

Mobile Apps

Craig Webster

Consultant Clinical Scientist, University Hospitals Birmingham, Heartlands Hospital

PDA's In Medicine

ACB Focus 1999

Craig Webster
Broomfield Hospital

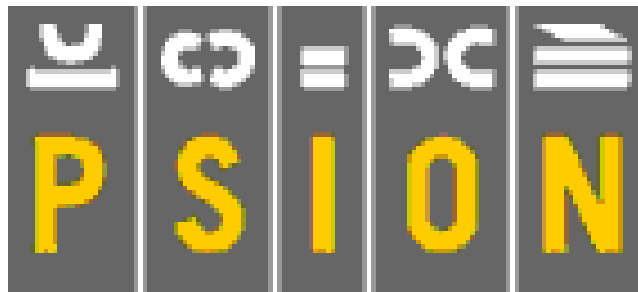
PDA Technologies

- A PDA (Personal Digital Assistant) is a small, handheld device that combines computing, telephone/fax and networking features.

Palm Pilot

- Palm III
 - 2meg of RAM
 - IR port
- Palm IIIx
 - 4meg of RAM
 - Expansion Slot
- Palm V
 - 2meg of RAM
 - Lithium-ion Rechargeable battery





PSION

- S5
 - 32-bit RISC-based ARM 7100 CPU, running at 18.432MHz
 - ROM: The built-in applications are stored in a 6MB ROM.
RAM: 4Mb or 8Mb
- 3C
- Siena



Windows CE Machines

The Future

- Increased processing power
- Increased battery life
- Colour displays
- Wireless synchronisation



Mobile Phones

iPhone 7

From
\$449

iPhone 8

From
\$599



iPhone X[®]

From
\$749



iPhone X[®] S

From
\$999



iPhone X[®] S Max

From
\$1099



A man in a dark shirt stands to the left of a large iPad Pro. The iPad is oriented vertically and displays a blue and yellow abstract image. The word "Tablets" is overlaid on the iPad screen.














Tablets

iPad Pro















32GB	128GB	128GB
\$799	\$949	\$1079
Wi-Fi	Wi-Fi	Wi-Fi + Cellular















Compute Performance is Staggering




















Single Core Multi-Core Metal Battery

Device	Score
 iPhone XS Max Apple A12 Bionic @ 2.5 GHz	4796
 iPhone XS Apple A12 Bionic @ 2.5 GHz	4796
 iPhone XR Apple A12 Bionic @ 2.5 GHz	4795
 iPhone 8 Apple A11 Bionic @ 2.4 GHz	4223
 iPhone 8 Plus Apple A11 Bionic @ 2.4 GHz	4221
 iPhone X Apple A11 Bionic @ 2.4 GHz	4212
 iPad Pro (10.5-inch) Apple A10X Fusion @ 2.3 GHz	3914
 iPad Pro (12.9-inch 2nd Generation) Apple A10X Fusion @ 2.3 GHz	3910
 iPad (6th generation) Apple A10 Fusion @ 2.3 GHz	3478
 iPhone 7 Plus Apple A10 Fusion @ 2.3 GHz	3439
 iPhone 7 Apple A10 Fusion @ 2.3 GHz	3403
 iPad Pro (12.9-inch) Apple A9X @ 2.3 GHz	3057
 iPad Pro (9.7-inch) Apple A9X @ 2.3 GHz	2971

Single Core Multi-Core

Mac	Score
 iMac (27-inch Retina Mid 2017) Intel Core i7-7700K @ 4.2 GHz (4 cores)	5677
 Mac mini (Late 2018) Intel Core i7-8700B @ 3.2 GHz (6 cores)	5645
 MacBook Pro (15-inch Mid 2018) Intel Core i9-8950HK @ 2.9 GHz (6 cores)	5346
 iMac Pro (Late 2017) Intel Xeon W-2150B @ 3.0 GHz (10 cores)	5293
 iMac (27-inch Retina Late 2015) Intel Core i7-6700K @ 4.0 GHz (4 cores)	5280
 iMac (21.5-inch Retina Mid 2017) Intel Core i7-7700 @ 3.6 GHz (4 cores)	5240
 iMac (27-inch Retina Mid 2017) Intel Core i5-7600K @ 3.8 GHz (4 cores)	5212
 iMac Pro (Late 2017) Intel Xeon W-2170B @ 2.5 GHz (14 cores)	5155
 iMac Pro (Late 2017) Intel Xeon W-2191B @ 2.3 GHz (18 cores)	5150
 Mac mini (Late 2018) Intel Core i5-8500B @ 3.0 GHz (6 cores)	5141
 MacBook Pro (13-inch Mid 2018) Intel Core i7-8559U @ 2.7 GHz (4 cores)	5131
 iMac (27-inch Retina Mid 2017) Intel Core i5-7600 @ 3.5 GHz (4 cores)	5095
 MacBook Pro (15-inch Mid 2018) Intel Core i7-8850H @ 2.6 GHz (6 cores)	5054
 iMac Pro (Late 2017) Intel Xeon W-2140B @ 3.2 GHz (8 cores)	5032

Device	Score
 iPhone XS Apple A12 Bionic @ 2.5 GHz	11248
 iPhone XR Apple A12 Bionic @ 2.5 GHz	11200
 iPhone XS Max Apple A12 Bionic @ 2.5 GHz	11191
 iPhone 8 Plus Apple A11 Bionic @ 2.4 GHz	10181
 iPhone X Apple A11 Bionic @ 2.4 GHz	10141
 iPhone 8 Apple A11 Bionic @ 2.4 GHz	10133
 iPad Pro (10.5-inch) Apple A10X Fusion @ 2.3 GHz	9335
 iPad Pro (12.9-inch 2nd Generation) Apple A10X Fusion @ 2.3 GHz	9319
 iPad (6th generation) Apple A10 Fusion @ 2.3 GHz	5922
 iPhone 7 Plus Apple A10 Fusion @ 2.3 GHz	5791
 iPhone 7 Apple A10 Fusion @ 2.3 GHz	5731
 iPad Pro (12.9-inch) Apple A9X @ 2.3 GHz	5111
 iPad Pro (9.7-inch) Apple A9X @ 2.3 GHz	4980
 iPad (5th generation) Apple A9 @ 1.8 GHz	4389

Mac	Score
 iMac Pro (Late 2017) Intel Xeon W-2191B @ 2.3 GHz (18 cores)	47109
 iMac Pro (Late 2017) Intel Xeon W-2170B @ 2.5 GHz (14 cores)	40765
 iMac Pro (Late 2017) Intel Xeon W-2150B @ 3.0 GHz (10 cores)	35521
 iMac Pro (Late 2017) Intel Xeon W-2140B @ 3.2 GHz (8 cores)	30795
 Mac Pro (Late 2013) Intel Xeon E5-2697 v2 @ 2.7 GHz (12 cores)	26814
 Mac mini (Late 2018) Intel Core i7-8700B @ 3.2 GHz (6 cores)	24116
 Mac Pro (Late 2013) Intel Xeon E5-1680 v2 @ 3.0 GHz (8 cores)	23297
 MacBook Pro (15-inch Mid 2018) Intel Core i9-8950HK @ 2.9 GHz (6 cores)	22577
 MacBook Pro (15-inch Mid 2018) Intel Core i7-8850H @ 2.6 GHz (6 cores)	21377
 MacBook Pro (15-inch Mid 2018) Intel Core i7-8750H @ 2.2 GHz (6 cores)	21209
 Mac Pro (Mid 2012) Intel Xeon X5675 @ 3.1 GHz (12 cores)	20292
 Mac mini (Late 2018) Intel Core i5-8500B @ 3.0 GHz (6 cores)	20099
 Mac Pro (Mid 2010) Intel Xeon X5670 @ 2.9 GHz (12 cores)	19507
 iMac (27-inch Retina Mid 2017) Intel Core i7-7700K @ 4.2 GHz (4 cores)	19336
 Mac Pro (Mid 2010) Intel Xeon X5650 @ 2.7 GHz (12 cores)	18900
 Mac Pro (Late 2013) Intel Xeon E5-1650 v2 @ 3.5 GHz (6 cores)	18034
 iMac (21.5-inch Retina Mid 2017) Intel Core i7-7700 @ 3.6 GHz (4 cores)	17792
 MacBook Pro (13-inch Mid 2018) Intel Core i7-8559U @ 2.7 GHz (4 cores)	17620
 iMac (27-inch Retina Late 2015) Intel Core i7-6700K @ 4.0 GHz (4 cores)	17528

Battery Performance

Top Geekbench 3 Battery Results

Uploaded	Model	Platform	User	Runtime	Score
Apr 24, 2016	Samsung Galaxy S 5 Qualcomm Qualcomm 2457 MHz (4 cores)	Android 32-bit		16:16:00	9760
Oct 10, 2017	iPhone10,2 ARM 2341 MHz (6 cores)	iOS 64-bit		16:12:20	9723
Sep 23, 2017	LENOVO Lenovo P2a42 ARM Qualcomm 2016 MHz (8 cores)	Android 64-bit	123456789cagdas	16:08:30	9684
Oct 29, 2016	iPad Pro Apple A9X 2238 MHz (2 cores)	iOS 64-bit	Rgorky	16:06:00	9660
Feb 08, 2016	iPad6,7 ARM 2257 MHz (2 cores)	iOS 64-bit		16:03:10	9631
Feb 16, 2016	iPad6,7 ARM 2257 MHz (2 cores)	iOS 64-bit	dernest	16:03:10	9631
Feb 17, 2016	iPad6,7 ARM 2253 MHz (2 cores)	iOS 64-bit		16:00:50	9608
Dec 01, 2015	iPad6,7 ARM 2253 MHz (2 cores)	iOS 64-bit		16:00:50	9608

Screen Resolution

Device	Native Resolution (Pixels)	UIKit Size (Points)	Native Scale factor	UIKit Scale factor
iPhone X	1125 x 2436	375 x 812	3.0	3.0
iPhone 8 Plus	1080 x 1920	414 x 736	2.608	3.0
iPhone 8	750 x 1334	375 x 667	2.0	2.0
iPhone 7 Plus	1080 x 1920	414 x 736	2.608	3.0
iPhone 6s Plus	1080 x 1920	375 x 667	2.608	3.0
iPhone 6 Plus	1080 x 1920	375 x 667	2.608	3.0
iPhone 7	750 x 1334	375 x 667	2.0	2.0
iPhone 6s	750 x 1334	375 x 667	2.0	2.0
iPhone 6	750 x 1334	375 x 667	2.0	2.0
iPhone SE	640 x 1136	320 x 568	2.0	2.0
iPad Pro 12.9-inch (2nd generation)	2048 x 2732	1024 x 1366	2.0	2.0
iPad Pro 10.5-inch	2224 x 1668	1112 x 834	2.0	2.0
iPad Pro (12.9-inch)	2048 x 2732	1024 x 1366	2.0	2.0
iPad Pro (9.7-inch)	1536 x 2048	768 x 1024	2.0	2.0
iPad Air 2	1536 x 2048	768 x 1024	2.0	2.0
iPad Mini 4	1536 x 2048	768 x 1024	2.0	2.0

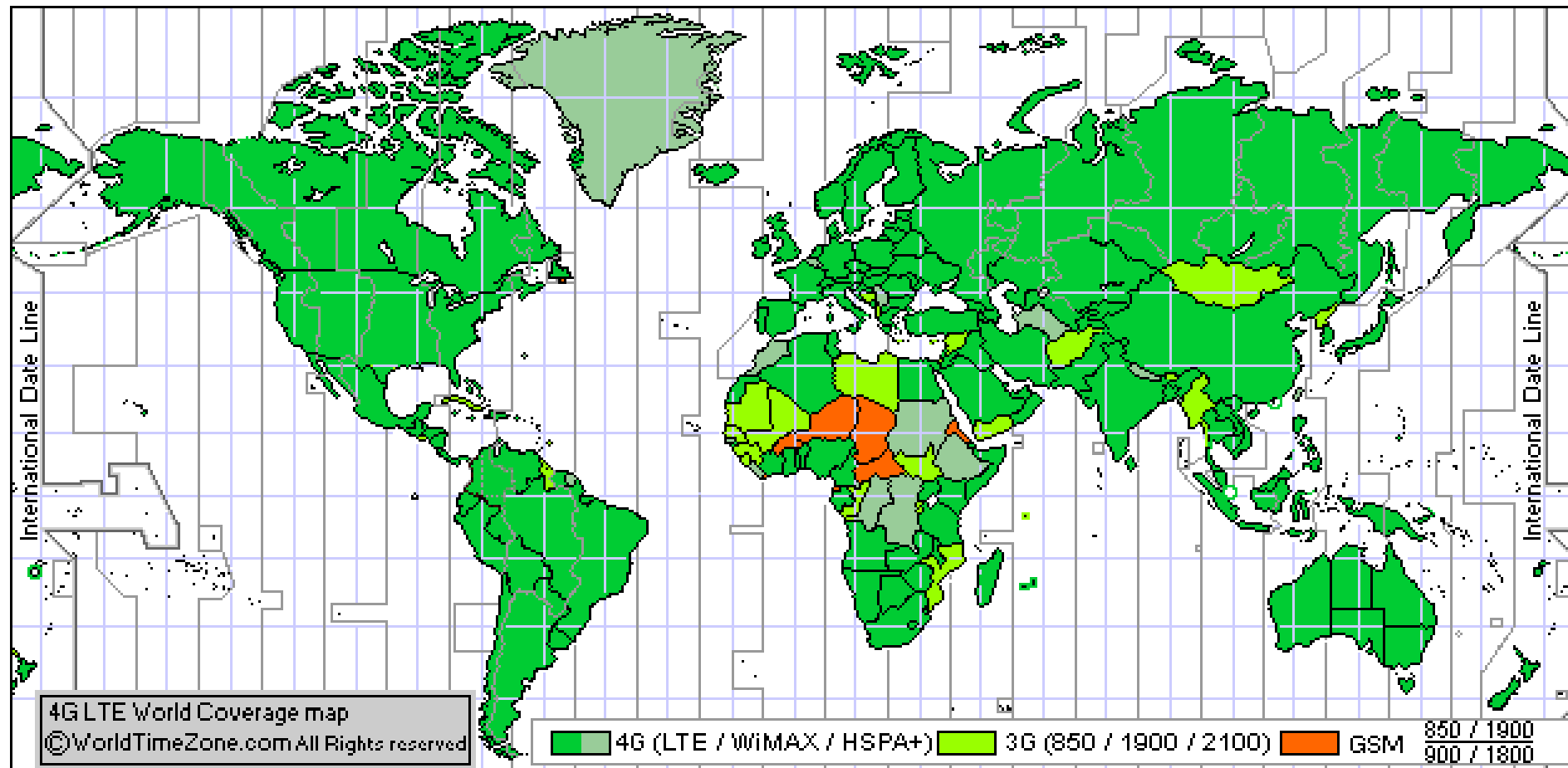
Screen Colour Reproduction

	iPhone X	Google Pixel 2 XL
Display size, resolution	5.8-inch; 2,436x1,125 pixels	6-inch; 2,880x1,440 pixels
Pixel density	458 ppi	538 ppi

Palm resolution: 160x160 pixels



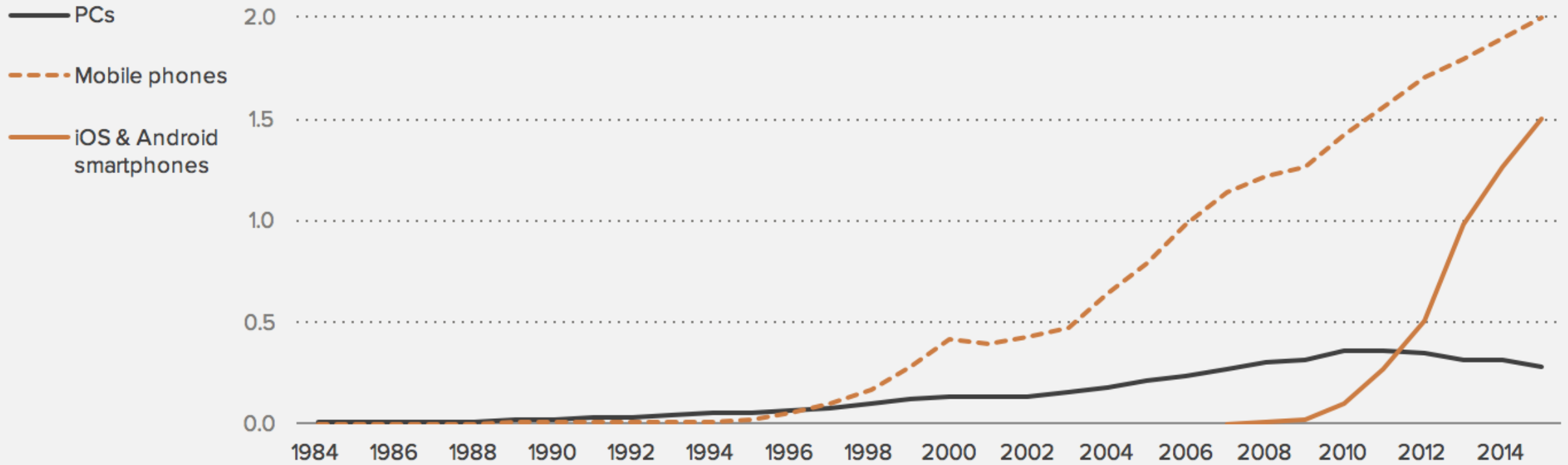
Wireless Connectivity Everywhere



Mobile is the new scale

Mobile was always bigger than PCs, but separate, and not really part of the computing market. Smartphones broke down that wall

Annual unit sales (bn)



What is an App?



<https://xkcd.com/1174/>

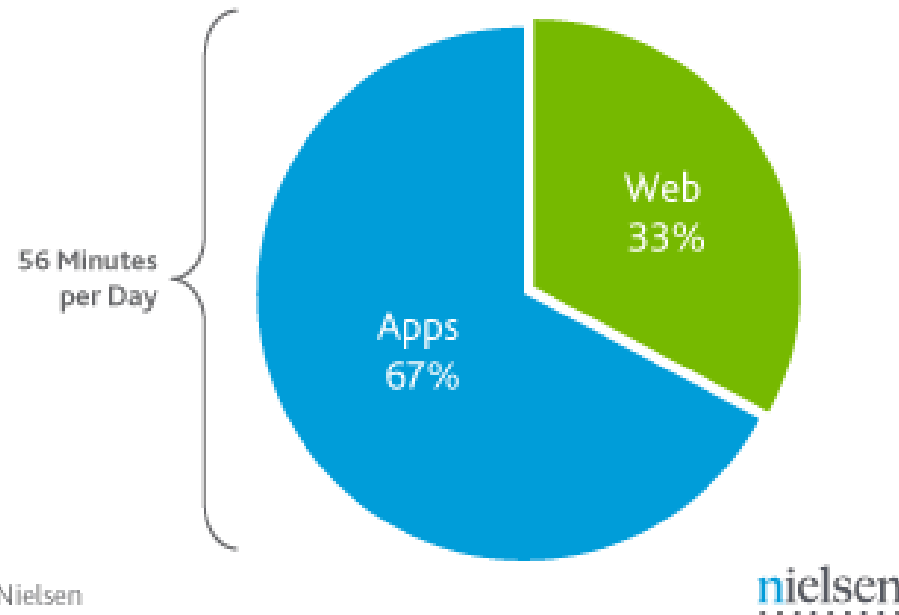
- It's a piece of software that can run through a web browser or offline on your computer, and on a smartphone, tablet or other electronic devices, including smart TVs and smartwatches.
- Apps may or may not have a connection to the internet.

Apps Everywhere

The average Android user spends almost an hour per day interacting with web and apps

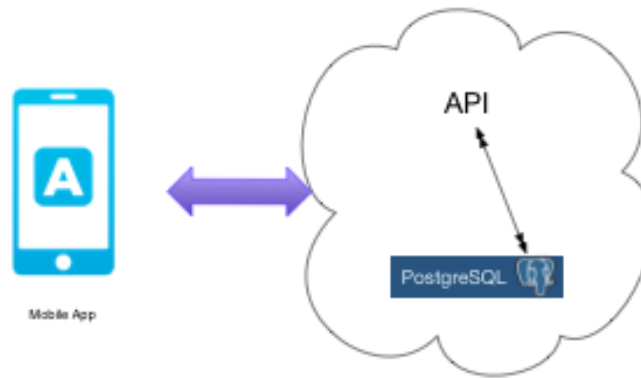
Proportion of Time Spent on Web vs. Apps

Nielsen Smartphone Analytics, June 2011

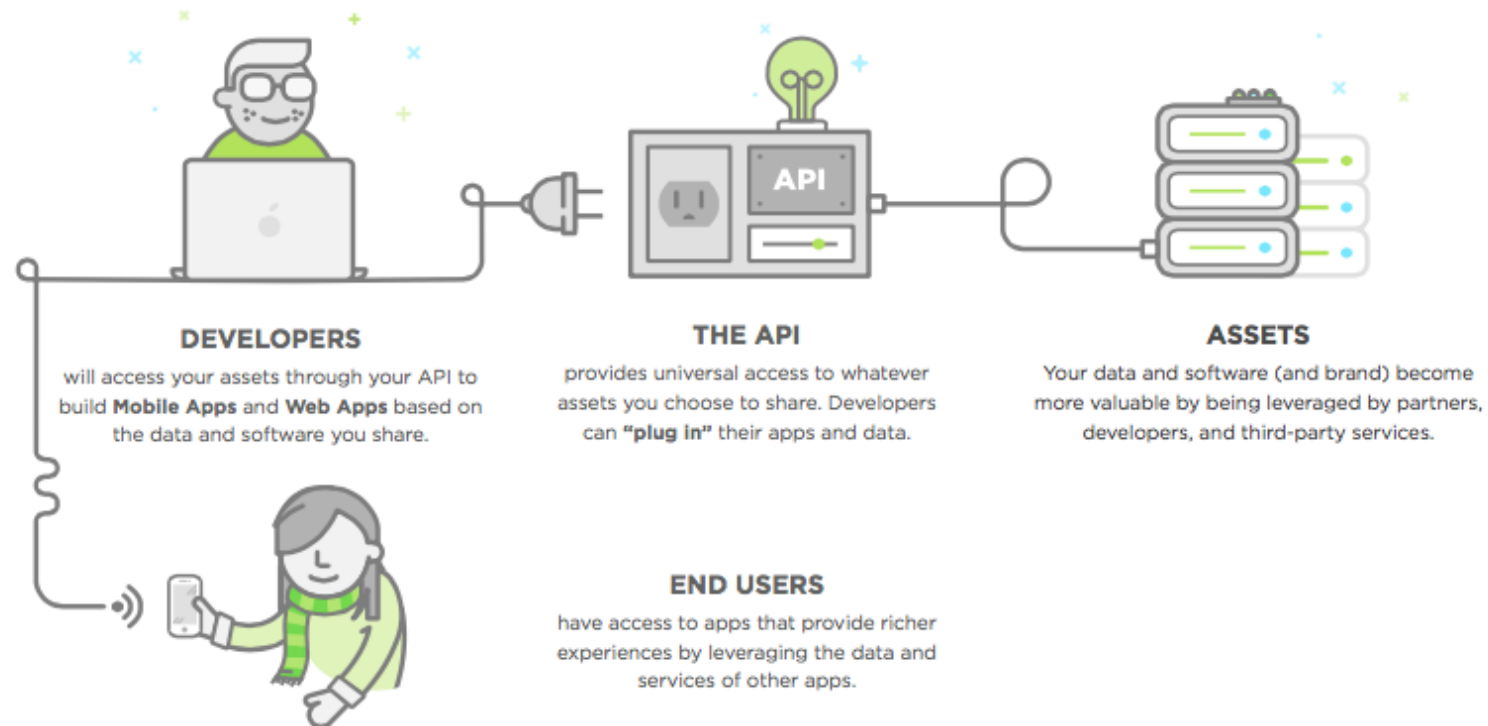


Source: Nielsen

How do Apps Work?



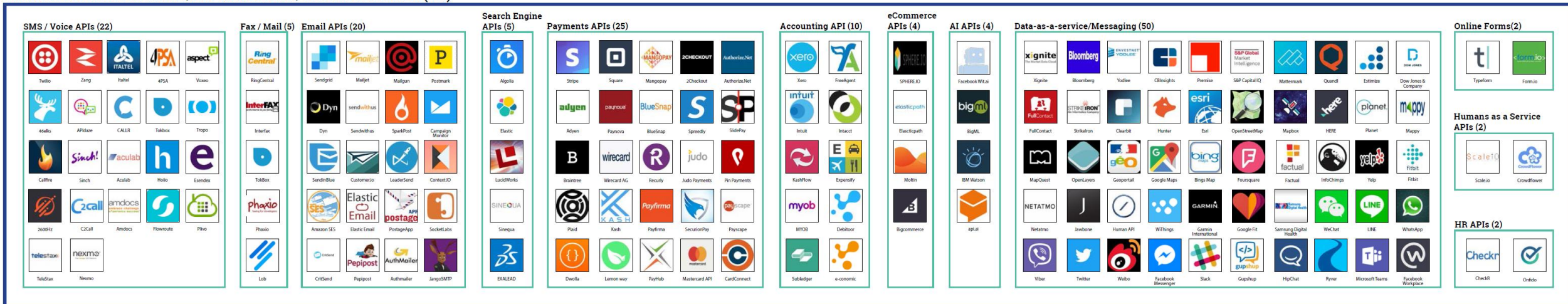
How do apps work?



Application Programming Interfaces

- Without APIs most software couldn't exist.
- Control access to the data
- Integrate with other systems
- APIs are sets of requirements that govern how one application can talk to another

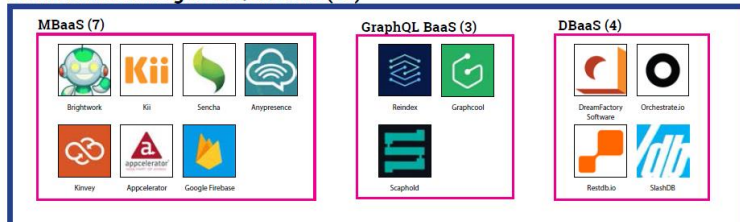
Business Processes as an API/API-as-a Product/Transactional APIs (151)



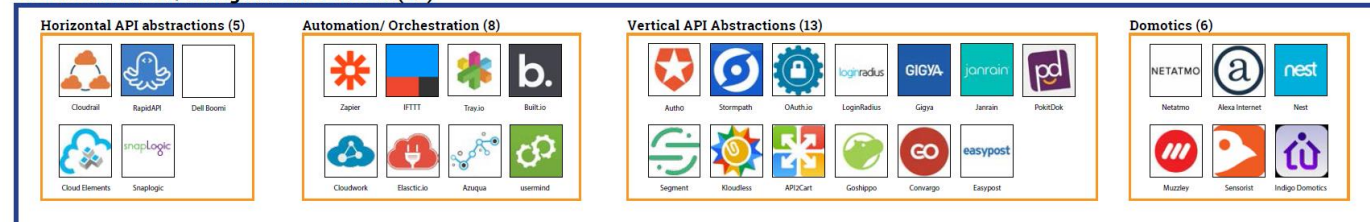
API Lifecycle platform (78)



Backend Building Tools/MBaaS (14)



API Abstraction / Integration Platform (32)



Who services apps?



ios Healthkit



HealthKit

Integrate HealthKit into your health and fitness apps for iOS and watchOS to create a more seamless user experience. When a customer provides permission for your app to read and write health and activity data to their Health app, your app becomes a valuable data source and can deliver deeply informed health and fitness solutions.

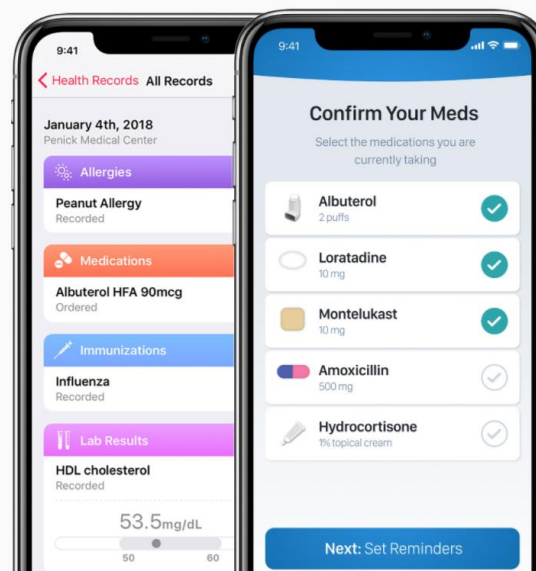


Health Records API

Health Records

The new Health Records API lets users share their health record data, including allergies, conditions, labs, medications, vitals, and more, with your app.

[Learn about the API >](#)



Research APIs

Apps for Medical Research and Care

Learn more about ResearchKit and CareKit, open source frameworks that enable powerful apps for medical research and care.



[ResearchKit >](#)



[CareKit >](#)

Palm Pilot Applications

- Databases
 - Jfile (www.land-j.com)
 - Handbase
- Web Browsers
 - Avant GO (www.avantgo.com)

Palm Pilot Applications

- Programming Tools
 - CbasPad (BASIC interpreter)
- Calculators
 - **Physiologic calculations:** sodium deficit, ideal body weight, serum osmolality and many more.
 - **Drug doses:** dose by weight in paediatrics, intravenous fluid replacement rate in paediatrics, drug dose by body surface area in oncology, and "suites" of drug doses in anaesthesia and emergency medicine are some examples.



Friendly Base Deficit Calculator 17+


The Medical College of Wisconsin

Free

iPhone Screenshots

Carrier 1:05 PM

FRIENDLY BASE DEFICIT CALCULATOR



ONE EASY RULE

PaCO2	pH	Met Ac
12	= 0.1	= 6
mmHg		mEq/L

Terms & Conditions Continue

Carrier 1:07 PM

Input

pH 7.34

PaCO2 (mm Hg) 41

Base Deficit (mmol/L) -3.6

Na (mmol/L) 140

Cl (mmol/L) 107

Lactate (mmol/L) ⓘ 1.03

Albumin (g/dL) ⓘ 4

Cr (mg/dL) ⓘ .99

Clear All Calculate

Carrier 1:07 PM

Calculated Results

Respiratory

PaCO2 41 mm Hg

Respiratory Effect on pH ⓘ -0.01

Metabolic mmol/L

BD of NaCL ⓘ -5

BD of Albumin 0.50

BD of Lactate -1.03

Expected Total BD -5.53

Measured BD -3.6

Effect of unmeasured ions on BD ⓘ -1.93

Effect of unmeasured ions on pH -0.03

Metabolic Effect on pH ⓘ -0.06

Total Respiratory & Metabolic Effect on pH -0.07

Save

Carrier 1:07 PM

Save Data Into

PATIENT 1

Sample 1	Sample 2
Sample 3	Sample 4

PATIENT 2

Sample 1	Sample 2
Sample 3	Sample 4

PATIENT 3

Sample 1	Sample 2
Sample 3	Sample 4

Clear All New Sample

Palm Pilot Applications

- Document Readers



- Aportis Doc (www.afortis.doc)
- (Reference documents)

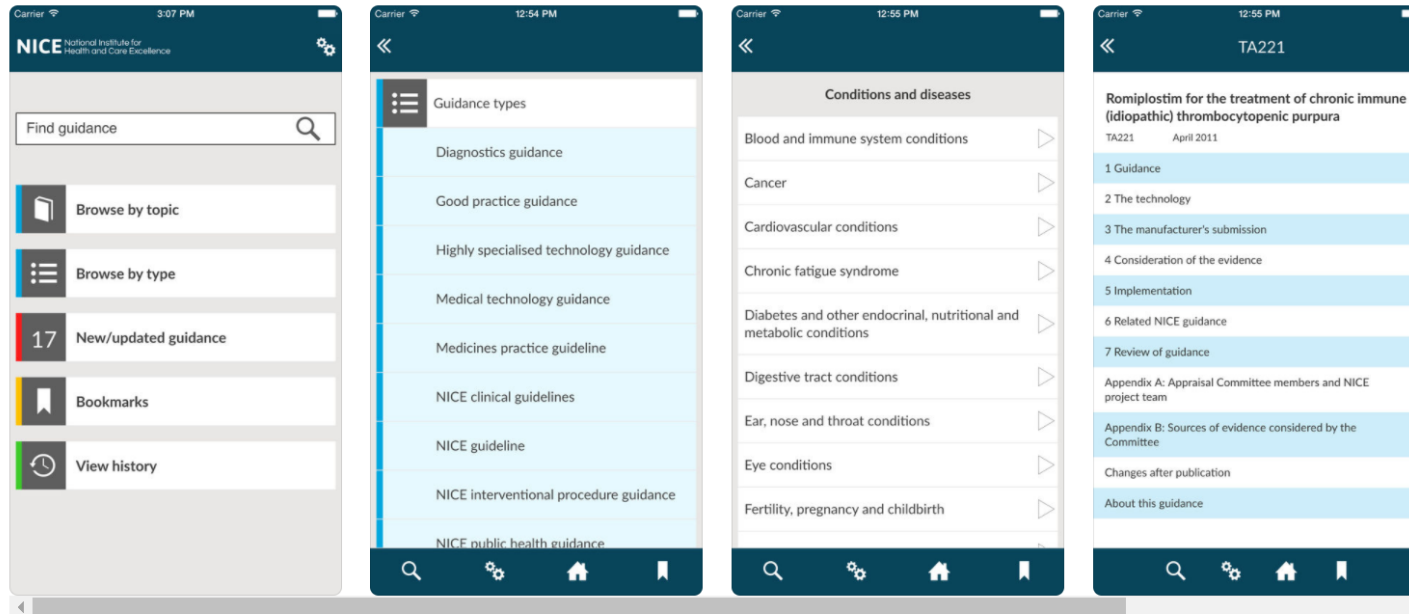


NICE Guidance 17+

National Institute for Health and Care Excellence

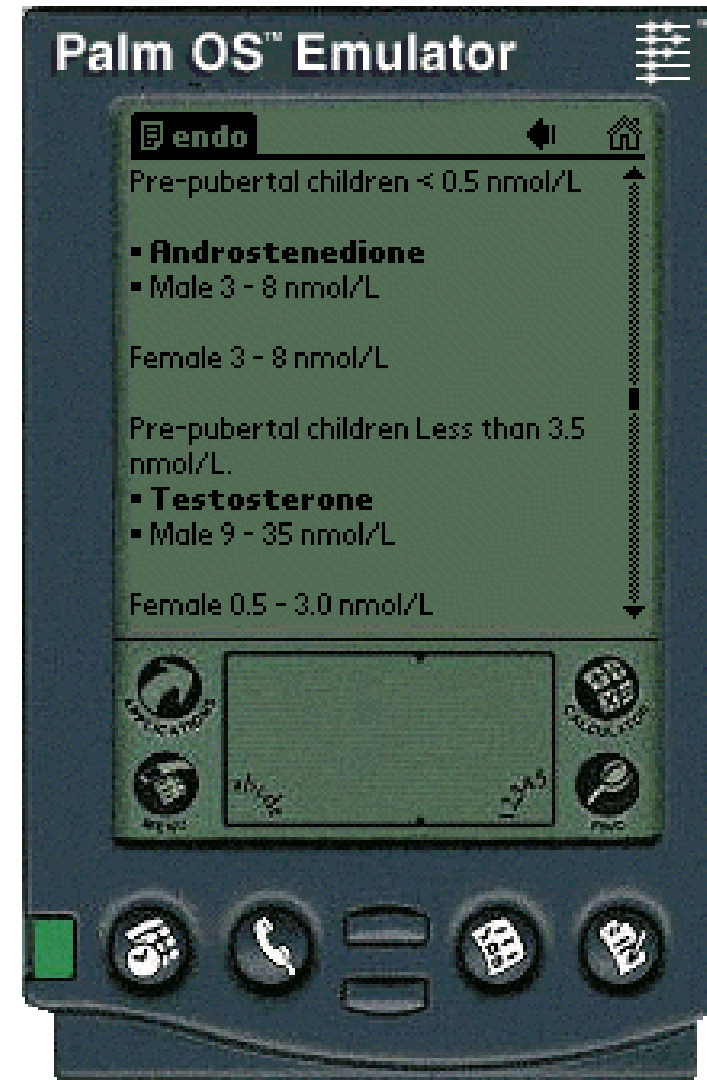
#57 in Medical
★★★★☆ 2.8, 18 Ratings
Free

Screenshots [iPhone](#) [iPad](#)



In house applications at Broomfield

- Mobile Lab Handbook
 - (Jfile or Avant GO)





Pocket Lab Values 4+

Joefrey Kibuule

#120 in Medical

★★★★☆ 3.7, 10 Ratings

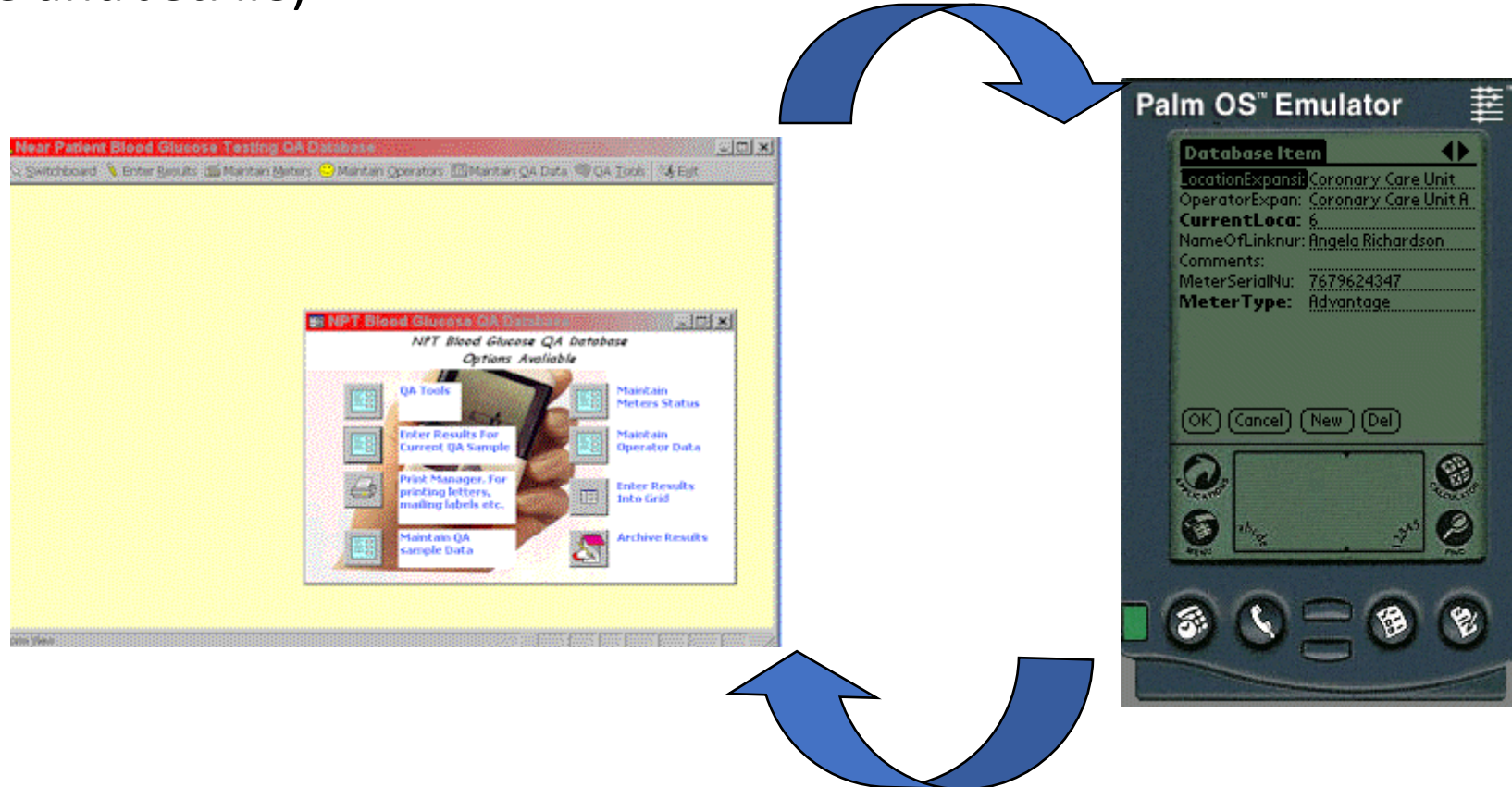
£2.99

Screenshots [iPhone](#) [iPad](#)



In house applications at Broomfield

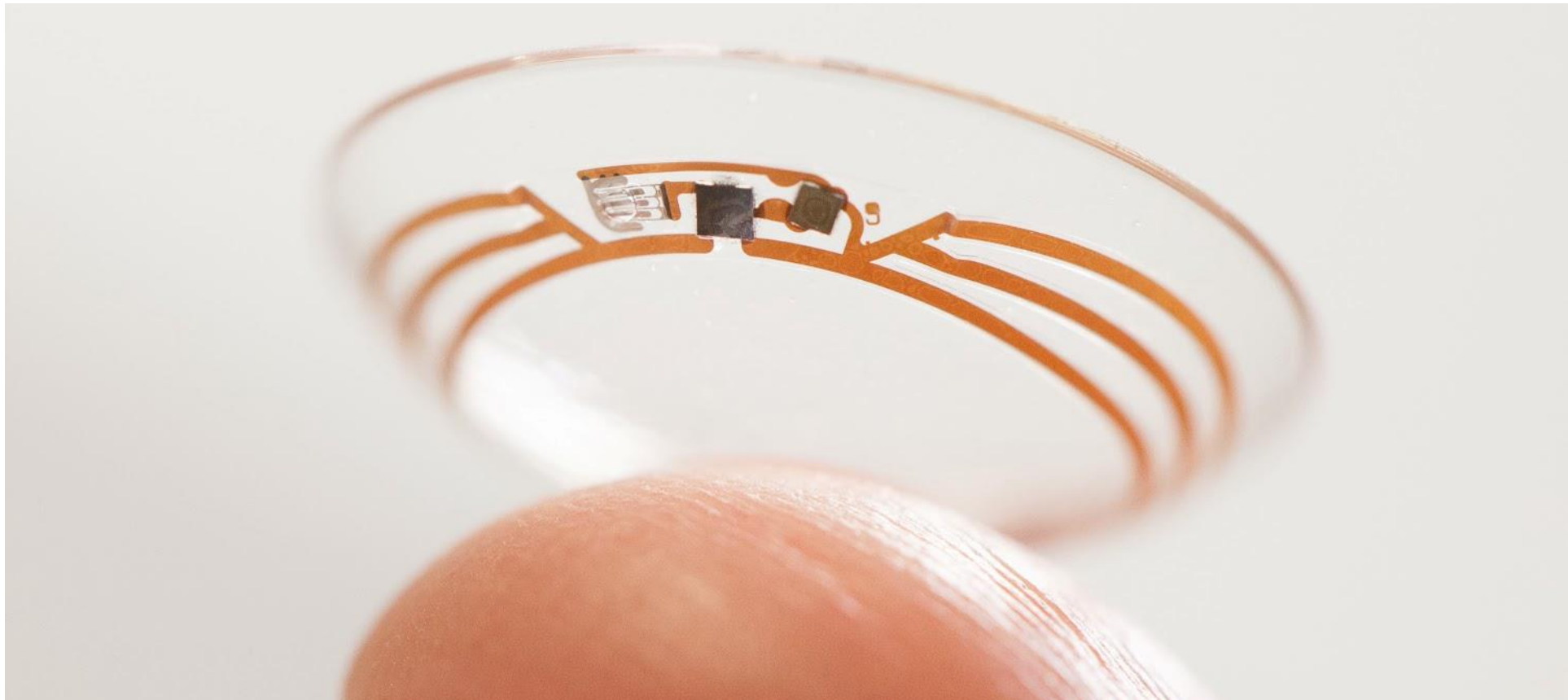
- Ward Based Blood Glucose testing
 - (Jfile and JetFile)



Google Contacts Will Help Diabetics Monitor Blood Sugar Via Tears



Maria Doyle , PTC



App Store > Medical > Azumio Inc.



Free

Offers In-App Purchases

★★★★★ (47)

Rating: 4+

TOP IN-APP PURCHASES

1. BP + WT add-on £2.49
2. No Ads add-on £2.49
3. Multi-Device Cross-Sync (bidirectional) 1Y add-on £8.99

LINKS

Developer Website

© Azumio Inc.

Glucose Buddy - Diabetes Logbook Manager w/syncing, Blood Pressure, Weight Tracking

4+

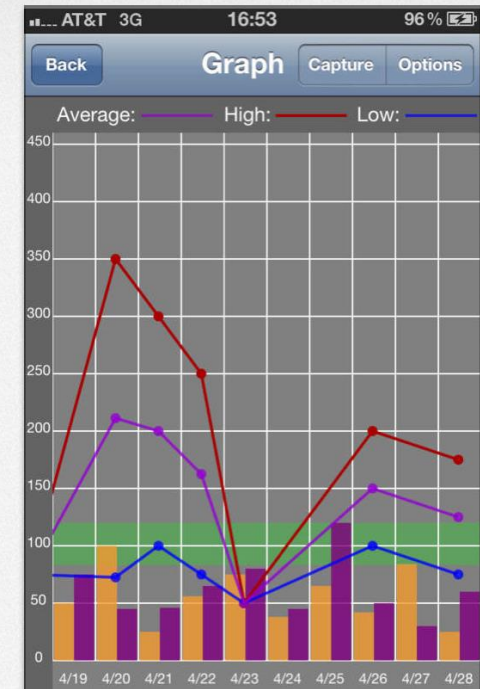
Azumio Inc. >

Details

Ratings and Reviews

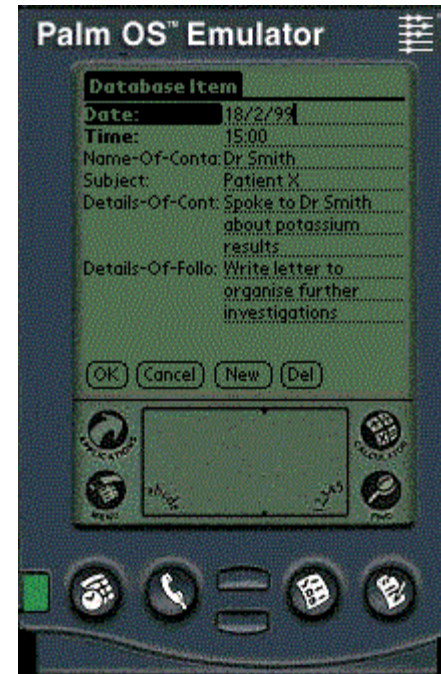
Related

iPhone Screenshots



In house applications at Broomfield

- Clinical Interaction Database
 - (Jfile and Jetfile)
 - Logs interpretative/clinical actions between colleagues
 - Comments synchronised on a central searchable database



Ma

106 STARTUPS TRANSFORMING HEALTHCARE WITH AI



Covergance of Limitless Cloud Power With Powerful Handheld Computing

- The rate limiting step won't be technology but privacy / data sharing concerns
- Blockchain

Capturing toilet behaviour for real-time data and health analysis.

[See our features](#)

[Live Feed CHI 2014](#)

This facility is proud to participate in the healthy building initiative.
Behaviour at these toilets is being recorded for analysis.
Access your live data at **quantifiedtoilets.com**

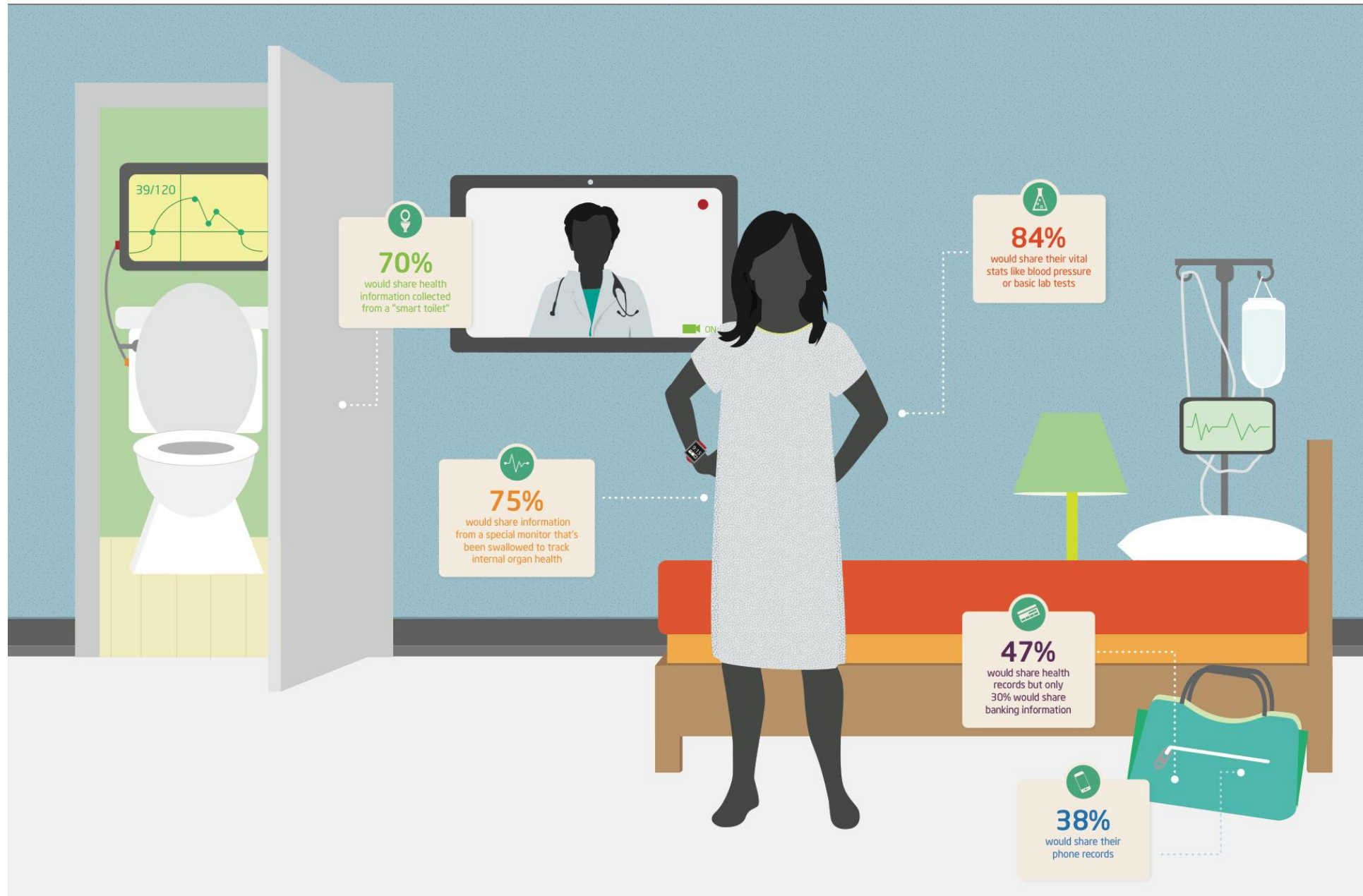


Feed from alpha deployment @ CHI2014

 Recent anonymized random data feed

Time	Toilet ID	Sex	Deposit	Odor	Blood alcohol	Drugs detected	Pregnancy	Infections
10:26:52 AM	T719	male	270ml	neutral	0.064%	no	no	none
10:26:48 AM	T215	female	220ml	nutty	0.001%	no	no	none
10:26:41 AM	T105	male	220ml	acidic	0.001%	no	no	none
10:26:38 AM	T707	female	240ml	neutral	0.000%	no	no	none
10:26:31 AM	T216	male	155ml	neutral	0.000%	no	no	none
10:26:21 AM	T704	male	155ml	neutral	0.002%	no	no	none
10:26:17 AM	T313	female	115ml	neutral	0.023%	no	no	none
10:25:52 AM	T315	female	145ml	acidic	0.051%	no	no	none
10:25:41 AM	T111	female	225ml	neutral	0.000%	yes	no	none
10:19:58 AM	T220	male	250ml	neutral	0.000%	yes	no	none
10:09:46 AM	T317	male	200ml	neutral	0.041%	no	no	none

What Information Are We Willing to Share to Improve Healthcare?




Improving Patient Management and Engagement

[SOLUTIONS](#) [FOR EMPLOYERS](#) [EVIDENCE](#) [BLOG](#) [ABOUT](#)

Diabetes is hard.
It doesn't have to be.

SHOP NOW





Today at 10:28 PM

Blood glucose to go down, but not too low, in the next 3 hours.

Thats the way to do it! Try to keep it steady for the next 24 hours.

[This is not helpful](#)

[This is helpful](#)

Health Goals

A1C 15 Oct 2018 50.0 mmol/L ↑ >

Your estimated A1C:
Based on your blood glucose data, we have calculated your estimated A1C. Use this estimation to see if you're on track to meet your A1c goals

6.9
eA1C

Weight 17 Sep 2018 35.37 lb ↑

Pressure 1 Nov 2018 109



Real time advice and prediction of future results to help manage chronic disease

Improving Patient Management and Engagement

Improving Patient Management and Engagement

mmol/L

mg/dL

Current Average Blood Glucose

9.0

mmol/mol

%

Predicted HbA1c

56.1



PRODUCTS

EVIDENCE

COMPANY

NEWS

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Triton™

AI-enabled platform for real
time monitoring of surgical
blood loss

 Apple Design Award Winner 2018



Machine Learning In Decision Support

[About](#) [Product](#) [Blog](#) [NHS](#)

[Sign](#)

Hello, how can I help you?

Start typing...

Ask Babylon

SXSW HealthTech Trends

Wearable Technology

Over **80%** consumers said that they find Wearable has a huge potential in making Healthcare convenient.



Population Health Management

70% mHealth providers said that they have seen tangible change in the patient care domain which can be attributed to population mHealth infrastructure.



Connected Devices

IoT has the potential to reduce the health system repair time in hospitals by **50%**



mHealth Apps

71% patients said they would prefer if their doctors used a mobile app.



EHR

71% Physicians have adopted Electronic Health Record system



Data Security

65% patients said that security is much more important than convenient access test result and diagnosis.



Telehealth

70% patients are extremely comfortable with having a conversation with their healthcare providers over video, email, or text.



Predictive Analytics

Soon **80%** of the doctor's tasks like measuring blood pressure, monitoring glucose to genomics will be handled by technology.

