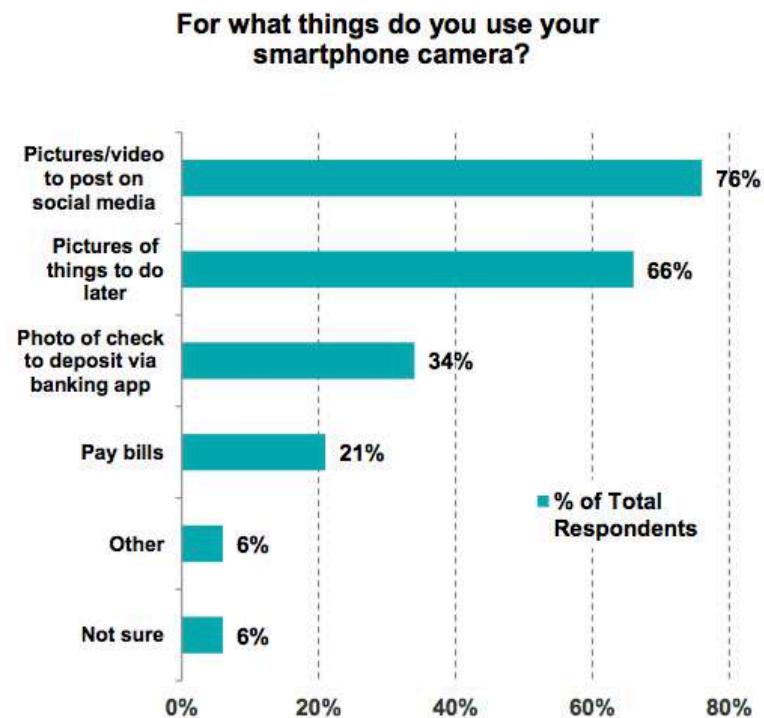


Millennials Love Their Smartphone Cameras... 44% Use Camera / Video Function Daily...76% Post on Social Media

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



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



Source: Zogby Analytics.

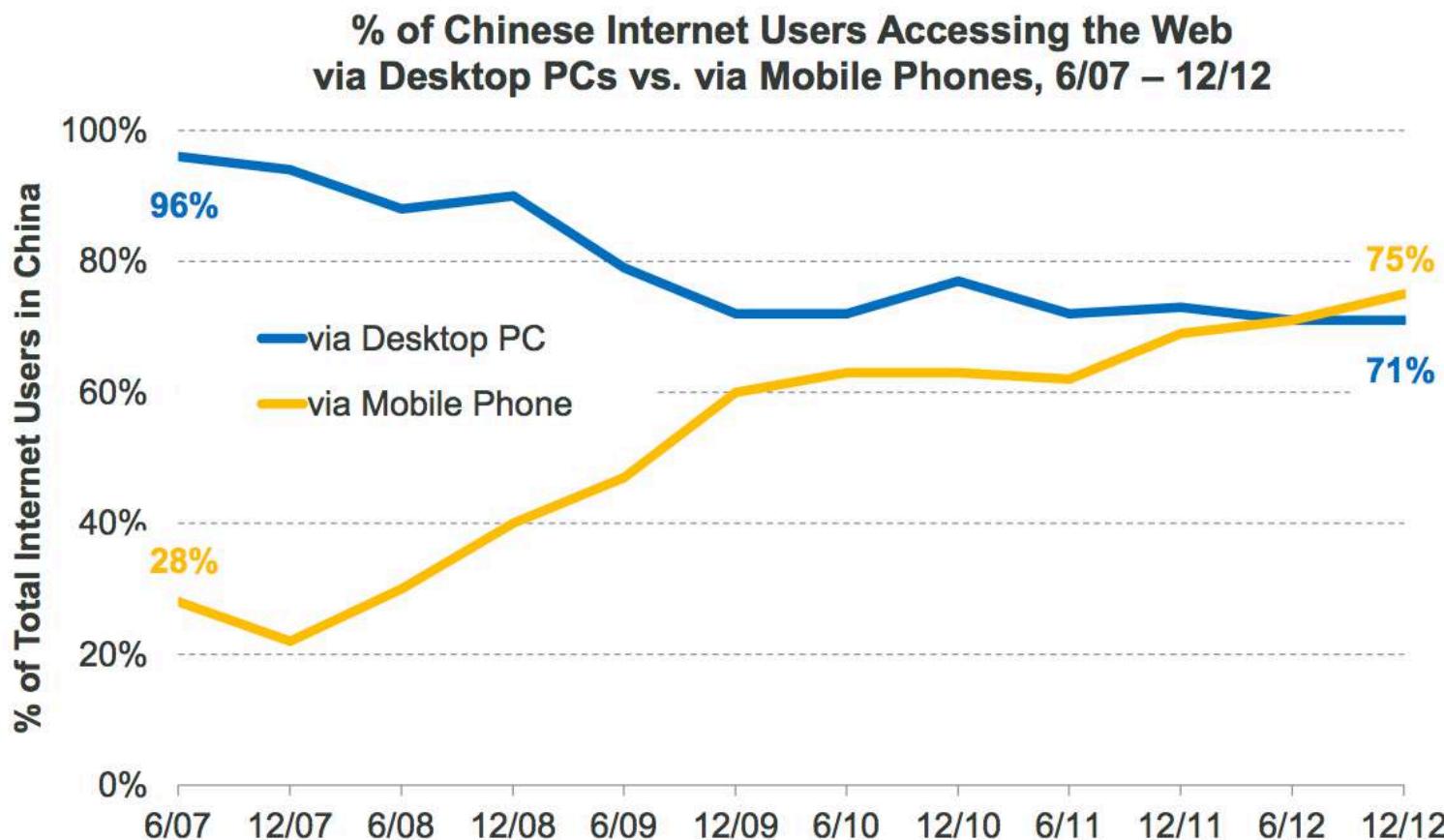
*18-24 year olds.

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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



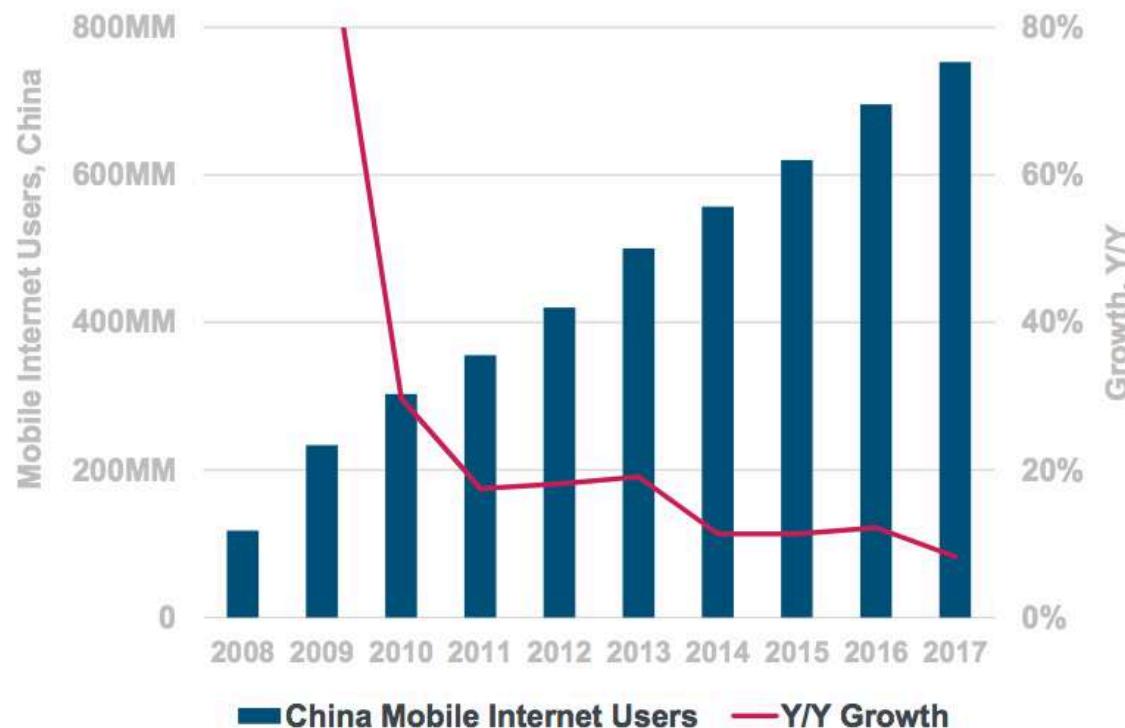
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Source: CNNIC, 1/13.

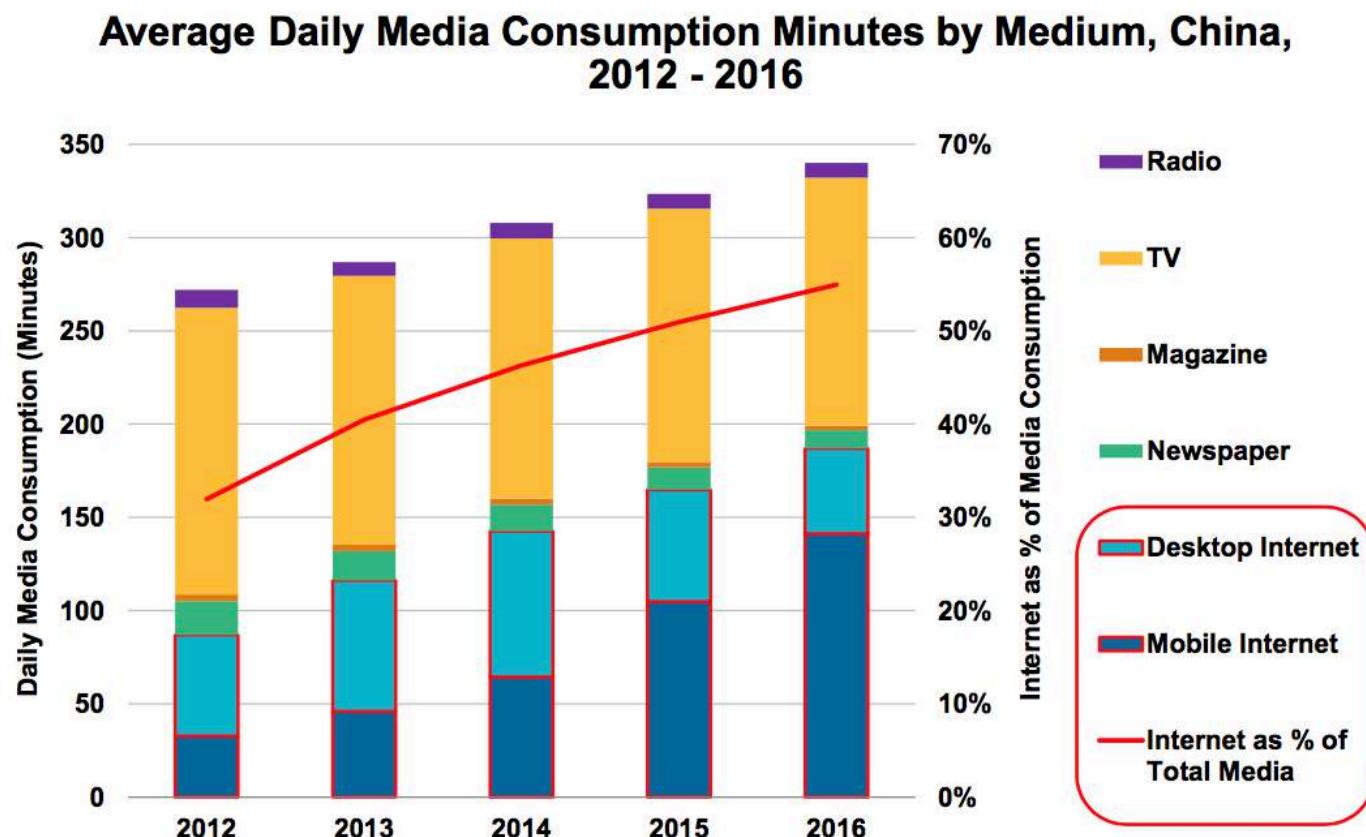
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China Mobile Internet Users = 753MM...+8% vs. 12% Y/Y

China Mobile Internet Users vs. Y/Y Growth



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



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Source: Zenith Optimedia



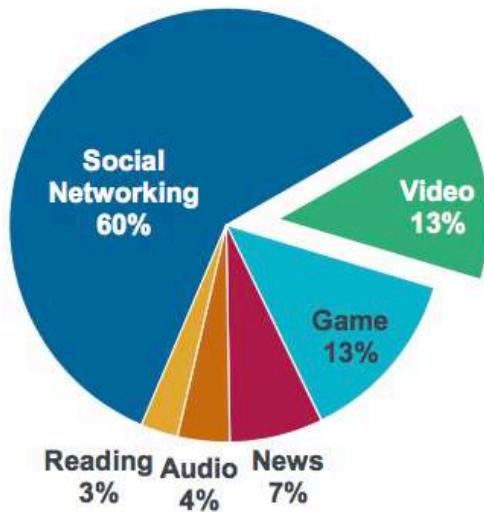
Hillhouse
Capital

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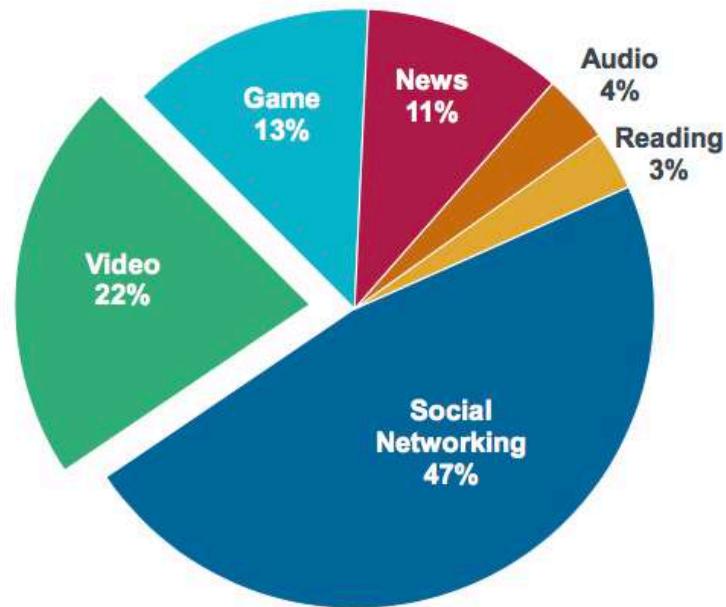
China Mobile Media / Entertainment Time Spent = +22% Y/Y...Mobile Video Growing Fastest

China Mobile Media / Entertainment Daily Time Spent

March 2016
2.0B Hours



March 2018
3.2B Hours, +22% Y/Y



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

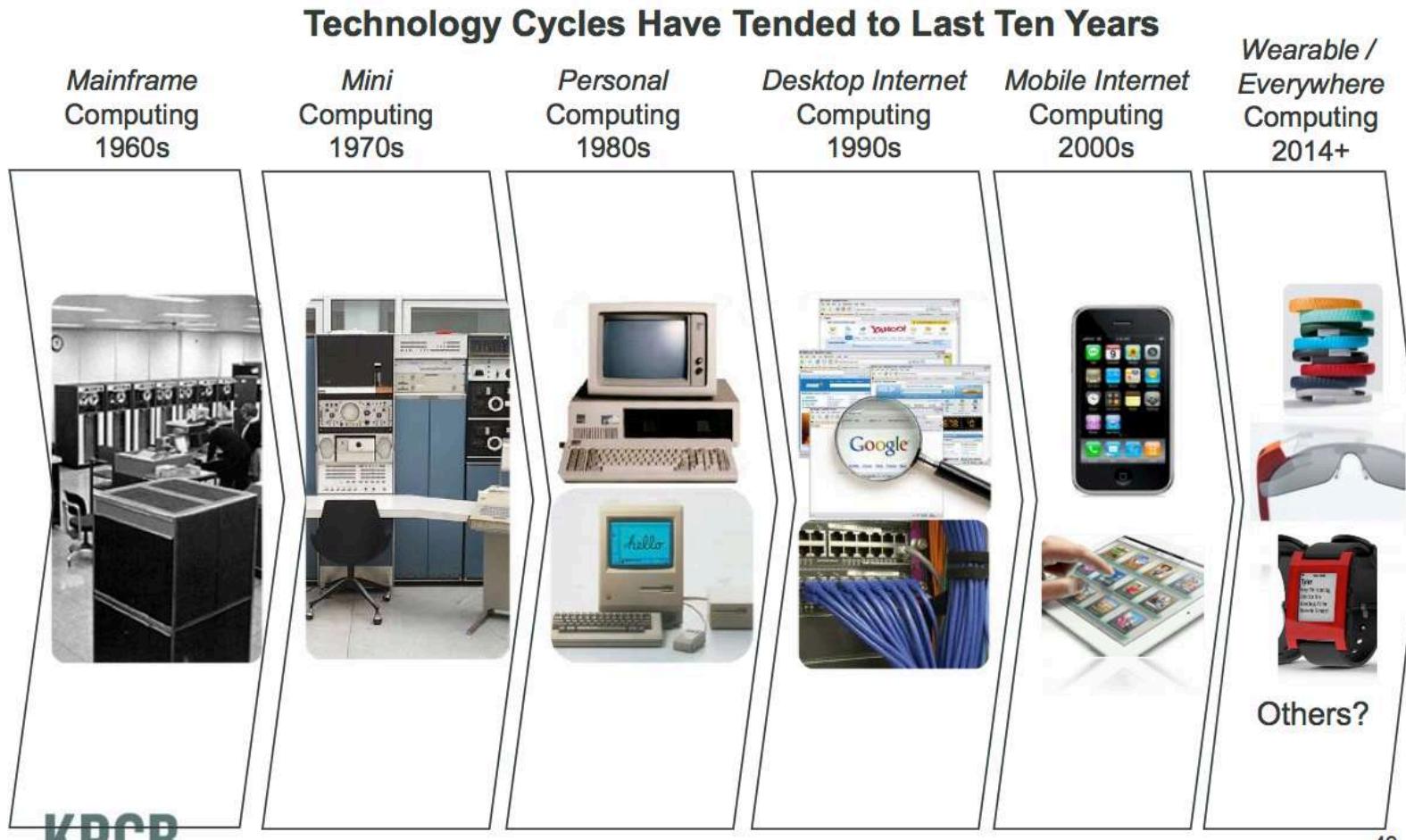
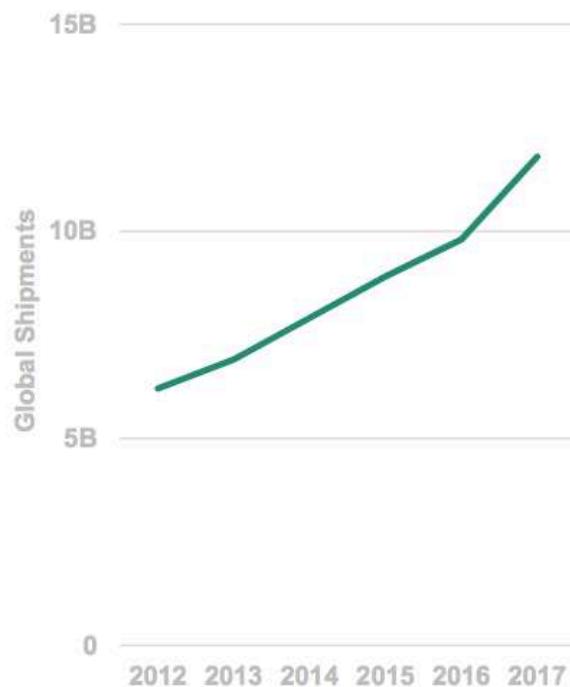


Image Source: Computersciencelab.com, Wikipedia, IBM, Apple, Google, NTT docomo, Google, Jawbone, Pebble.

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

MEMS Sensor / Actuator Shipments

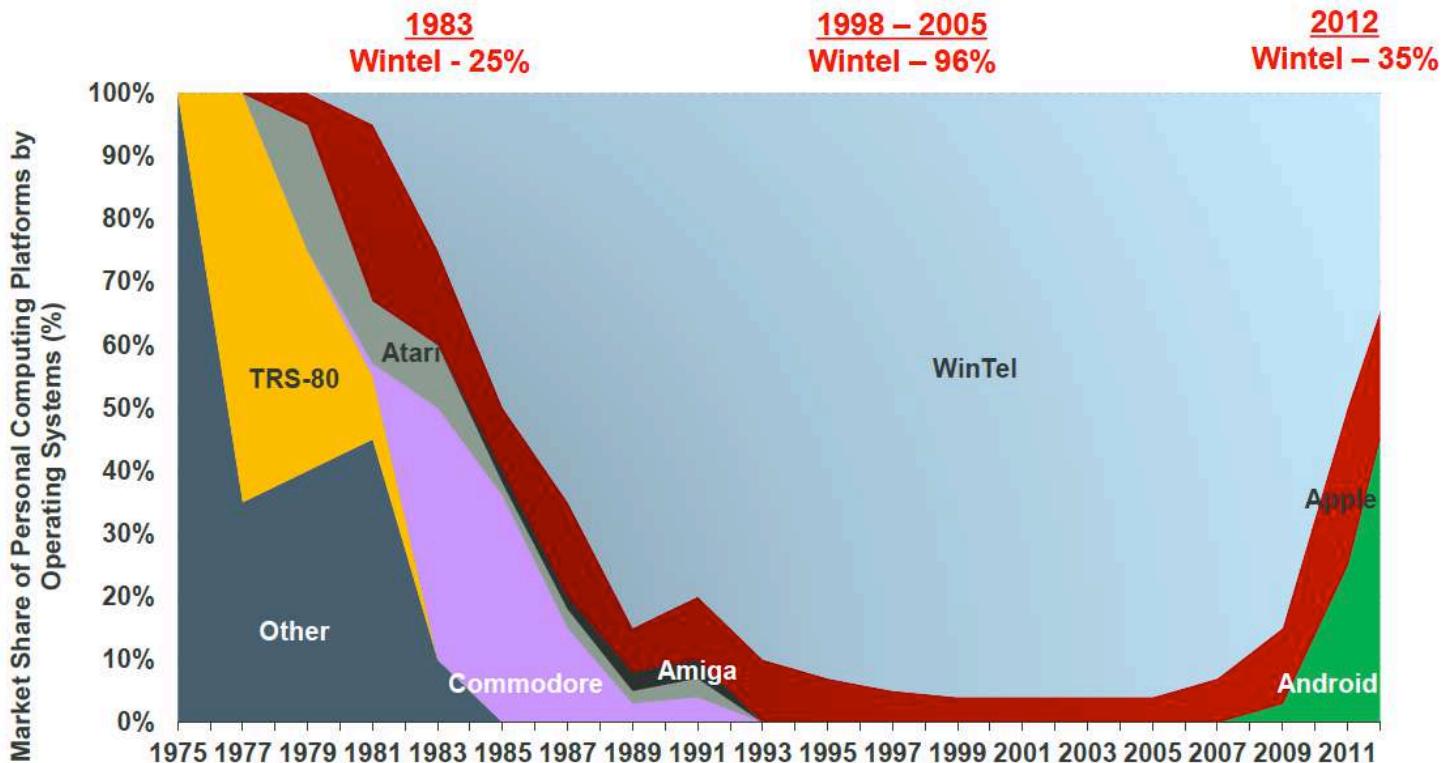


Sensors + Data = In More Places



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



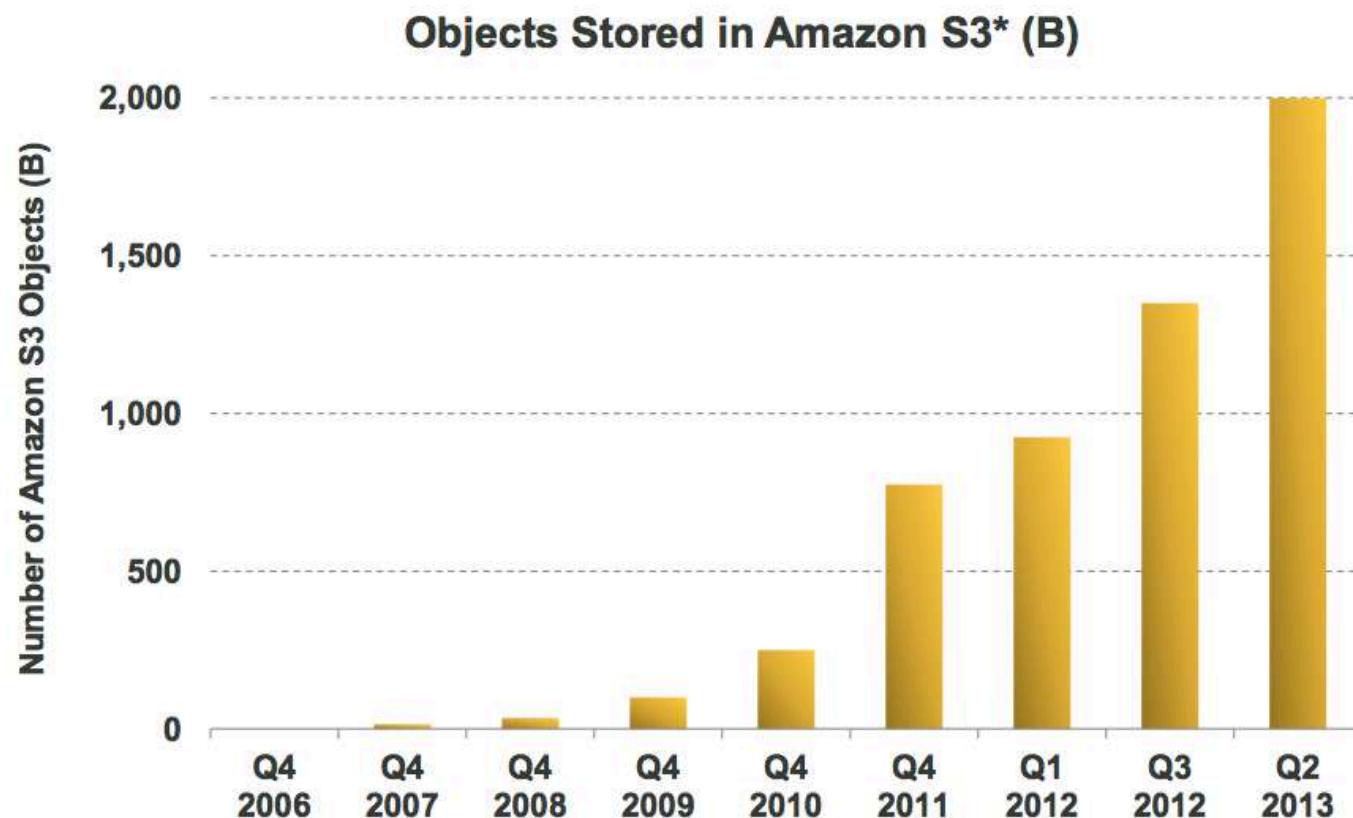
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Source: Asymco.com (as of 2011), Public Filings, Morgan Stanley Research, Gartner for 2012 data.

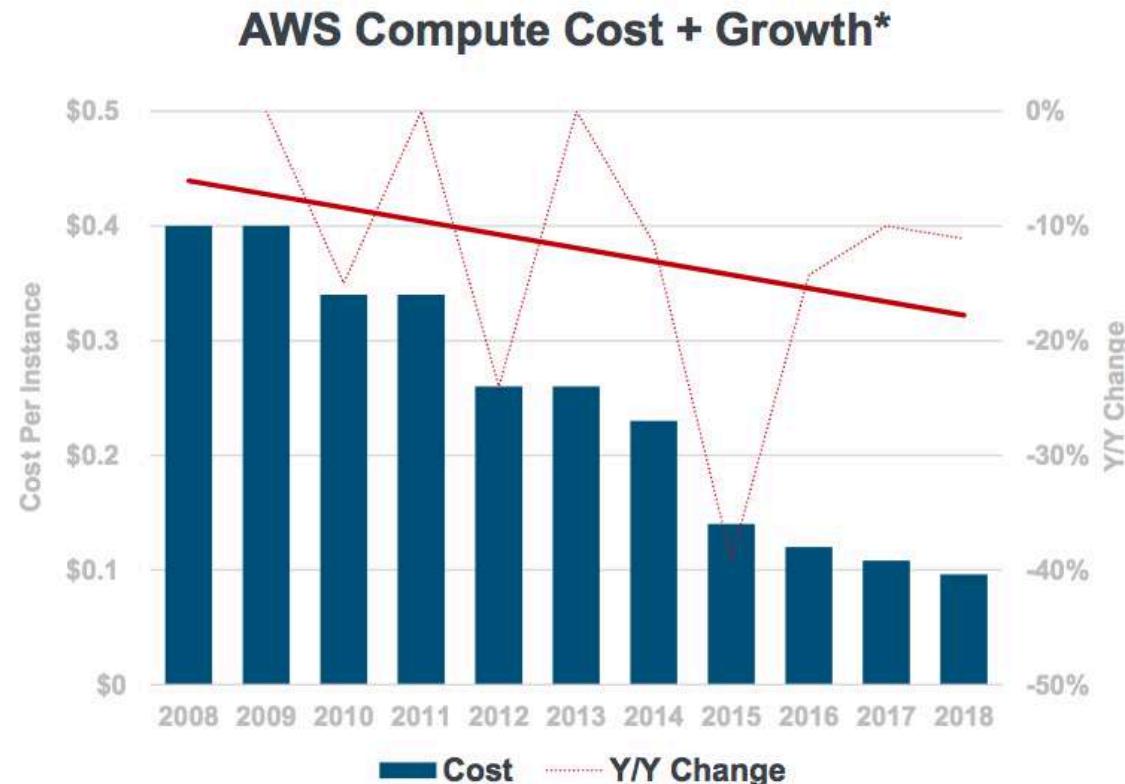
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...While The Cloud Rises

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

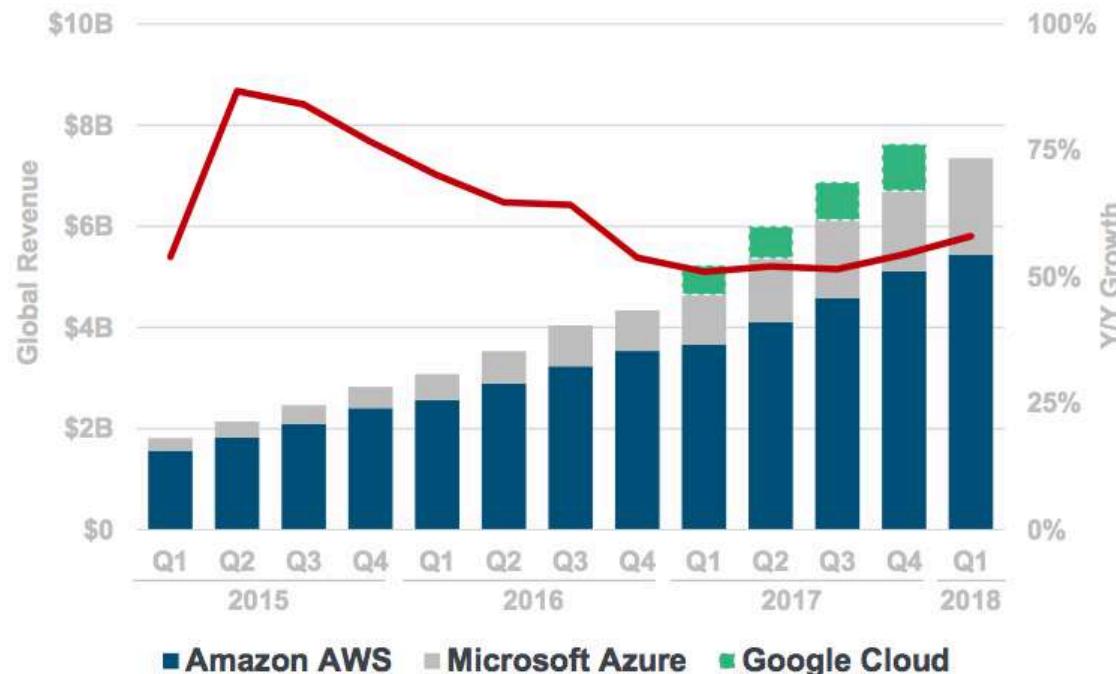


...Computing Big Bangs Volume Effects = Cloud Compute Cost Declines Continue -11% vs. -10% Y/Y...



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

Cloud Service Revenue – Amazon + Microsoft + Google



Cloud 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

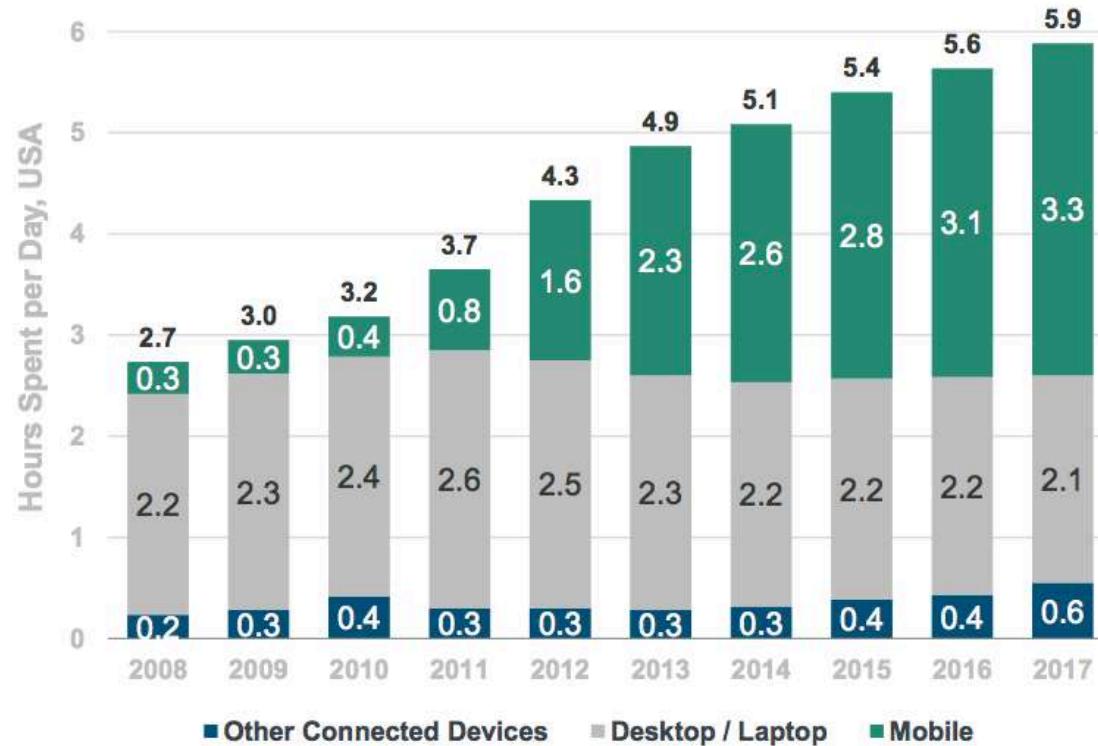


Edge Computing =

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 @ +4% Growth... 5.9 Hours per Day (Not Deduped)

Daily Hours Spent with Digital Media per Adult User



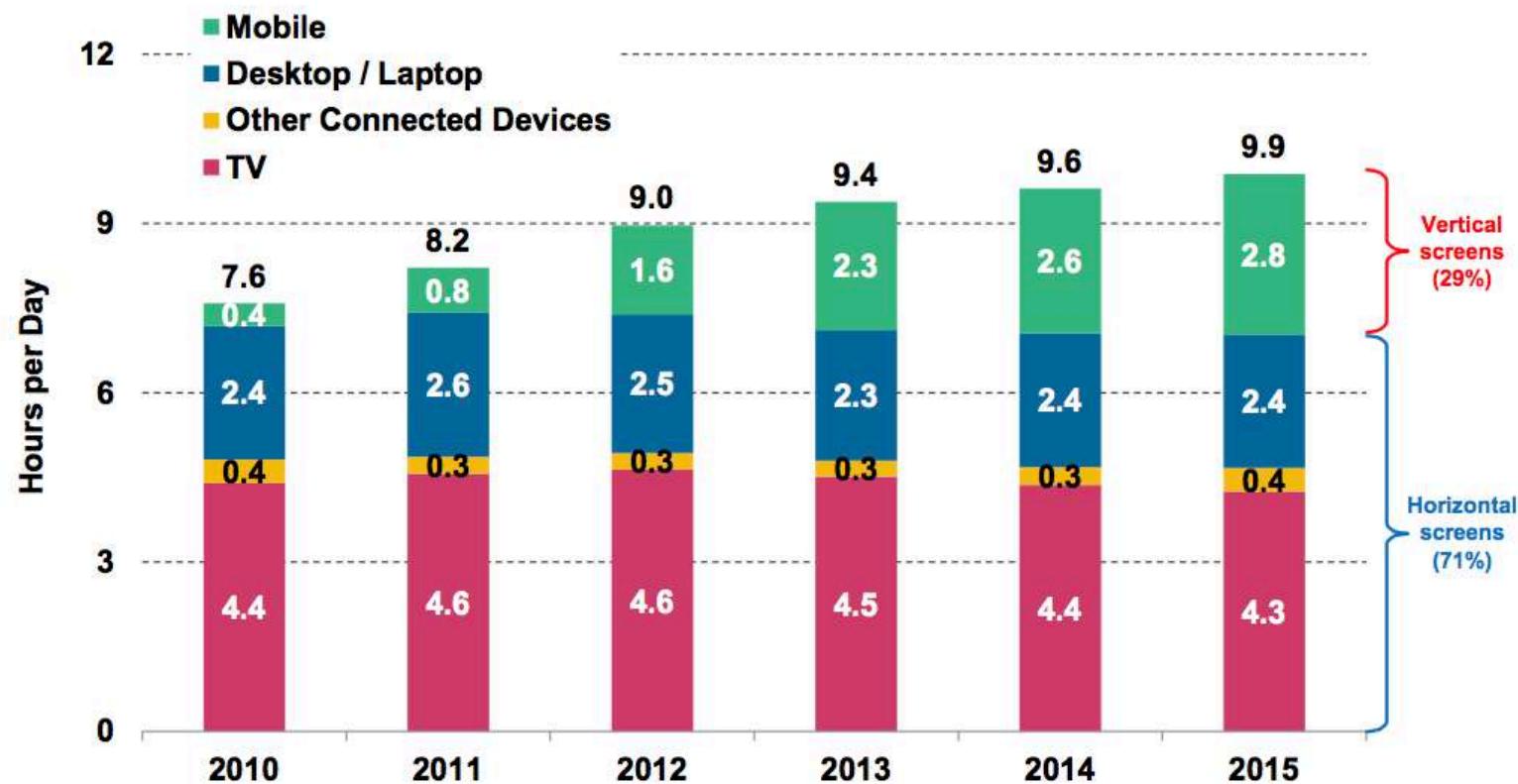
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Source: eMarketer 9/14 (2008-2010), eMarketer 4/15 (2011-2013), eMarketer 4/17 (2014-2016), eMarketer 10/17 (2017). Note: Other connected devices include OTT and game consoles. Mobile includes smartphone and tablet. Usage includes both home and work for consumers 18+. Non deduped defined as time spent with each medium individually, regardless of multitasking.

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...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, Coattue 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

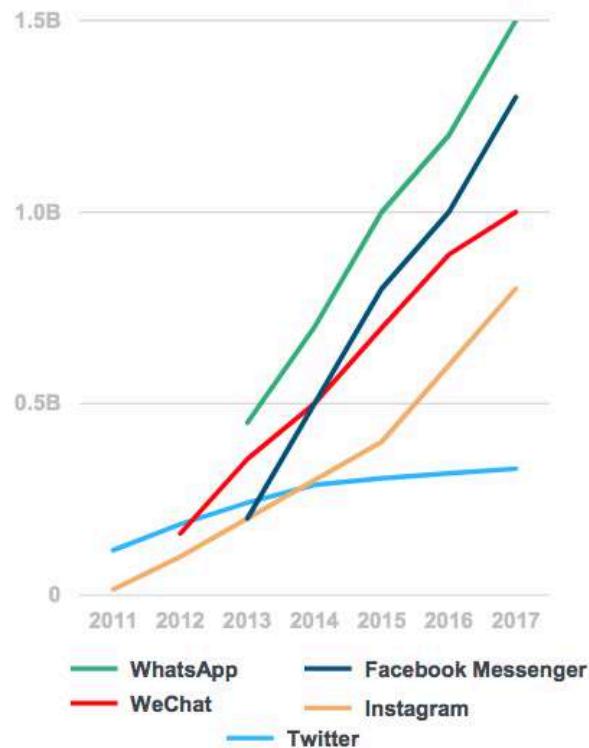
Messaging Tencent (2000 → 2018)



I am on WeChat: marcopapa99

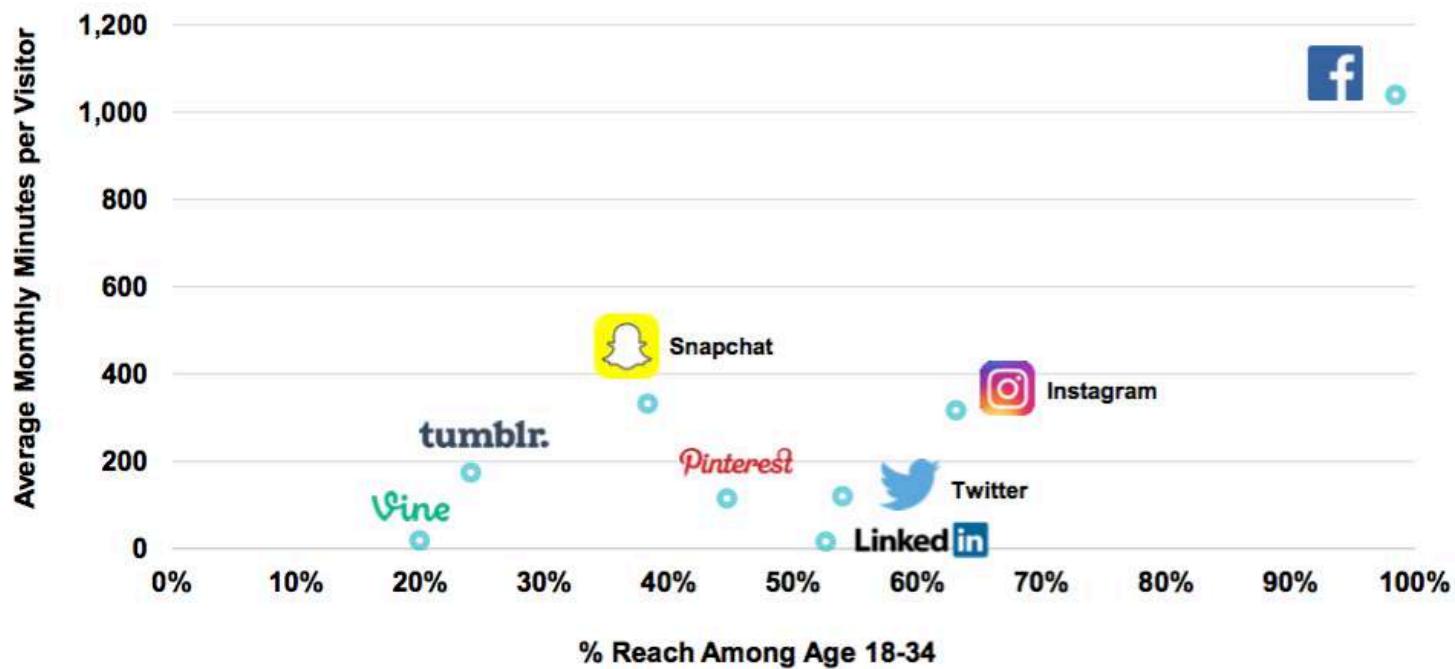
Messenger MAUs

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

New Services Added 2015 -16*

Previous Existing Services



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	x	Enterprise WeChat (3/16)	x
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)



Source: Company websites, press releases, Morgan Stanley Research.

*Blue shading denotes that at least one of the platforms listed has added new features since 2015. Some features for other platforms may have been added in prior years.

Note: Enterprise denotes product made specifically for messaging or social networking within the enterprise, which is distinct from B2C messaging where businesses engage with current or potential customers.

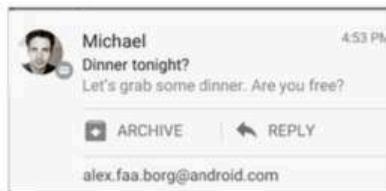
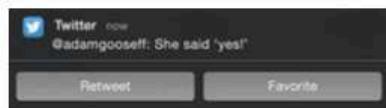
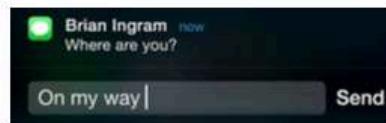
Average Global Mobile User = ~33 Apps...12 Apps Used Daily... 80% of Time Spent in 3 Apps

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

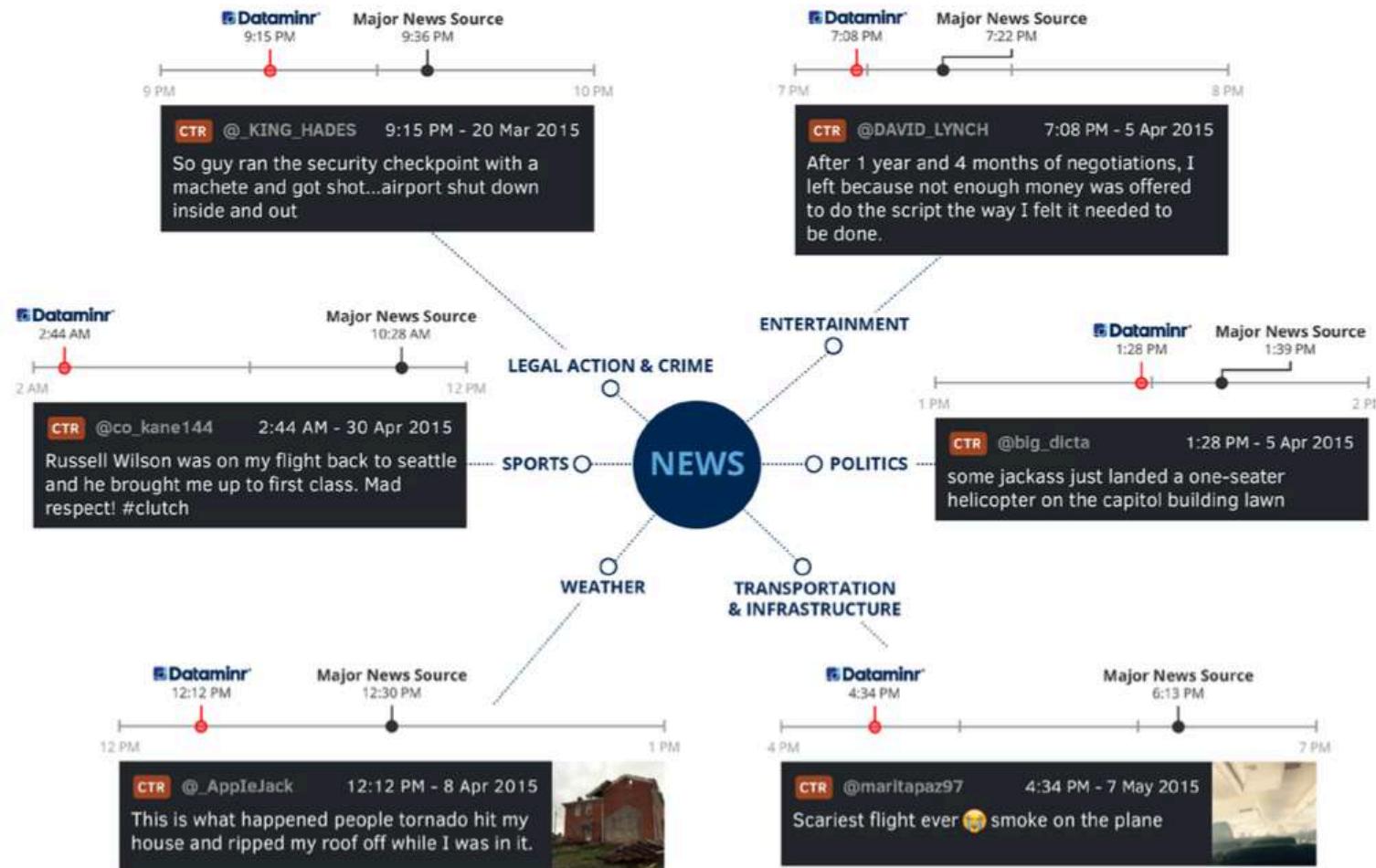
**Direct Interaction
on Notification Panel –**
without users interrupting
what they're doing...



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



Users Increasingly First Source for News via Twitter / Dataminr



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Source: Dataminr, 5/15.

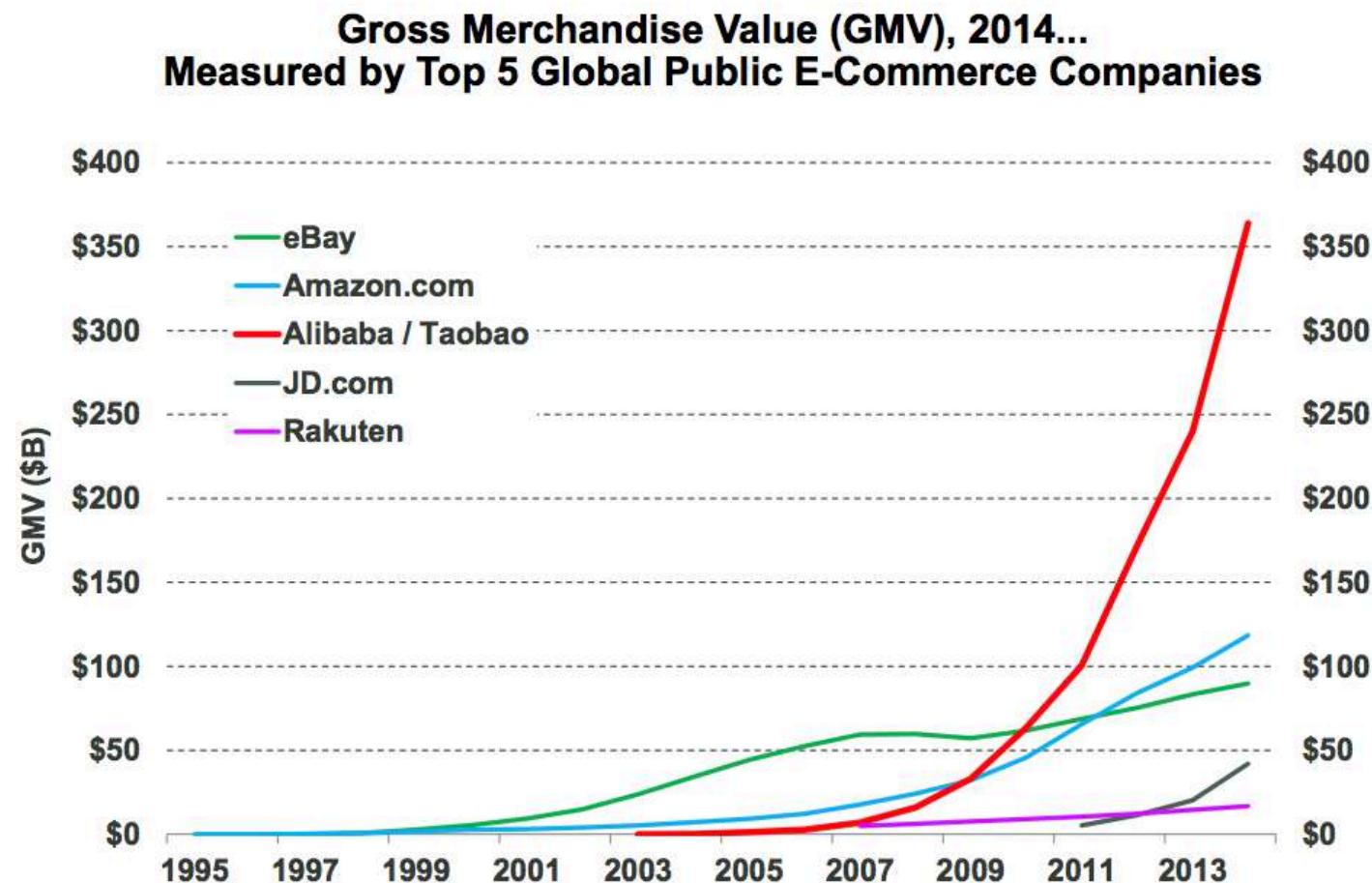
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Video Evolution = Accelerating

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

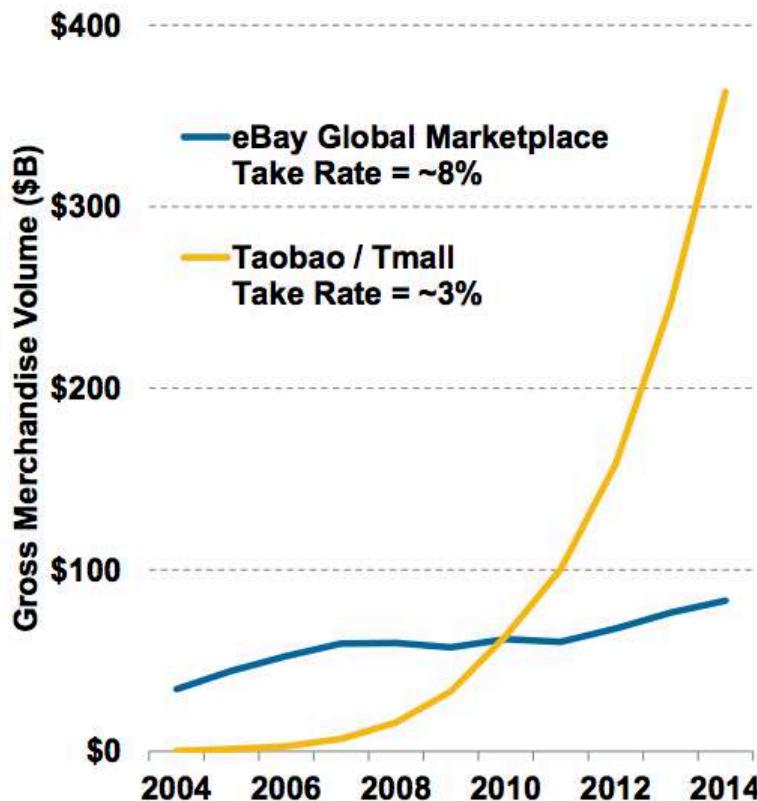
Live (Linear)	On-Demand	Semi-Live	Real-Live
<i>Traditional TV 1926</i>	<i>DVR / Streaming 1999</i>	<i>Snapchat Stories 2013</i>	<i>Periscope + Facebook Live 2015 / 2016</i>
Tune-In or Miss Out	Watch on Own Terms	Tune-In Within 24 Hours or Miss Out	Tune-In / Watch on Own Terms
Mass Concurrent Audience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

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

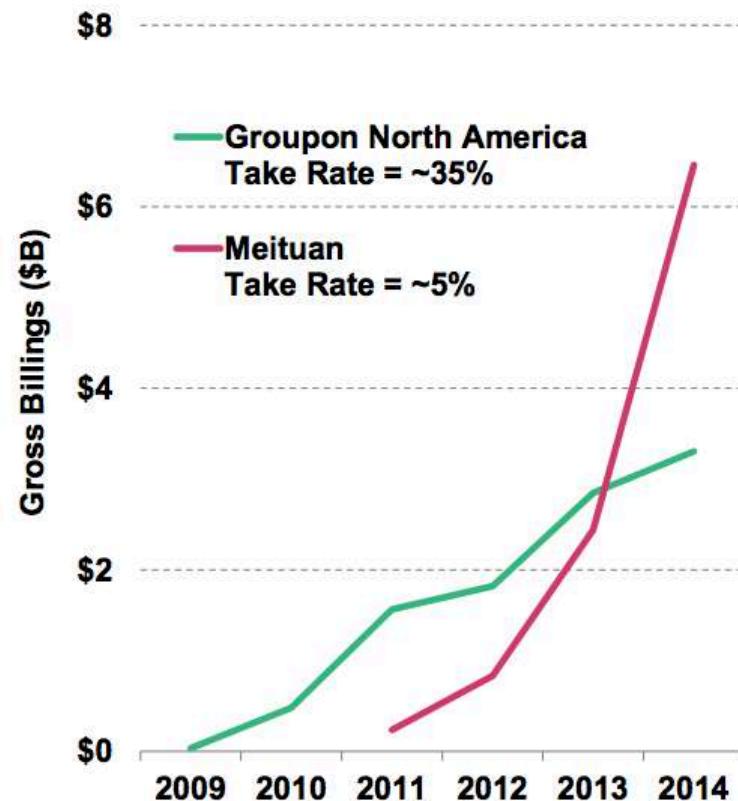


China E-Commerce = Low Take Rates* Helped China Marketplace Leaders Pass USA Peers

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



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



@KPCB

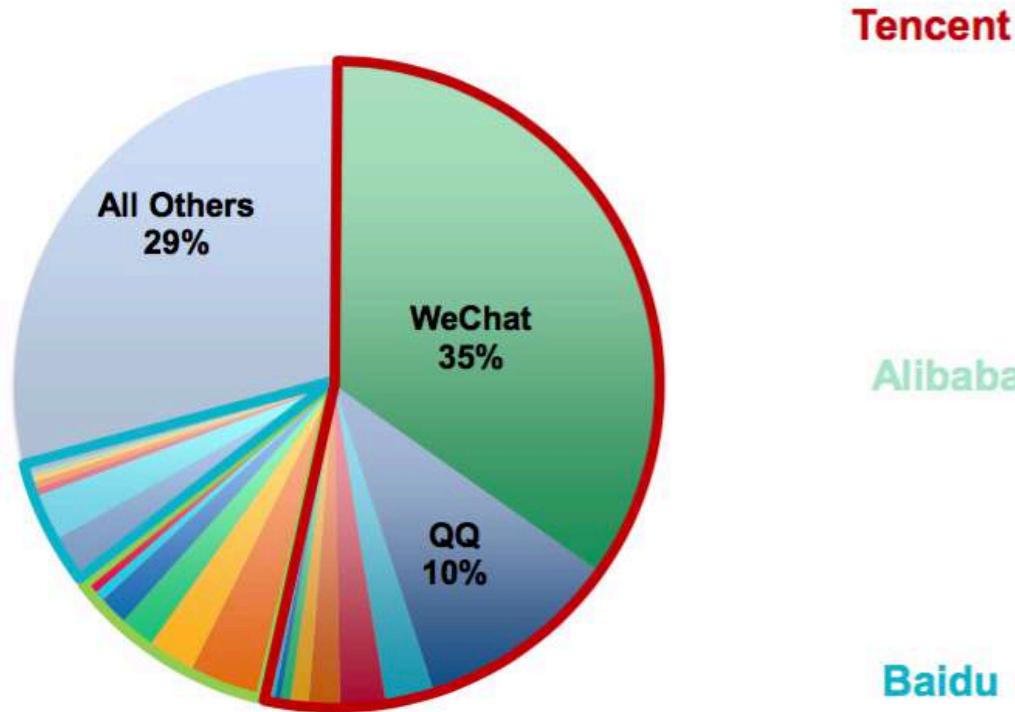
Source: Meituan gross billings data are estimates by Tuan800.com, eBay, Groupon, Alibaba GMV data per company.
 Note: Take rate defined as net revenue divided by gross merchandise value or gross billings. eBay marketplace take rate excludes PayPal (~3%),
 eBay, Alibaba GMV data per company. Meituan take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

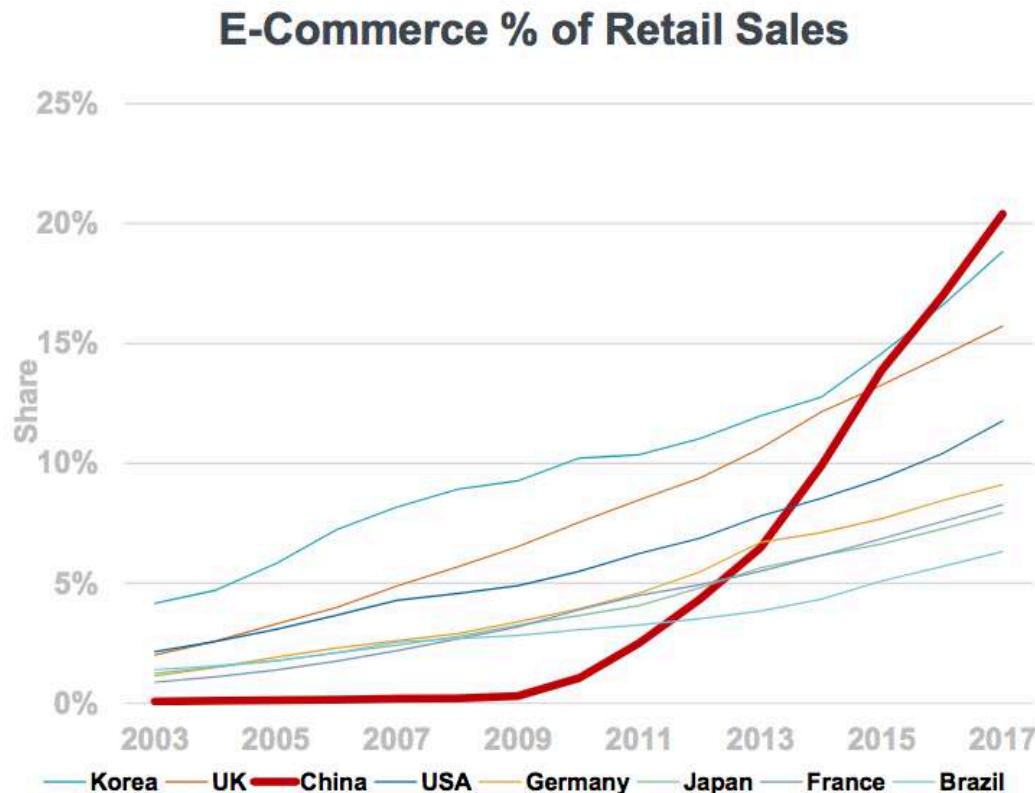


WeChat
QQ
QQ Browser
Tencent Video
Tencent News
Tencent Games
QQ Music
JD.com
QQ Reading

UCWeb Browser
Taobao
Weibo
YouKu Video
Momo
Shuqi Novel
AliPay
AutoNavi

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



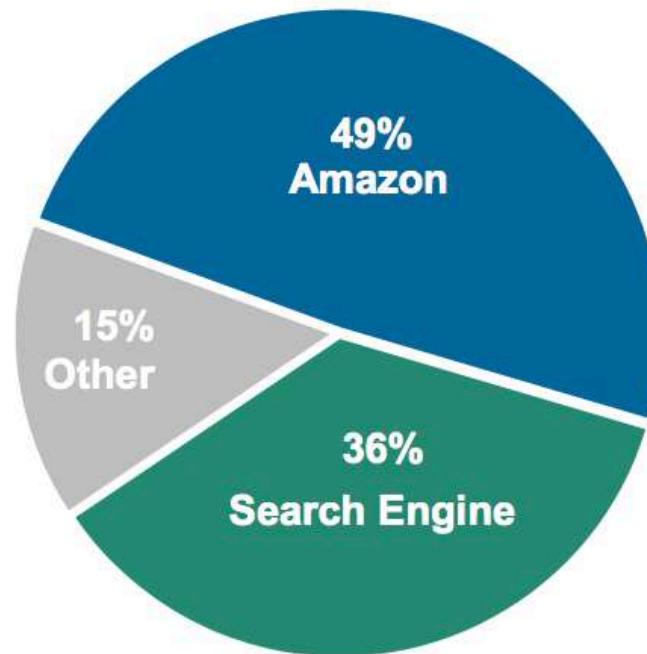
KLEINER PERKINS
2018
INTERNET TRENDS

Source: Euromonitor. Note data excludes certain consumer-to-consumer (C2C) transactions.

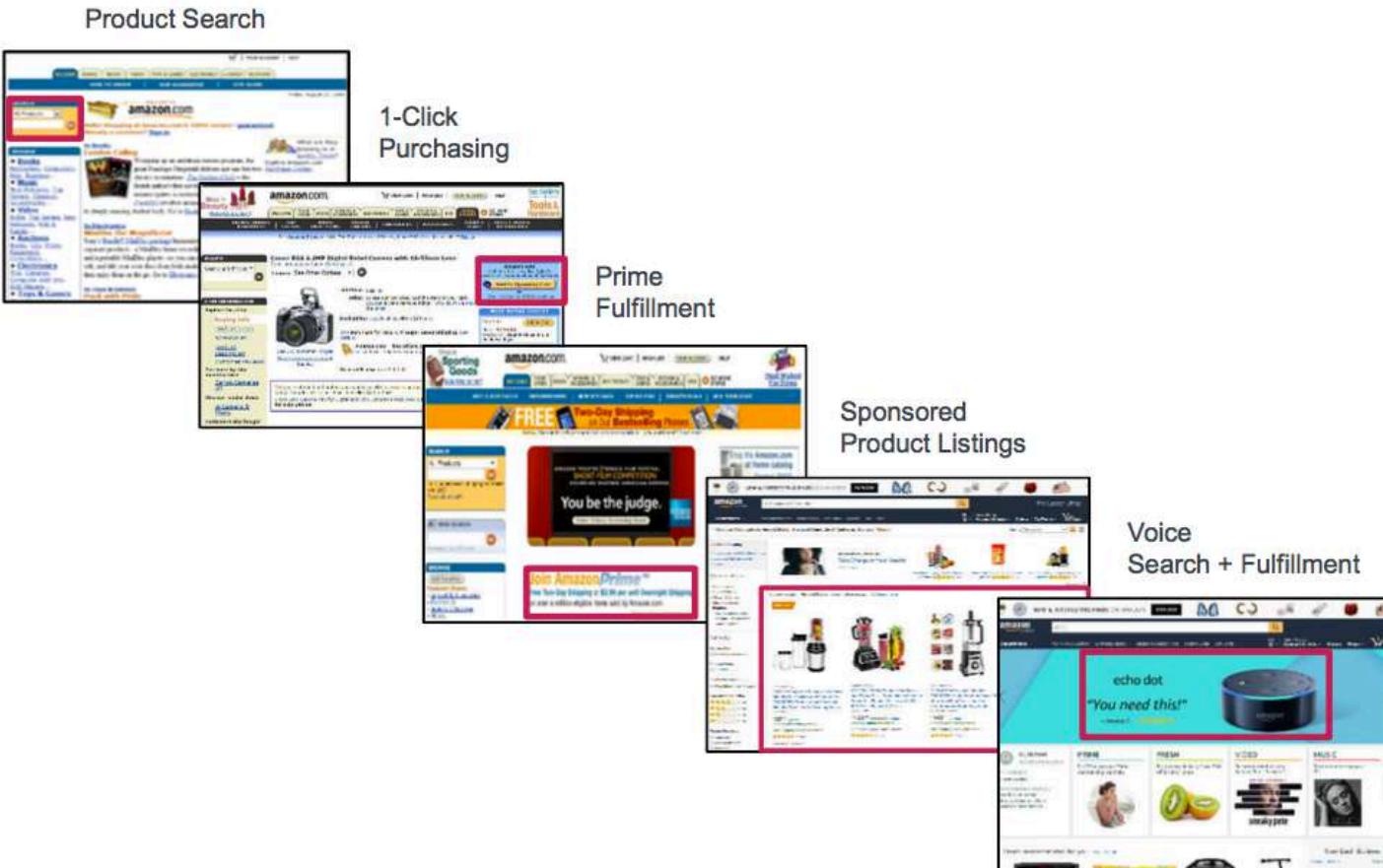
HILLHOUSE
Capital 253

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

Where Do You Begin Your Product Search?



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



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

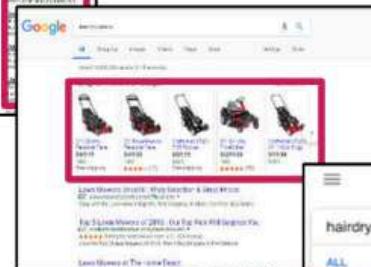
Organic Search



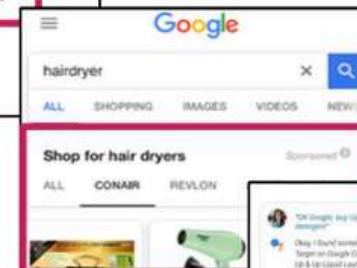
Paid Search



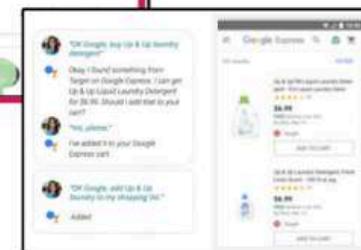
Google Shopping



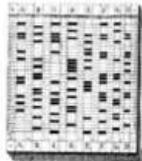
Product Listing Ads



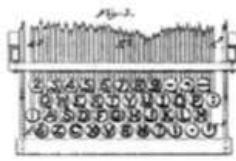
Shopping Actions



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



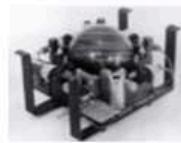
Electronic Computer
(ENIAC)
1943



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

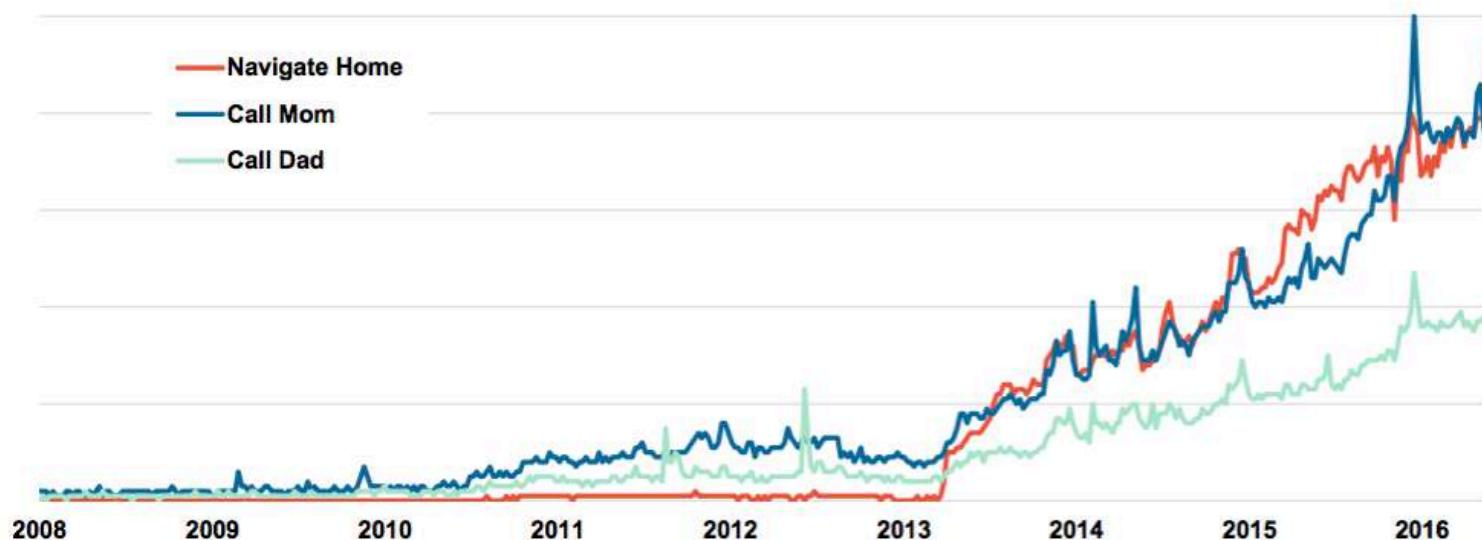


Voice on Connected /
Ambient Devices
(Amazon Echo)
2014

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

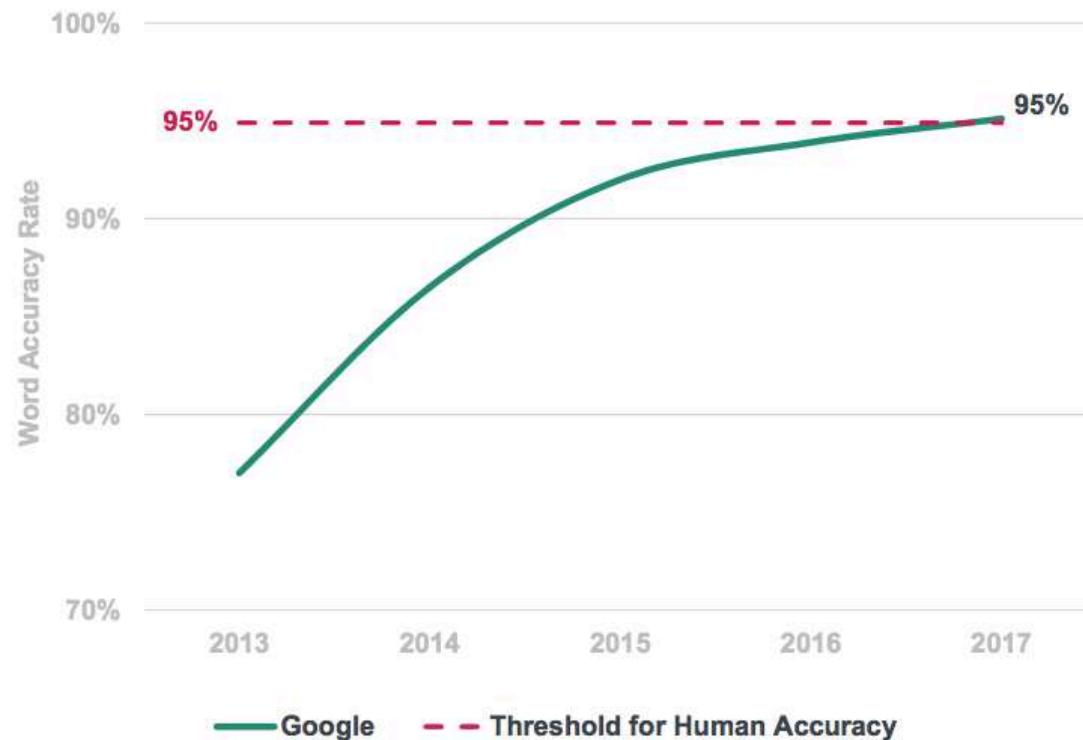
Google Trends imply queries associated with voice-related commands have risen >35x since 2008 after launch of iPhone & Google Voice Search

Google Trends, Worldwide, 2008 – 2016



Voice =
Technology Lift Off...

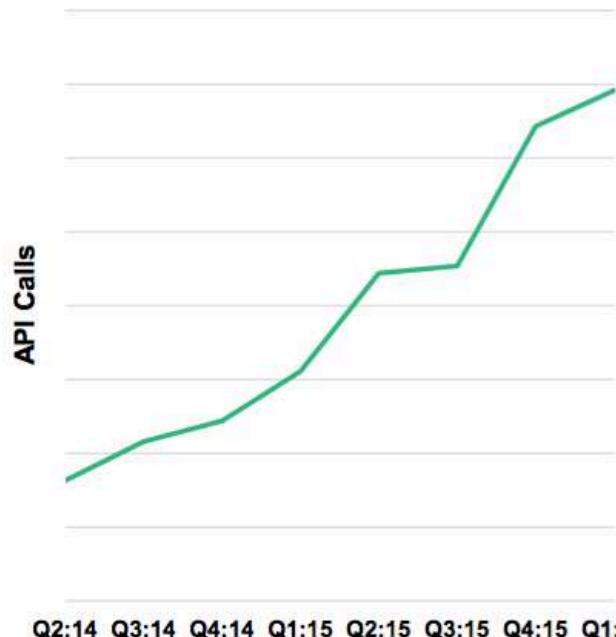
Google Machine Learning Word Accuracy



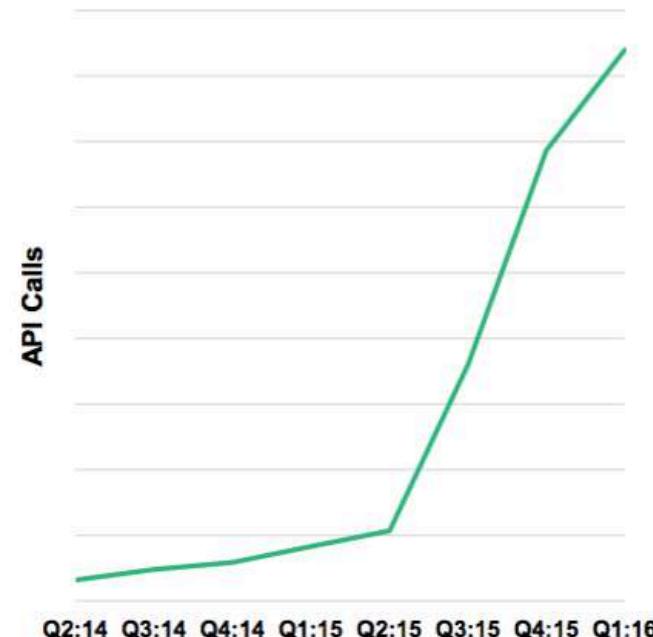
Baidu Voice = Input Growth >4x...Output >26x, Since Q2:14

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.

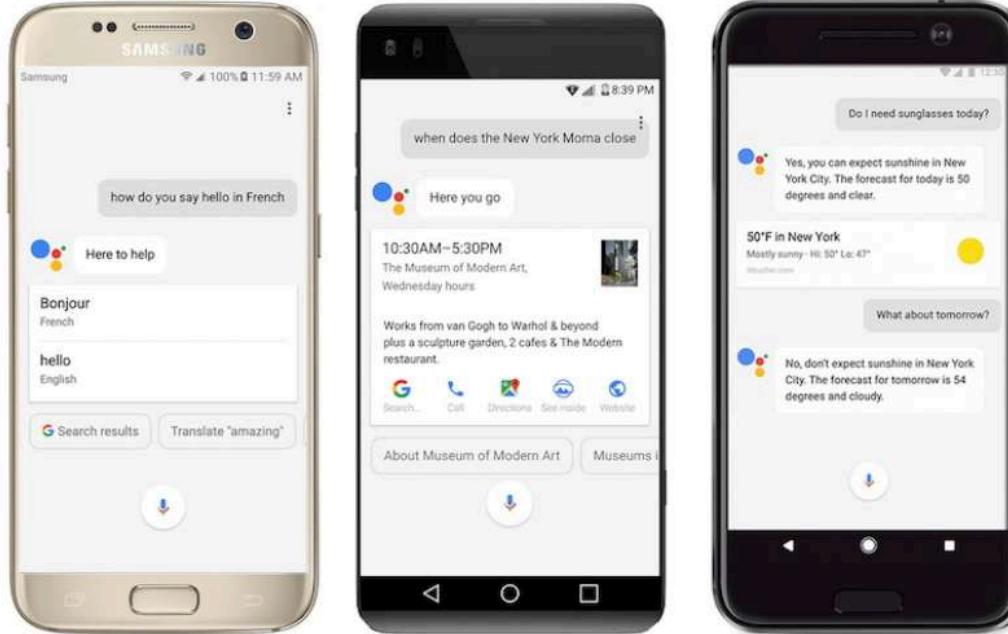


Voice-Based Mobile Platform Front-Ends = Voice Can Replace Typing

Google Assistant

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

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



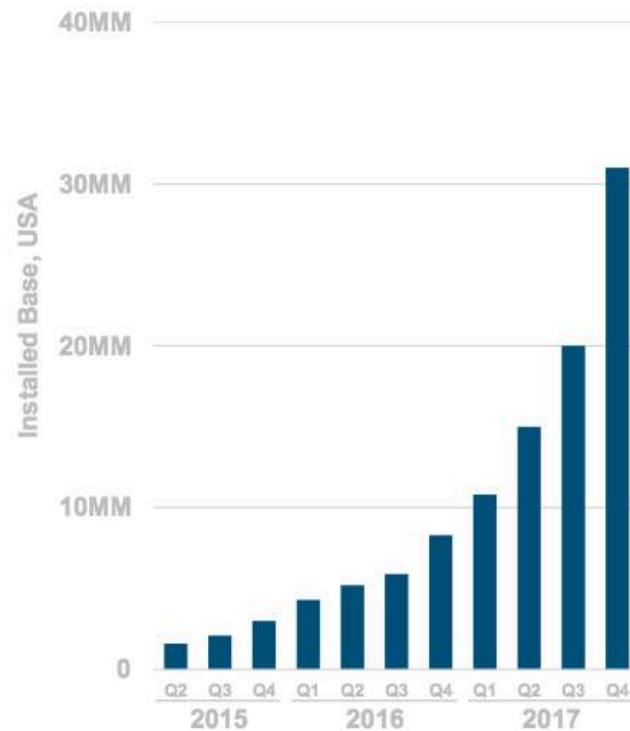
KLEINER
PERKINS

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

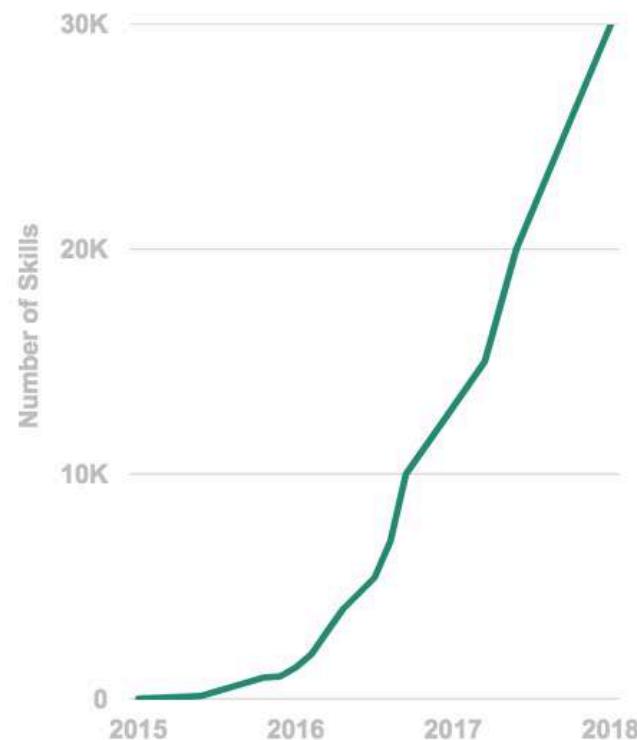
KP INTERNET TRENDS 2017 | PAGE 46

...Voice = Product Lift Off

Amazon Echo Installed Base



Amazon Echo Skills



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

Add by using this form: <https://forms.gle/eBugPNBD7yPhg7>

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

PLEASE NOTE: List updates occur at least once each day

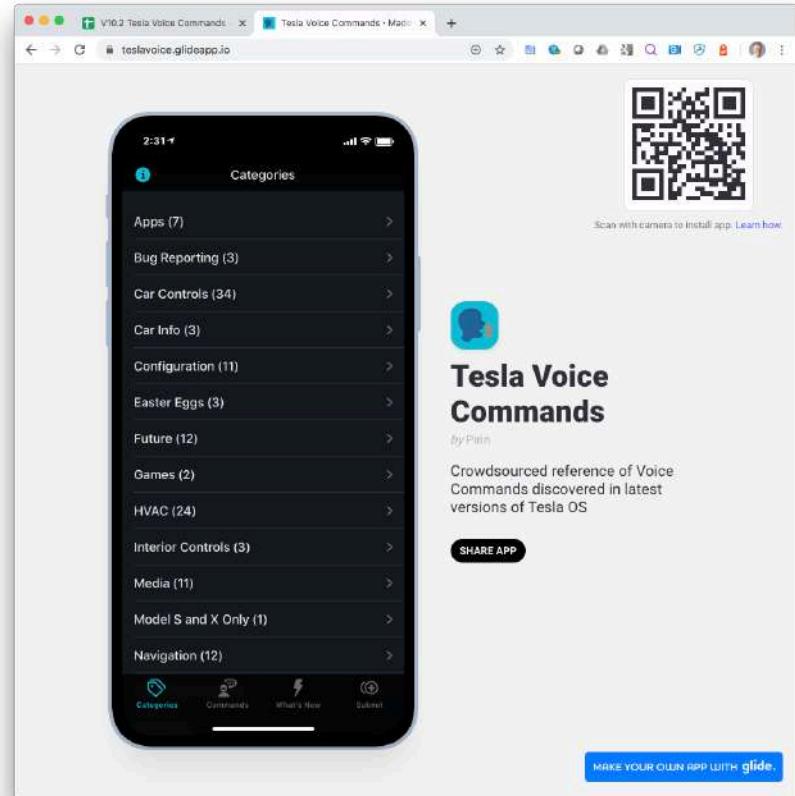
Thanks for your patience as we take time to try out the submissions before adding them to the list.

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

System (Color Background=SiX Only)

Now Available as an app:

Category	Command	Similar Commands
Apps	Show/Hide calendar	
Apps	Open Browser	Open/Close Web, Web, Web Browser
Apps	Show/Hide charging screen	Show/Hide Charging
Apps	Open/Close Easter Eggs	
Apps	Open/Close Energy [App]	Open/Show Energy Graph
Apps	Open/Close Phone	
Apps	Open/Close Toolbox	
Bug Reporting	[File] Bug report [brief description]	
Bug Reporting	Report Error	
Bug Reporting	Take a screenshot	
Car Controls	Adjust mirrors	Adjust Driver/left/My Mirror, Adjust right mirror (adjust left/right)
Car Controls	Adjust steering wheel	
Car Controls	Eject Passenger Seal	Turns passenger seat heater to high
Car Controls	Enable/Disable sentry mode	Keep Summer Safe, Keep Tesla Safe
Car Controls	Fold/Unfold mirrors	Open/Close Mirrors
Car Controls	Lock/unlock doors	Lock/Unlock
Car Controls	Lock/Unlock Windows	Tam window lock on/off, enable/disable window locks
Car Controls	My butt is cold	Surprisingly, "My butt is (too) hot" says if I turn down the heat
Car Controls	Open/Close charge port door	Open Charge Port
Car Controls	Open/Close Internet	
Car Controls	Set (XXX) Seat Heater to (YYYY)	Set XXX seat [heat] 1 (2 or 3) boost
Car Controls	Set front seats to YYYY	
Car Controls	Set rear seats to YYYY	
Car Controls	Set wipers [to] auto /1/2/3/4	[Turn windshield] wipers (auto/on/off/medium/high)
Car Controls	Show HomeLink Settings	
Car Controls	Show Wi-Fi [Settings]	
Car Controls	Show/Close Backup/Rear Cameras	
Car Controls	Show/Close Bluetooth	



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

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

Google Cloud AI Services / Infrastructure

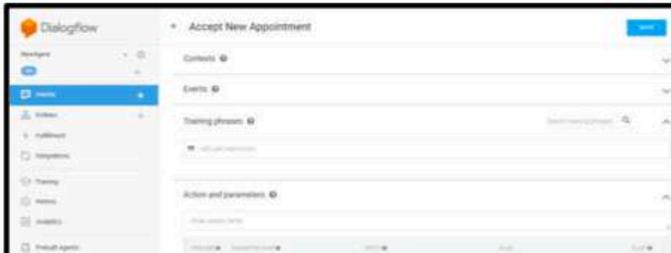
Google Cloud Vision API



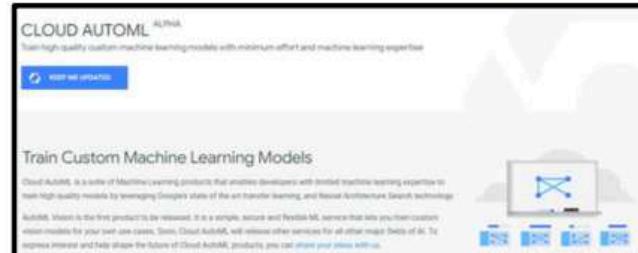
AI Hardware – Tensor Processing Units



Dialogflow Conversational Platform



Cloud AutoML – Custom Models



Current Generation of Internet Leaders = Growing Faster than Previous Generation

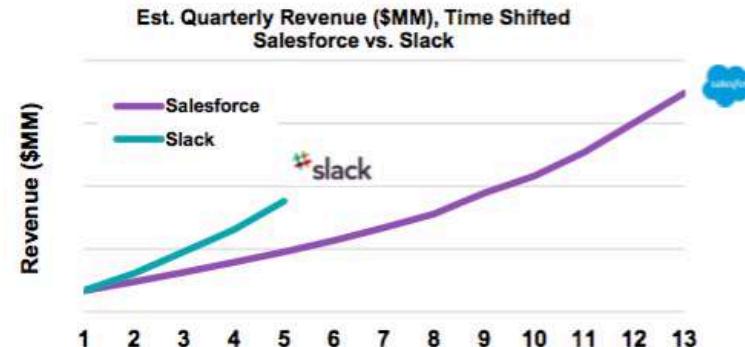
Marketplaces



Commerce



Enterprise



Today's Top 20 Worldwide Internet Leaders 5 Years Ago* = USA @ 9...China @ 2...

Public / Private Internet Companies, Ranked by Market Valuation (5/29/18)

Rank	2018 Company	Region	Market Value (\$B)	
			5/29/13	
1)	Apple	USA	\$418	
2)	Amazon	USA	121	
3)	Microsoft	USA	291	
4)	Google / Alphabet	USA	288	
5)	Facebook	USA	56	
6)	Alibaba	China	--	
7)	Tencent	China	71	
8)	Netflix	USA	13	
9)	Ant Financial	China	--	
10)	eBay + PayPal**	USA	71	
11)	Booking Holdings	USA	41	
12)	Salesforce.com	USA	25	
13)	Baidu	China	34	
14)	Xiaomi	China	--	
15)	Uber	USA	--	
16)	Didi Chuxing	China	--	
17)	JD.com	China	--	
18)	Airbnb	USA	--	
19)	Meituan-Dianping	China	--	
20)	Toutiao	China	--	
			Total	\$1,429

Source: CapIQ, CB Insights, The Wall Street Journal, media reports. *Only includes public companies in 2013. **eBay + PayPal combined for comparison purposes through PayPal spin-off of eBay on 7/20/15.

...Today's Top 20 Worldwide Internet Leaders Today = USA @ 11...China @ 9

Public / Private Internet Companies, Ranked by Market Valuation (5/29/18)

Rank 2018	Company	Region	Market Value (\$B)	
			5/29/13	5/29/18
1)	Apple	USA	\$418	\$924
2)	Amazon	USA	121	783
3)	Microsoft	USA	291	753
4)	Google / Alphabet	USA	288	739
5)	Facebook	USA	56	538
6)	Alibaba	China	--	509
7)	Tencent	China	71	483
8)	Netflix	USA	13	152
9)	Ant Financial	China	--	150
10)	eBay + PayPal*	USA	71	133
11)	Booking Holdings	USA	41	100
12)	Salesforce.com	USA	25	94
13)	Baidu	China	34	84
14)	Xiaomi	China	--	75
15)	Uber	USA	--	72
16)	Didi Chuxing	China	--	56
17)	JD.com	China	--	52
18)	Airbnb	USA	--	31
19)	Meituan-Dianping	China	--	30
20)	Toutiao	China	--	30
		Total	\$1,429	\$5,788

Source: CapIQ, CB Insights, Wall Street Journal, media reports. *eBay + PayPal combined for comparison purposes though PayPal spin-off of eBay on 7/29/15. Market value data as of 5/29/18. The Wall Street Journal, Recode, TechCrunch, Reuters, and the Information articles detail the latest valuations for Ant Financial (4/18), Xiaomi (5/18), Uber (2/18), Didi Chuxing (12/17), Airbnb (3/17), Meituan-Dianping (10/17), and Toutiao (12/17).

USA = 56% of Most Highly Valued Tech Companies Founded By... 1st or 2nd Generation Americans...1.7MM Employees, 2017

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

Rank	Company	Mkt Cap (\$MM)	LTM Rev (\$MM)	Employees	Founder / Co-Founder (1 st / 2 nd Gen Immigrant)	Generation
1	Apple	\$923,554	\$239,176	123,000	Steve Jobs	2 nd – Syria
4	Amazon.com	782,608	177,866	566,000	Jeff Bezos	2 nd – Cuba
3	Microsoft	753,030	95,652	124,000	--	--
2	Alphabet / Google	739,122	110,855	80,110	Sergey Brin	1 st – Russia
5	Facebook	537,648	40,653	25,105	Eduardo Saverin	1 st – Brazil
6	Intel	257,791	62,761	102,700	--*	--
7	Cisco	202,083	48,096	72,900	--	--
8	Oracle	188,848	39,472	138,000	Larry Ellison / Bob Miner	2 nd – Russia / 2 nd – Iran
11	Netflix	152,025	11,693	4,850	--	--
10	NVIDIA	150,894	9,714	10,299	Jensen Huang	1 st – Taiwan
9	IBM	129,635	79,139	366,600	Herman Hollerith	2 nd – Germany
12	Adobe Systems	119,271	7,699	17,973	--	--
13	Booking.com	100,013	12,681	22,900	--	--
14	Texas Instruments	108,912	14,961	29,714	Cecil Green / J. Erik Jonsson Max Levchin / Luke Nosek / Peter Thiel / Elon Musk***	1 st – UK / 2 nd – Sweden 1 st – Ukraine / 1 st – Poland / 1 st – Germany / 1 st – South Africa
15	PayPal	95,858	13,094	18,700	--	--
16	Salesforce.com	94,260	10,480	25,000	--	--
17	Qualcomm	86,333	22,360	33,800	Andrew Viterbi	1 st – Italy
19	Automatic Data Processing	57,237	12,790	58,000	Henry Taub	2 nd – Poland
21	VMware	55,282	7,922	20,615	Edouard Bugnion	1 st – Switzerland
20	Activision Blizzard	53,772	7,017	9,625	--	--
18	Applied Materials	52,439	15,463	18,400	--	--
23	Intuit	50,471	5,434	8,200	--	--
22	Cognizant Technology	43,597	14,810	260,000	Francisco D'Souza / Kumar Mahadeva	1 st – India** / 1 st – Sri Lanka
24	eBay	37,304	9,567	14,100	Pierre Omidyar	1 st – France
25	Electronic Arts	34,763	4,845	8,800	--	--

KLEINER PERKINS
2018
INTERNET TRENDS

Source: CapIQ as of 4/16/18. "The 'New American' Fortune 500" (2011), a report by the Partnership for a New American Economy, as well as "Reason for Reform: Entrepreneurship" (10/16). "American Made, The Impact of Immigrant Founders & Professionals on U.S. Corporations." 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	Immigrant Founder / Co-Founder	Country of Origin	Market Value (\$B)
Uber	Garrett Camp	Canada	\$72
SpaceX	Elon Musk	South Africa	25
Palantir	Peter Thiel	Germany	21
WeWork	Adam Neumann	Israel	21
Stripe	John Collison, Patrick Collison	Ireland	9
Wish (ContextLogic)	Peter Szulczeński, Danny Zhang	Canada	9
Moderna Therapeutics	Noubar Afeyan, Derrick Rossi	Armenia / Canada	8
Robinhood	Baiju Bhatt, Vlad Tenev	India / Bulgaria	6
Slack	Stewart Butterfield, Serguei Mourachov, Cal Henderson	Canada / Russia / UK	5
Tanium	David Hindawi	Iraq	5
Credit Karma	Kenneth Lin	China	4
Houzz	Adi Tatarko, Alon Cohen	Israel	4
Instacart	Apoorva Mehta	India	4
Bloom Energy	KR Sridhar	India	3
Oscar Health	Mario Schlosser	Germany	3
Unity Technologies	David Helgason	Iceland	3
Avant	Al Goldstein, John Sun, Paul Zhang	Uzbekistan / China / China	2
Zenefits	Laks Srinivasan	India	2
AppNexus	Mike Nolet	Holland	2
ZocDoc	Oliver Kharraz	Germany	2
Sprinklr	Ragy Thomas	India	2
Compass	Ori Allon	Israel	2

Company	Immigrant Founder / Co-Founder	Country of Origin	Market Value (\$B)
JetSmarter	Sergey Petrossov	Russia	\$2
Warby Parker	Dave Gilboa	Sweden	2
Carbon3D	Alex Ermoshkin	Russia	2
Infinidat	Moshe Yanai	Israel	2
Tango	Uri Raz, Eric Setton	Israel / France	2
Quanergy	Louay Eldada, Tianyue Yu	Lebanon / China	2
Zoox	Tim Kentley-Klay	Australia	2
Eventbrite	Renaud Visage	France	2
Apttus	Kirk Krappe	UK	2
Cloudflare	Michelle Zatlyn	Canada	2
Proteus Digital Health	Andrew Thompson	UK	2
Anaplan	Guy Haddleton, Michael Gould	New Zealand / UK	1
Rubrik	Bipul Sinha	India	1
OfferUp	Arean Van Veelen	Netherlands	1
Actifio	Ash Ashutosh	India	1
Gusto	Tomer London	Israel	1
Medallia	Borge Hald	Norway	1
FanDuel	Nigel Eccles, Tom Griffiths, Lesley Eccles	UK	1
AppDirect	Daniel Saks, Nicolas Desmarais	Canada	1
Evernote	Stepan Pachikov, Phil Libin	Azerbaijan / Russia	1
Udacity	Sebastian Thrun	Germany	1
UiPath*	Daniel Dines, Marius Tirca	Romania	1
Zoom Video	Eric Yuan	China	1

IoT is ...

a proposed development of the Internet in which everyday objects have network connectivity, allowing them to send and receive data.

Google Definition

The Internet of Things (**IoT**) is the network of physical objects that contain embedded technology to communicate and sense or interact with their internal states or the external environment.

Gartner

The Internet of Things (**IoT**) has been defined in Recommendation [ITU-T.Y.2060](#) (06/2012) as a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies.

ITU

[6 slides from Al Brown, CTO of 1 For 1]

Types of IoT



Consumer

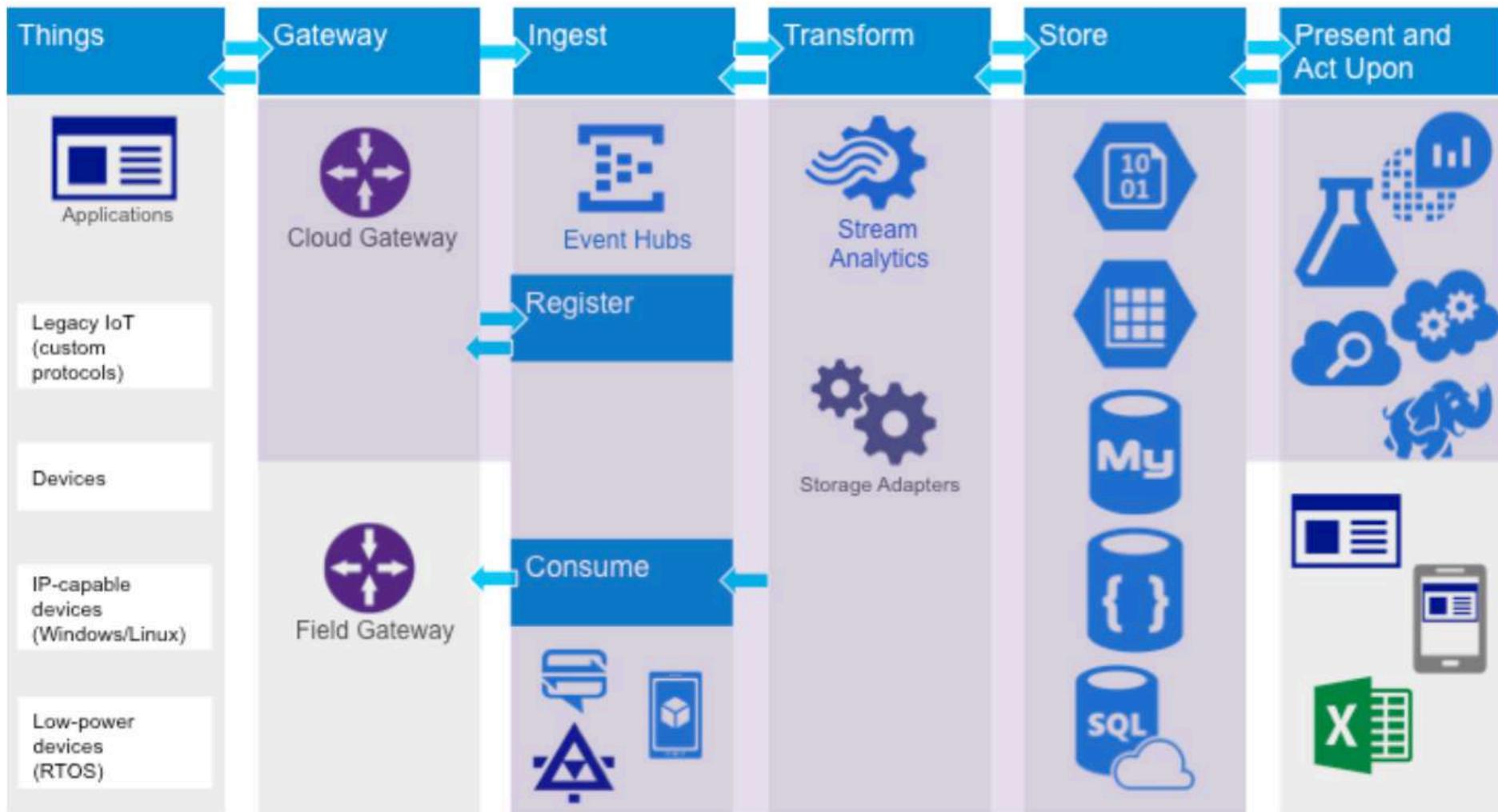


Health



Industrial

(NORMAL) IoT Layers



IoT Protocols

Networks and protocols are mostly not reliable and slow. Plan for it.

Device/Thing to Gateway:

- ZigBee - Wireless sensors
- BLE – Wireless sensors
- ModBus (Serial or TCP)

Gateway to Server:

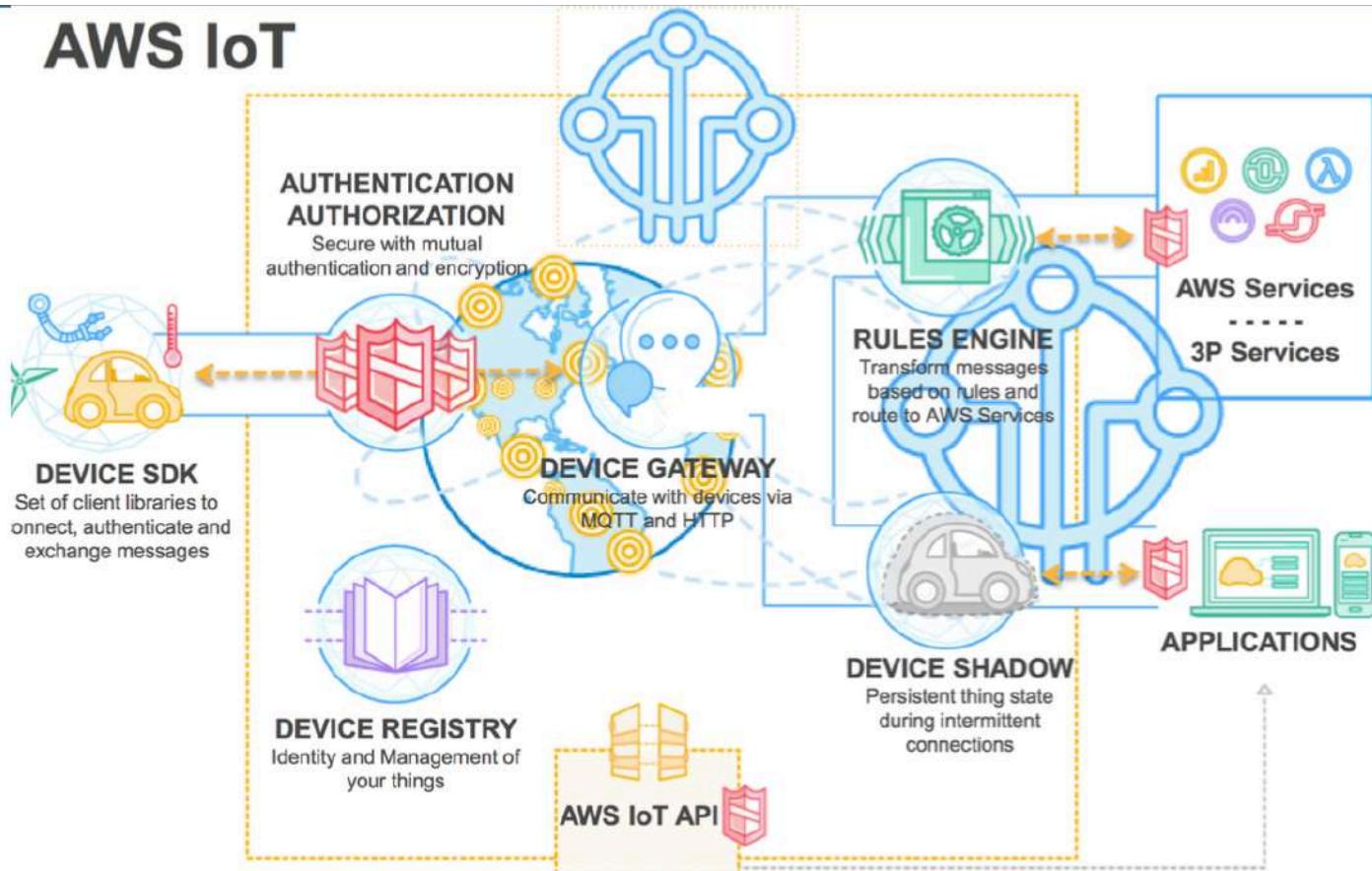
- ModBus TCP – Common
- OPC - Common for industrial assets
- HTTP – JSON over HTTP
- MQTT - Consumer oriented, promising

IoT Platforms

- Amazon IoT
 - Physical/Shadow Device (Persisted JSON State)
 - MQTT Endpoint
 - Rules
 - AWS Connectivity
- GE Predix 2.0 (PaaS)
 - CloudFoundry, HDP
 - Asset Model, Machine Connectivity, Time Series DB, Analytics Plugin (BPMN)
- PTC ThingWorx
 - Originally HMI for TCP-connected devices
- Xively
 - Device connectivity, time series database, connectivity to applications
 - Popular with Arduino developers

AWS IoT

AWS IoT



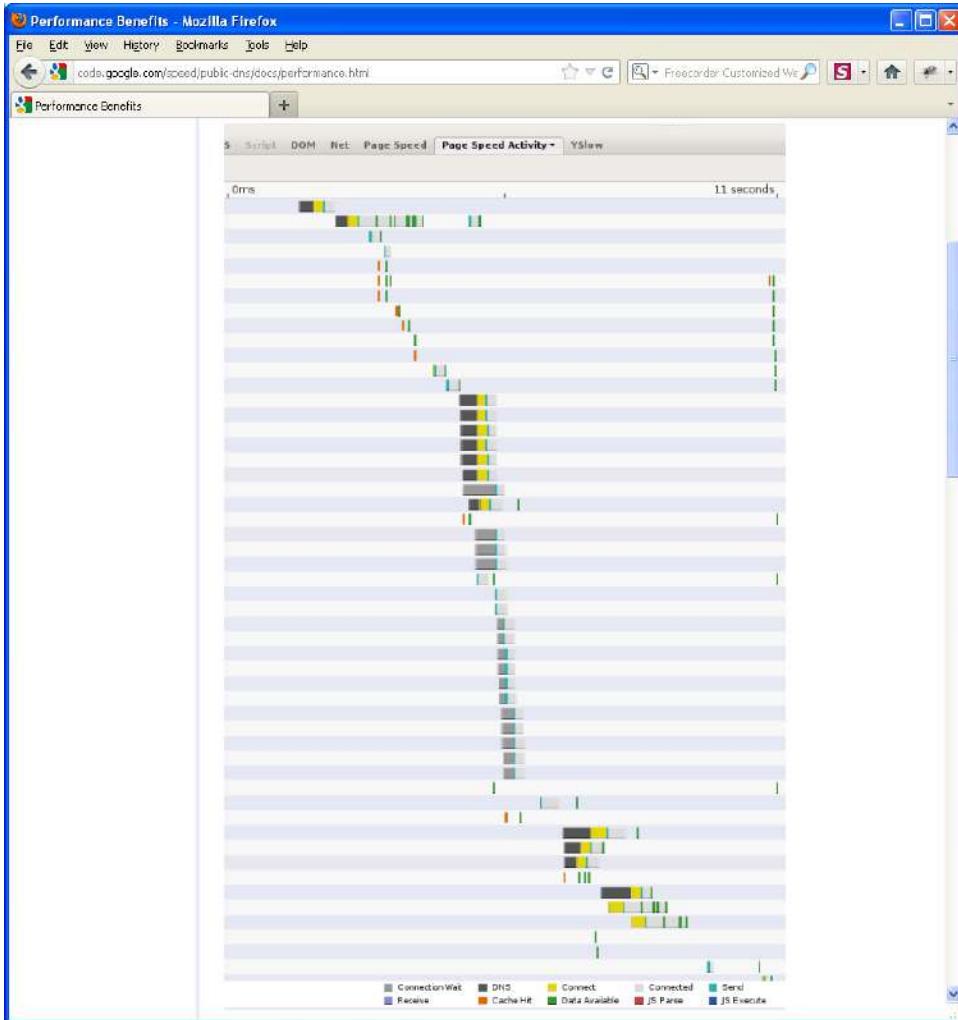
Domain Name System

- Lets focus on one important aspect of the Internet, the domain name system

DNS (Domain Name System) Resolution

- The DNS protocol is an important part of the web's infrastructure
- Every time you visit a website, your computer performs a DNS lookup
- Complex pages often require multiple DNS lookups before they start loading, so your computer may be performing hundreds of lookups a day
- DNS latency is mainly due to
 - The round-trip time to make the request and get the response, due to network congestion, overloaded servers, denial-of-service attacks
 - Cache misses which cause recursive querying of other name servers
- Google has introduced **Google Public DNS**
 - Configure your network to use 8.8.8.8 and 8.8.4.4
 - Google handles more than 70 billion requests *a day!*
 - Google also has IPv6 addresses
 - 2001:4860:4860::8888 and 2001:4860:4860::8844
 - <http://code.google.com/speed/public-dns/docs/intro.html>
- Another alternative is **opendns.com**
 - They have a global network of DNS resolvers to speed resolution
 - The base service is free, but upgrades cost

DNS Resolution is a Critical Component of Efficient Web Page Downloading



- The chart shows the times spent loading a page where
 - black represents DNS resolution,
 - Gray represents Connection waiting,
 - Yellow represents connection,
 - red is JavaScript parsing, and
 - blue is JavaScript execution.
- There are 13 calls to the DNS resolver and 5 of them are serial lookups accounting for several seconds of the total 11 seconds spent loading the page

<http://code.google.com/speed/public-dns/docs/performance.html>

Internet Domain Names

- The Domain Name System is a mapping to/from IP addresses to domain names
 - defined in RFC 1034, 1035, see e.g.
 - <http://www.faqs.org/rfcs/rfc1035.html>
 - Invented in 1983 by Paul Mockapetris **while at USC**, see http://en.wikipedia.org/wiki/Domain_name_system
- There are 13 top level root name servers, see http://en.wikipedia.org/wiki/Root_name_server
- Founded in 1998, ICANN is the organization in charge of maintaining the DNS system, see www.icann.com



Internet Corporation for Assigned Names and Numbers

Top Level Domain Names

- **In 1984** Top level domains were **originally** divided into the following logical categories
 - com commercial and industrial organizations
 - edu educational institutions
 - gov non-military, government affiliated organizations
 - mil military organizations
 - net network operations
 - org other organizations and user groups
- **In 2001** new top level domains were added
 - .biz, .info, .name, .museum, .coop, .aero, .pro, .xxx
 - www.internic.net/faqs/new-tlds.html
- **In 2009** ICANN agreed to accept internationalized domain names, encoded as Unicode. See:
 - <http://www.icann.org/en/resources/idn/fast-track>
- **In 2011** ICANN announced a huge expansion of TLDs, giving requirements for anyone wanting to establish one
 - As of 9/12 they have received 2,000 applications
 - <http://www.icann.org/en/news/announcements/announcement-13jun12-en.htm>

Domain Name Statistics

Distribution of Top-Level Domain Names
by Host Count, January 2019, (no longer active)
at <http://ftp.isc.org/www/survey/reports/2019/01/bynum.txt>

Domain	Beste	All	Hosts	Dup	Names	Level 2 Domains	Level 3 Domains	
TOTAL	1612695272	1077730537	65035265	4832503	121929359			
.net	367709849	376265314	855465	30635	63743254	Networks		
.com	171764916	193221063	21458147	2892775	23142566	Commercial		
.jp	74749861	74812775	1564134	60402	1243484	Japan		
.de	4475393	44875251	121658	150103	2265608	Germany		
.br	36307426	3694836	641153	520	407810	Brazil		
.it	2120120	212012045	55919	39939	65110	Italy		
.fr	21101768	21216185	114217	41715	625312	France		
.cn	19832950	2138525	1572304	8836	23749	China		
.mx	17938753	19266502	1347749	2691	109655	Mexico		
.ar	14488605	14711480	222875	41	15419	Argentina		
.au	14488605	14711480	427	97	70	Australia		
.nl	12329780	12549732	218952	36913	286981	Netherlands		
.pl	11240083	11365333	65255	27936	1802133	Poland		
.edu	10635693	1096207	365014	9044	3249676	Educational		
.ru	10530317	11174765	651448	86663	2625128	Russian Federation		
.ca	984184	9851006	353184	38133	10851	Canada		
.in	9340182	9351606	893180	12184	7387	India		
.tr	6922403	6943540	21137	29	7674	Turkey		
.tw	6780226	685202	71796	1586	27865	Taiwan, Province of China		
.co	6767396	693222	319826	9427	32744	Colombia		
.il	6197417	620922	62092	96	22616	Southern Africa		
.se	5921773	596922	87149	12430	14446	Sweden		
.be	5362014	5389817	22903	21951	144671	Belgium		
.ch	5230569	5236918	106349	25971	1302078	Switzerland		
.uk	5158243	6206332	1048089	1558	100360	United Kingdom		
.eg	4989280	5004756	15376	39	758	Egypt		
.es	469237	470622	23847	12307	8460	Spain		
.fi	3900155	4001608	21653	11336	1818046	Finland		
.pt	3820151	3837398	17237	7294	261928	Portugal		
.at	3650990	3663950	18609	25815	352943	Austria		
.no	3422043	3450893	20858	11413	247748	Norway		
.nz	337475	341391	12130	19	1217	New Zealand		
.cl	332332	3399473	82142	10589	64945	Chile		
.nz	2935395	3493503	519108	429	22327	New Zealand		
.cz	2933884	2937528	24144	22538	655923	Czech Republic		
.hu	2666465	2675428	8962	16883	501101	Hungary		
.gr	2385254	2388251	171	6590	54727	Greece		
.ua	2324320	2324320	964679	115	13030	Ukraine		
.dk	2309516	2321904	14388	11076	54452	Denmark		
.li	2253613	2271293	17769	25	11953	Israel		
.gov	2211757	2297289	705259	2291	621385	Government		
.sg	213175	2143750	17345	1249	8285	Singapore		
.ro	209098	210098	45457	21436	162726	Romania		
.us	1945613	2081695	136072	22928	111087	United States		
.hr	1915803	1919493	1919	1605	42048	Croatia (local name: Hrvatska)		
.id	1841324	1857116	15792	829	15863	Indonesia		
.org	1792394	1976093	183699	225182	1219300	Organizations		
.tv	1792394	1976093	183699	225182	1219300	Other		
.lt	1738246	1721943	3697	3802	308420	Lithuania		
.ua	1690886	1691744	125888	2211	153045	Ukraine		
.mil	1556744	2663038	1106292	171	272944	US Military		
.ie	1329458	1333473	4015	7781	228325	Ireland		
.ir	1315128	1315128	1643	1488	123440	Iran (Islamic Republic Of)		
.ve	1294042	1294042	3701	23	23	Venezuela		
.ka	1201033	1228164	27431	2963	723391	Kazakhstan		
.ec	1054535	1056538	2000	2633	156544	Ecuador		
.tr	1037518	1040009	2098	1832	49706			
.sk	997487	998901	4114	6238	221228	Slovakia (Slovensk Republic)		
.py	911338	911338	4595	409	20	Paraguay		
.unknowm	779630	13018528	13039898	306205	623649	Unknown		
.bg	771130	847227	76097	2276	209393	Bulgaria		
.hk	715546	829738	114192	1159	43712	Hong Kong		
.do	667607	706812	39205	205	802	Dominican Republic		
.eu	640196	640196	26131	3194	45248	European Union		
.ee	611150	613192	2002	2447	56297	Estonia		
.ona	580039	580326	287	427	490			

Top-level Domains (TLDs) Overview

For the day of December 28, 2019

TLD	New	Deleted	Transferred	Current Total
.COM	106,845	111,018	148,201	145,379,497
.NET	5,891	11,697	8,475	13,286,468
.ORG	4,804	5,042	4,525	10,090,564
.INFO	3,231	3,264	4,187	4,661,629
.BIZ	930	3,036	866	1,617,678
.US	322	1,112	481	1,766,407
TOTALS	122,023	135,169	166,735	176,802,243

Above shows 145 million .com sites out
Of a total 176 million; see
<http://www.dailychanges.com>

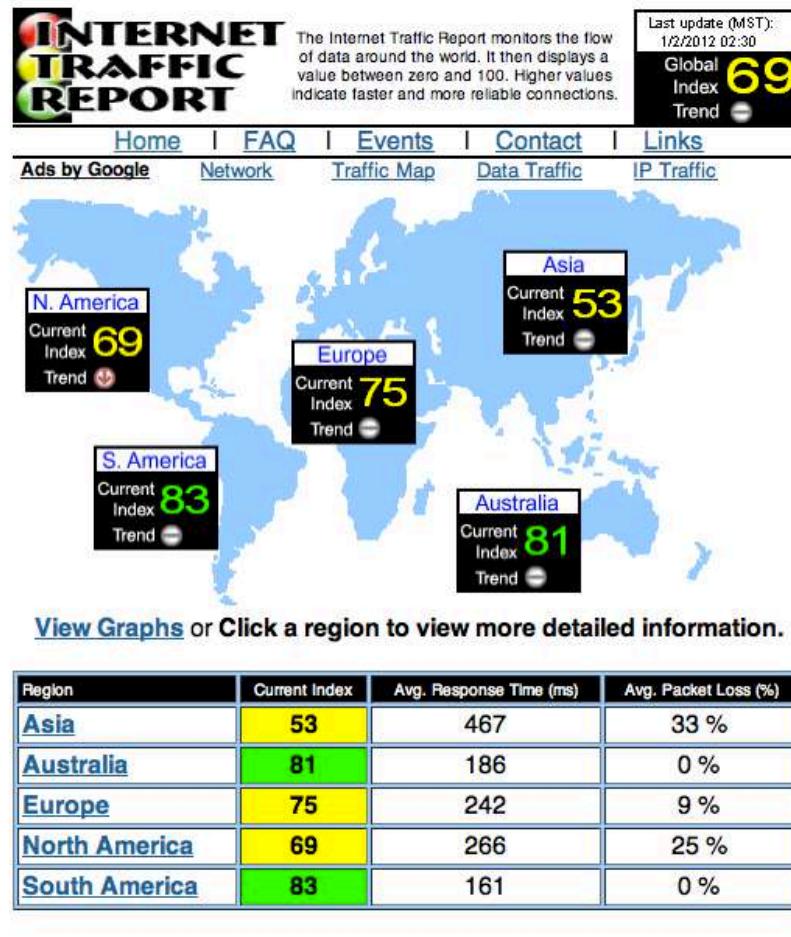
Try also:

<http://research.domaintools.com/statistics/tld-counts/>

Conclusion: the .net and .com categories are the largest followed by Japan, Germany and Brazil

Internet Traffic

- How efficiently is the Internet working now
 - <http://www.internettrafficreport.com>

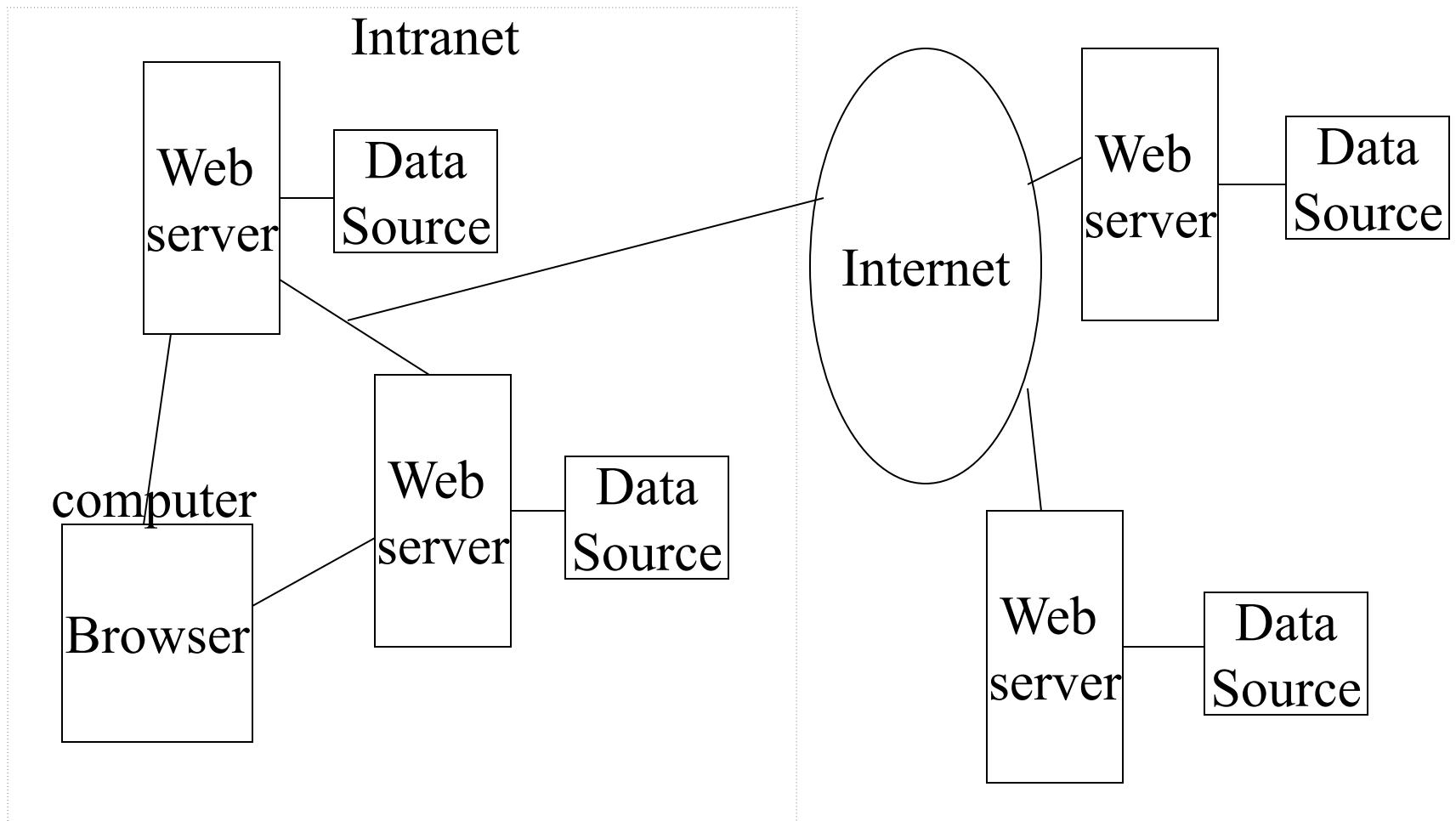


*Data
from
January
2012*

Defining the World Wide Web

- A wide-area hypertext, multimedia information retrieval system that provides access to a large universe of documents
- A uniform way of accessing and viewing some information on the Internet
- The WWW
 - creates a world in which information has a reference by which it can be accessed
 - subsumes the capabilities of ftp, gopher, wais and news

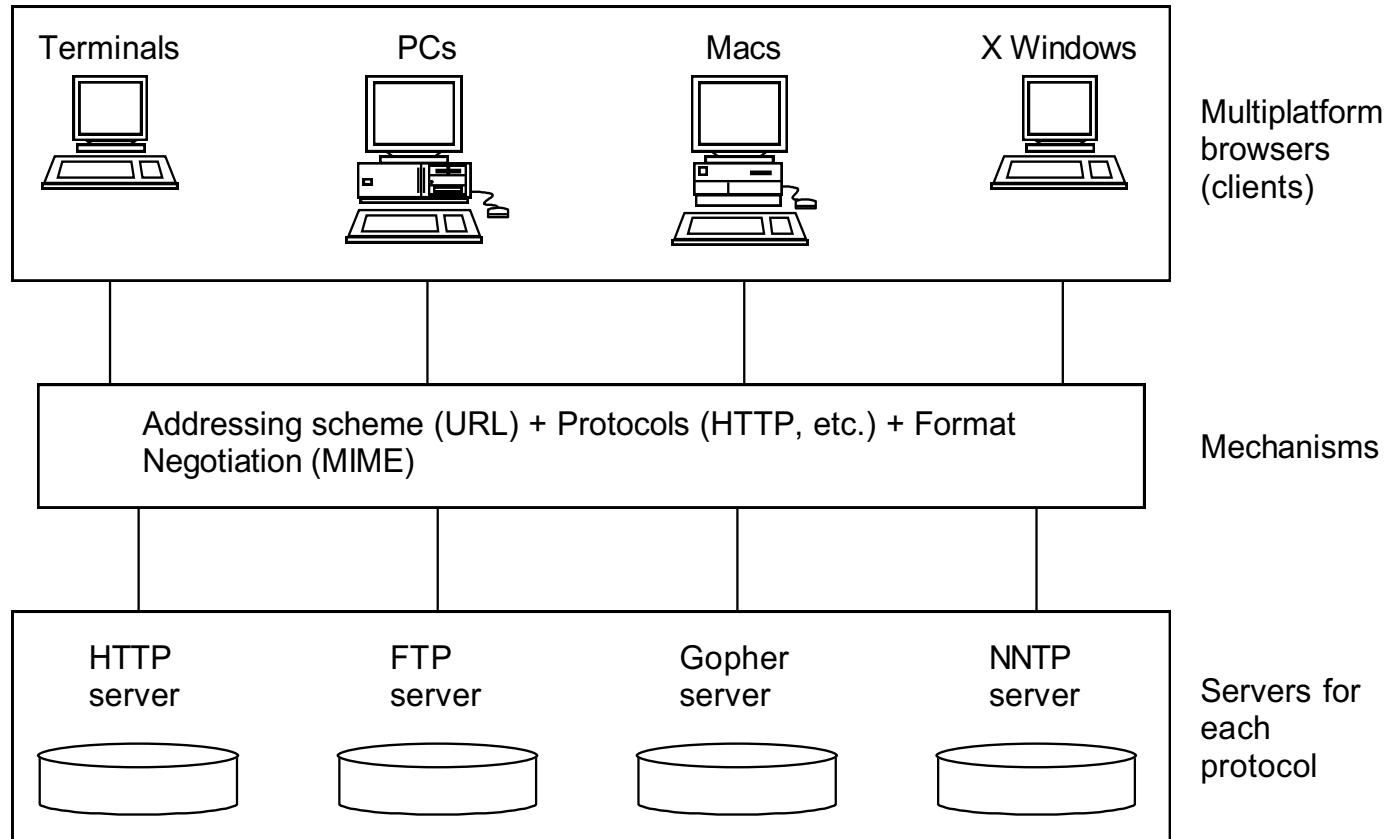
Graphical View of the WWW



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 1.1
- 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:, gopher:, news:, mailto:, wais:, telnet:

2. **Double slash** (only for http, ftp, gopher, wais) //

3. Internet **domain** name e.g., pollux.usc.edu

4. **Port** number (this field is optional; e.g., pollux.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

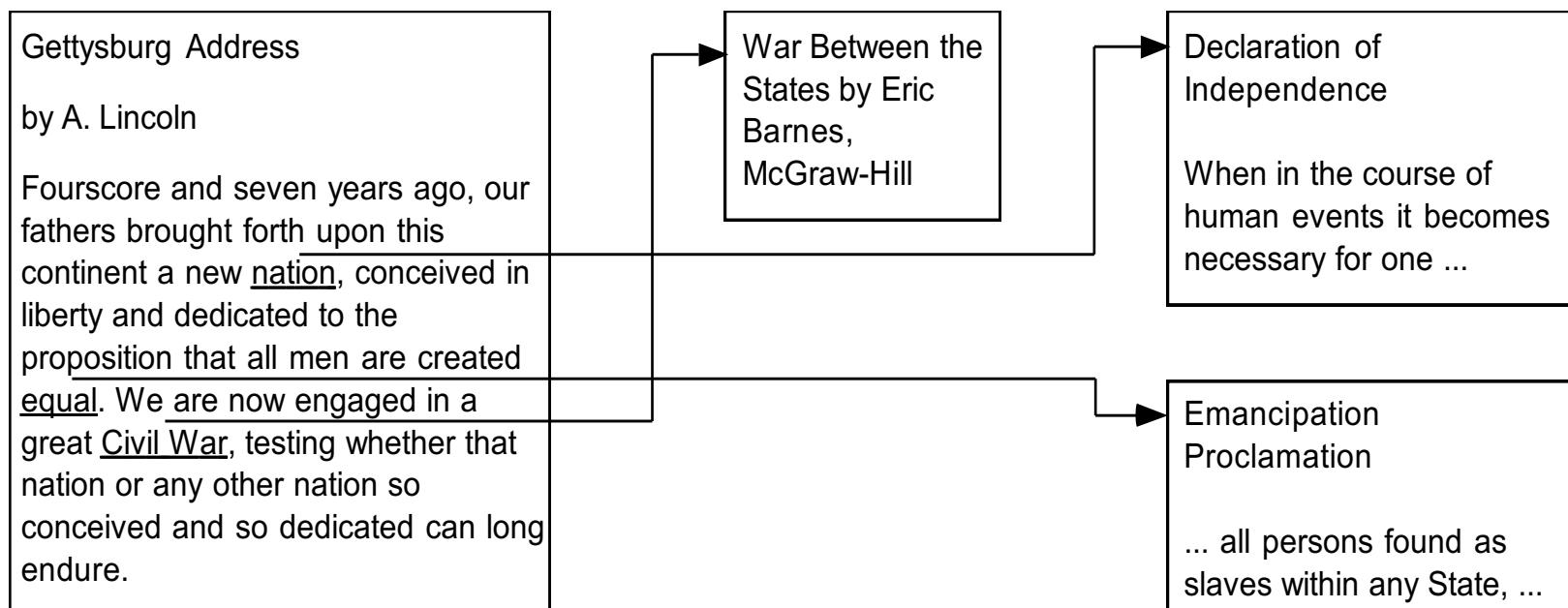
~	%7E		%7C
SPACE	%20	\	%5C
%	%25	^	%5E
&	%26	[%5B
=	%3D]	%5D
?	%3F	#	%23
{	%7B	>	%3E
}	%7D	<	%3C

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

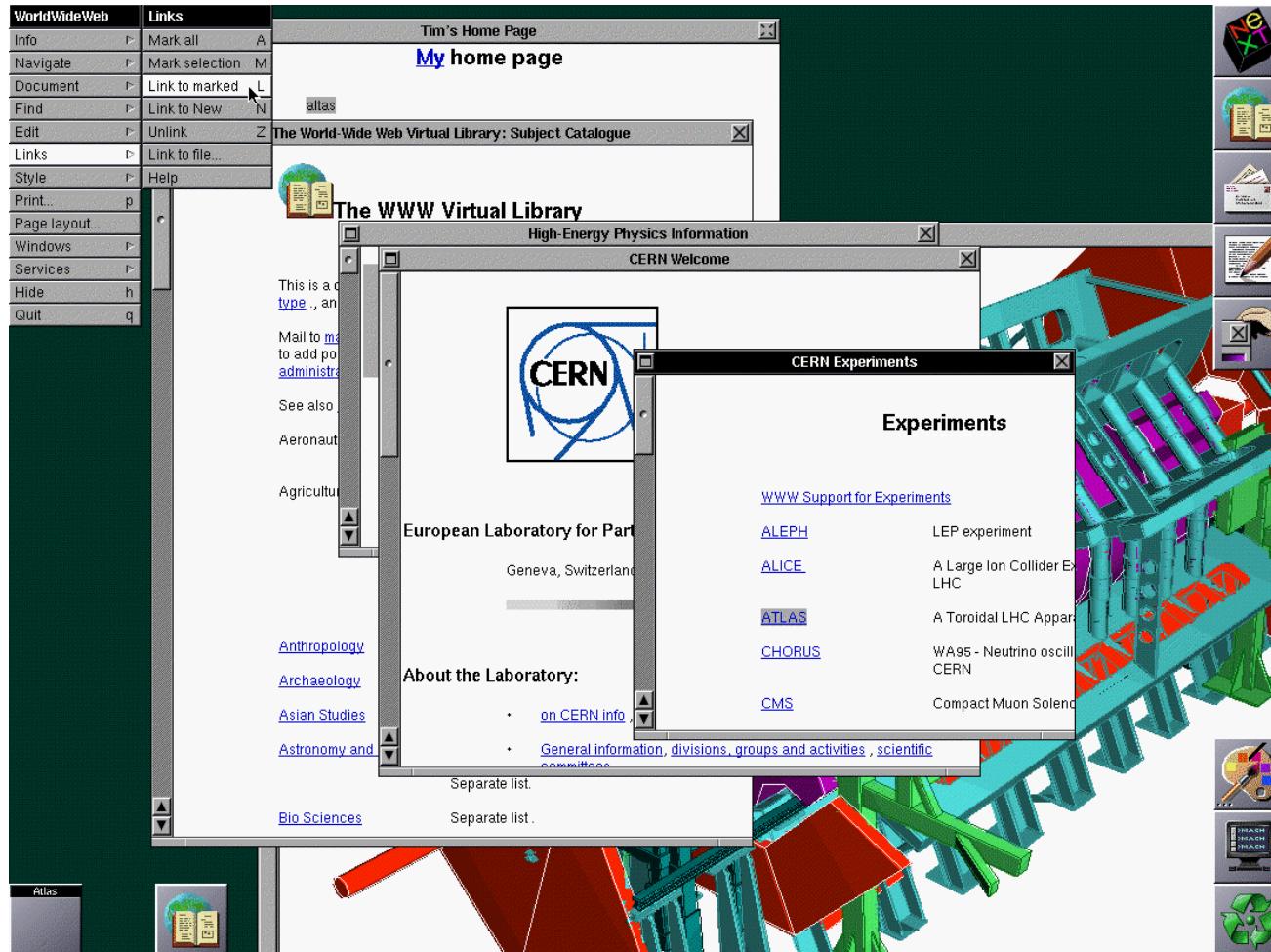


Early History of the WWW

- 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. 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 contains several sections with links: "What's out there?", "Help", "Software Products", "Technical", "Bibliography", "People", "History", "How can I help?", and "Getting code". Each section has a brief description of its content.

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.