Soft Power: Zero to 60 Billion in Four Years

> *Apps, the new American software industry*
> *Broadband platform fuels software creativity*
> *Mobile + Cloud = Endless Apps*
> *Macroeconomic effects: the Soft Power jobs machine*

BRET SWANSON > December 5, 2012

Mobile apps. Has the world known a faster, broader, deeper diffusion of a major technology? Doubtful.

Apple launched the iPhone in 2007 and the App Store a year later in summer 2008. Google followed with Android apps the following year, in 2009. In this short timespan, apps have revolutionized the way we use our mobile devices and the Internet – and the way we think about software.

In 2011, worldwide smartphone sales reached 488 million units, topping PC sales for the first time. Smartphone sales in 2012 could tip 700 million.

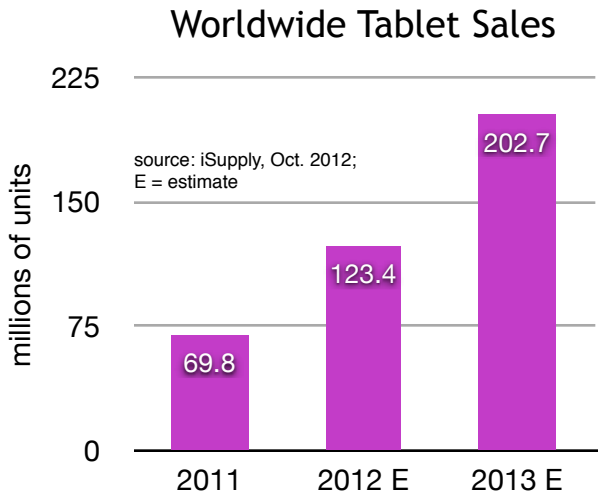
Tablet sales of 70 million in 2011 may, according to iSupply, grow to around 123 million in 2012 and could top 200 million in 2013. This means by next year sales of smart mobile devices could top one billion units.

Computer hardware and software have been paired, at least conceptually, since 1843 when Ada Lovelace, daughter of Lord Byron, wrote a "program" to calculate Bernoulli numbers on Charles Babbage's never-completed Analytical Engine. A hundred years later, IBM was feeding punchcards through its business machines. Then came programmable mainframes, the silicon microprocessor, the PC, and the Web server. Over the last half century, software has grown to be a larger market than computers. But now, with the added ingredient of *broadband communication*, software has entered a new era.

Smart mobile devices are the most personal of computers. The colossal numbers of these devices, and their connectivity to each other and to all the Internet's vast resources, creates a market so large and so diverse that the economic forces of innovation and specialization are supercharged. This platform of distributed computation and bandwidth offers unlimited possibilities to create tools and content serving every interest. We call this phenomenon Soft Power.

Rx for Innovation

In October, the *New York Times* profiled a young internal medicine resident, Dr. Alvin Rajkomar, showing the ways mobile apps are changing just one occupation.



"Among the new crop of device-happy physicians," wrote the *Times*, "Dr. Rajkomar is now an elder statesman of sorts, showing trainees his favorite apps, along with shortcuts through the electronic medical record and computerized prescribing system.

"He stores every clinical nugget he finds on an application called Evernote, an electronic filing cabinet. 'I use Evernote as a second brain,' he said. 'I now have a small textbook of personalized, auto-indexed clinical pearls that I carry with me at all times on my iPhone.'

"Along with MedCalc, the clinical calculator, Dr. Rajkomar's phone has ePocrates, an app for looking up drug dosages and interactions; and Qx Calculate, which he uses to create risk profiles for his patients. His favorite technology is his electronic stethoscope, which amplifies heart sounds while canceling out ambient noise."

Similar stories are playing out across every workplace and in daily life. Software and apps, even those for medicine, are not new. But the Soft Power revolution is. The number and diversity of software tools towers over anything known before.

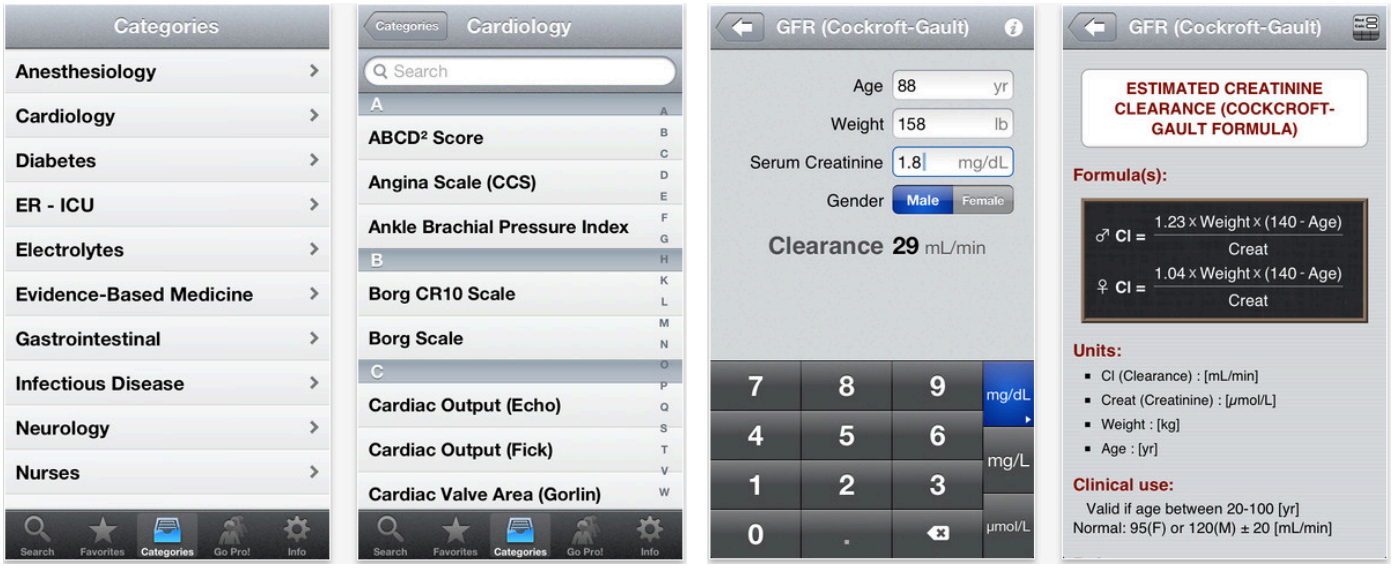
In the era of mainframe business computers, large companies mostly developed internal custom software for their own one-of-a-kind needs. In the minicomputer years, companies like DEC and Wang bundled software with the systems they sold to a growing population of small and medium-sized businesses. Bell Labs and other research institutes and university scientists built operating systems like Unix.

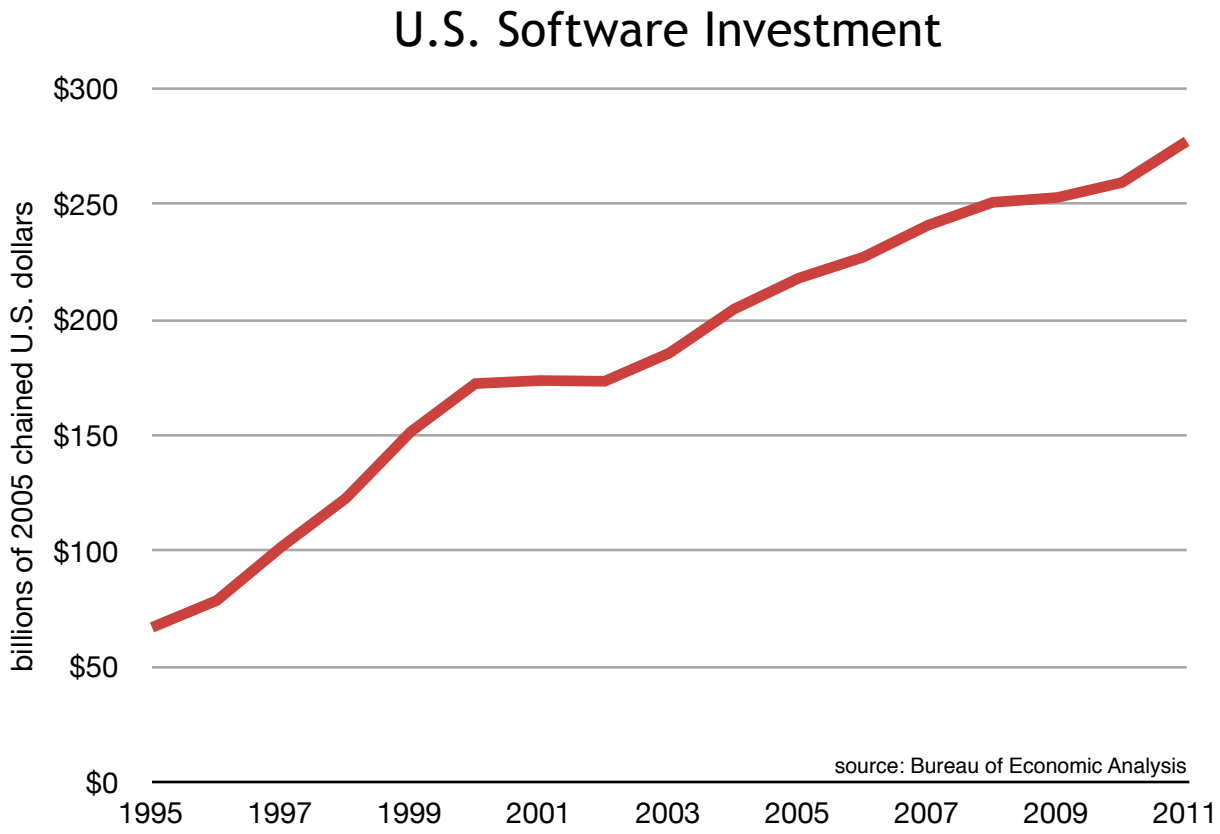
The PC era, with its dominant duo of Intel and Microsoft, democratized computing for the first time, offering machines individuals could buy and the basic tools of the time – word processing, spreadsheets, databases, simple graphic design and publication programs, and games.

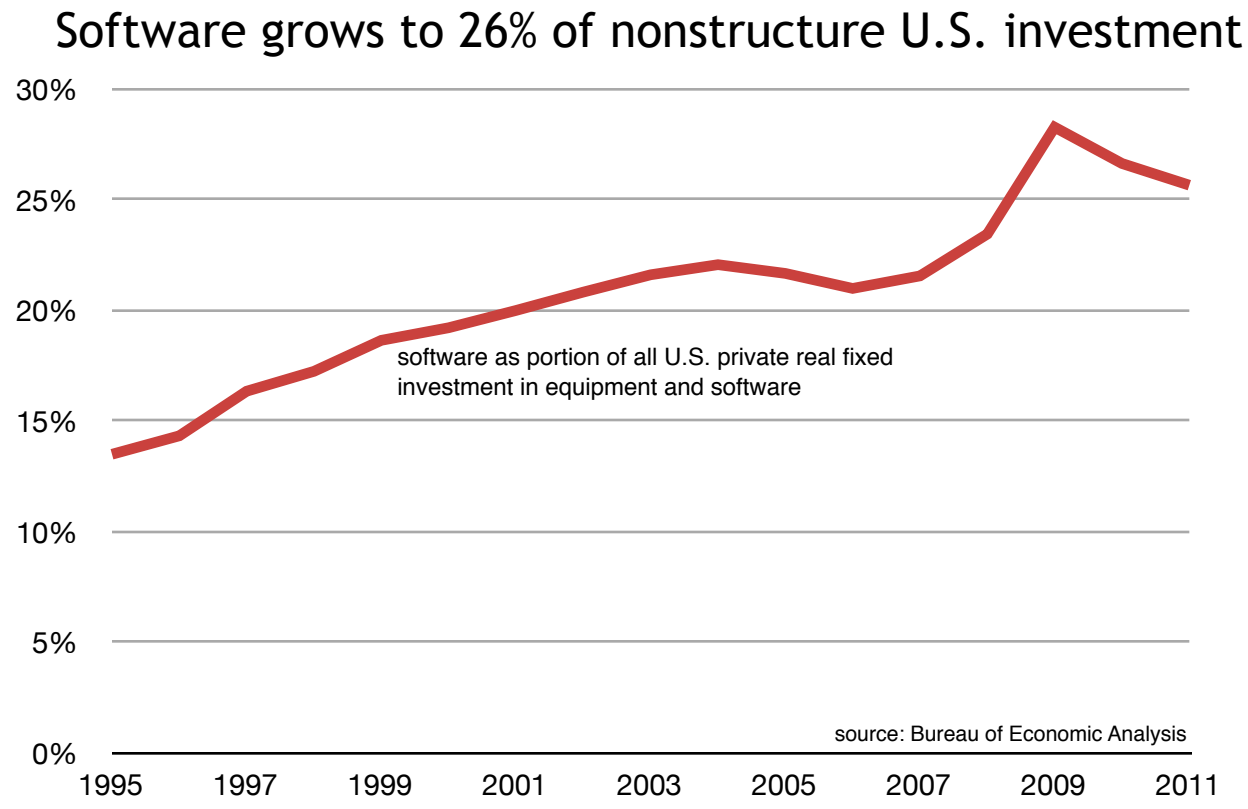
Microsoft towered over the operating system and office application markets. The boxed software market was significant for Windows-based PCs. Apple, which designed its own hardware and software, however, had trouble attracting a large third-party base of software offerings.

Physicians' Assistants: medicine goes digital

pictured here: MedCalc




U.S. Software Investment
billions of 2005 chained U.S. dollars
$300
$250
$200
$150
$100
$50
$0
source: Bureau of Economic Analysis
1995
1997
1999
2001
2003
2005
2007
2009
2011


Software grows to 26% of nonstructure U.S. investment
30%
25%
20%
15%
10%
5%
0%
software as portion of all U.S. private real fixed investment in equipment and software
source: Bureau of Economic Analysis
1995
1997
1999
2001
2003
2005
2007
2009
2011

The moniker – "boxed" software – helps explain one crucial difference with the new Soft Power era. We were selling bits in boxes. For cereal, boxes are fine. For bits, not ideal.

Before apps, the U.S. software industry was already massive. But much of it was hidden – in back-office databases, for example, or on servers in remote data centers, or in industry-specific manufacturing systems. There was of course an explosion of enterprise software, such as Oracle and SAP databases and customer relationship management (CRM), often "implemented" by sprawling teams of consultants charging millions of dollars. Linux, launched in 1991, meanwhile, drove the open source movement and is today one of the most widely used operating systems (it is, for example, used across Google's network infrastructure and is the basis for Google's mobile operating system Android).

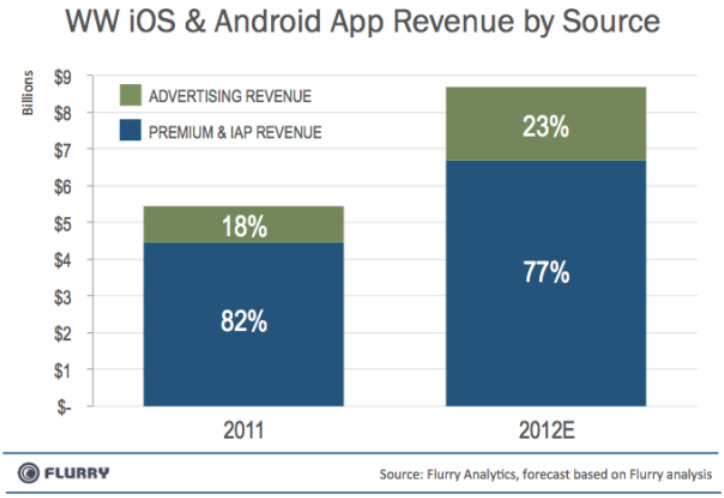
The Internet brought new kinds of software to the masses – though most probably didn't think of it as software. The Web offered a new model of content distribution. The user-friendly browser and HTML made the Web and the Internet's resources easily accessible to non-specialists. Java, with its promise of "write once, run anywhere," unleashed apps from OS and device in theory and, to a great extent, delivered in practice. (In a preview of apps, we called them "applets." Remember?)

By 2007, the U.S. invested around $240 billion a year in software. The mobile environment, however, remained unsatisfying. Despite attempts from many device makers, phones were still mostly phones, and mobile still had not tapped the power of the Net and Web.

App-celeration

Then came iPhone. Apple expanded the display, improved input-output with the touchscreen, and offered the first truly appealing mobile browser. At the same time, we were moving from 2G to faster 3G mobile data networks, and Wi-Fi was growing. There was, however, an even bigger conceptual breakthrough: the mobile device as general purpose computer, open to the world of software, powered by the resources of the cloud.

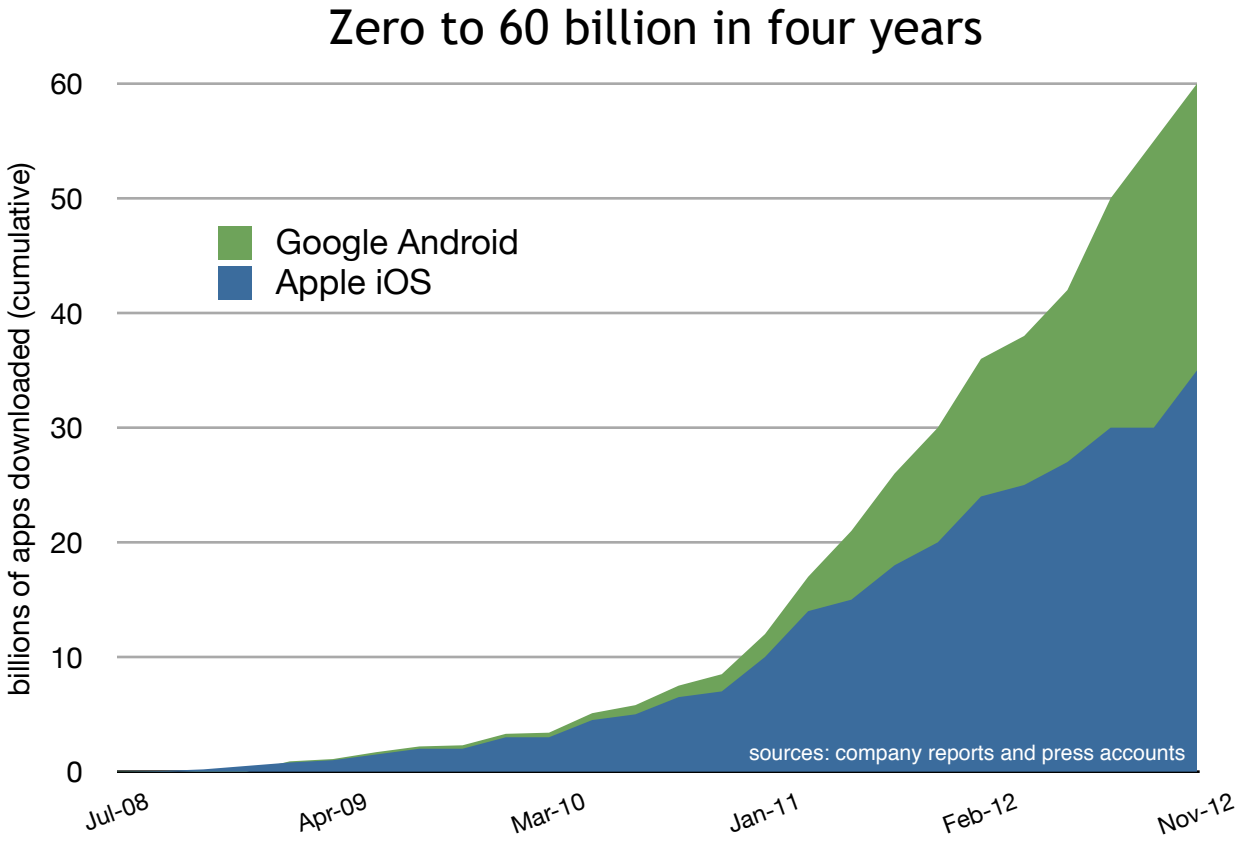
The result astounded probably even Steve Jobs. In just four years, since the opening of the Apple App Store in the summer of 2008, the number of available mobile apps has grown from essentially zero to 1.425 million.

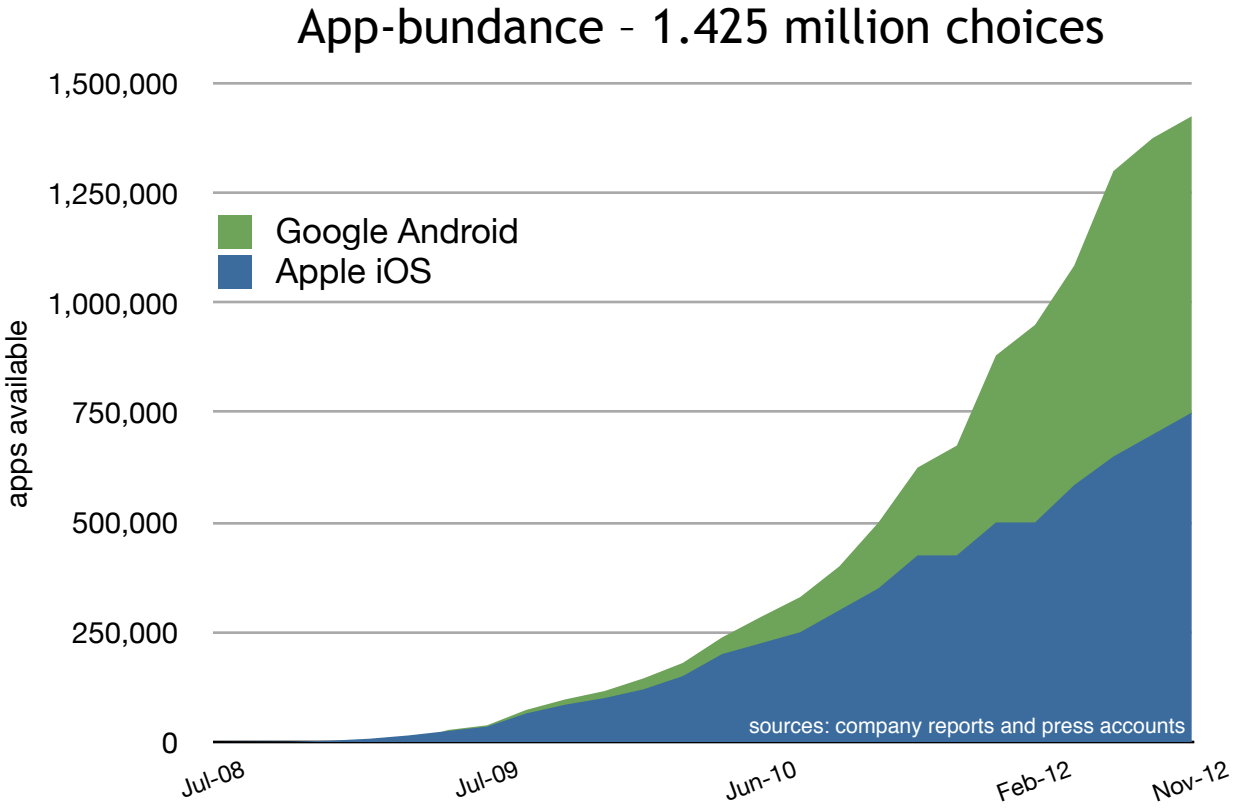


In an extraordinary explosion of innovation, mobile app downloads grew from (again) essentially zero to 60 billion. (See charts on page 5.)

Although the great majority of apps are free, apps are real business. Advertising, premium, and in-app revenue topped $5 billion in 2011 and could approach $9 billion in 2012. Apple says it has paid app developers $6.5 billion for their share of revenue flowing through the App Store.

Google's Android lagged Apple by over a year but quickly caught up. Most of the non-Apple device makers now produce smartphones and tablets based on Android. Samsung especially has emerged as iPhone and iPad's strongest device rival.


Zero to 60 billion in four years
billions of apps downloaded (cumulative)
60
50
40
30
20
10
0
Google Android
Apple iOS
sources: company reports and press accounts
Jul-08
Apr-09
Mar-10
Jan-11
Feb-12
Nov-12


App-bundance – 1.425 million choices
apps available
1,500,000
1,250,000
1,000,000
750,000
500,000
250,000
0
Google Android
Apple iOS
sources: company reports and press accounts
Jul-08
Jul-09
Jun-10
Feb-12
Nov-12

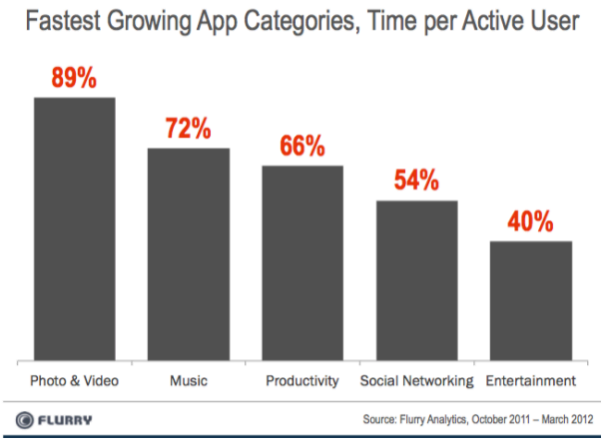
In just three and a half years, Google Play (the Android marketplace) has accumulated 675,000 apps that have been downloaded, in aggregate, 25 billion times. This compares to Apple iOS figures of 750,000 available apps and 35 billion downloads. (See chart on page 8.)

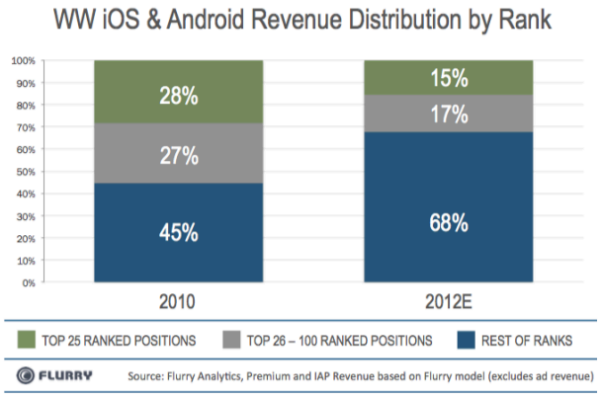
Mobile + Cloud = Endless Apps

To understand the ascent of mobile, think about this: Qualcomm, the wireless chip maker, just surpassed the market value of Intel, the titanic microchip company of the computer era. Communications has trumped computation.

The size of the mobile market and the power of broadband connectivity have combined to reshape both the computer and software industries. PC and laptop sales are stagnant or falling, while mobile form factors are surging. We often now care more about what cloud infrastructure and software we use, rather than what's under our desk. Large companies and home-office entrepreneurs are able to conceive, build, and rapidly distribute apps to suit every existing need and newly imagined niche.

Compared to software of the past, mobile apps are inexpensive to develop and distribute. They are smaller. They are easily updatable. They are interactive. And because most of them are inexpensive to end-users (in terms of money, time, and computer resources), volumes are large, and trial and error feedback is robust. In the PC world, a software package had to be large enough – it had to do enough things – to be worth the developer's wile and the consumer's money. It made little sense to build a tiny, stand-alone app for which any market was small and uncertain. And any small apps that did get built were quickly gobbled up into the Windows OS. Compared to boxed software that was expensive, bloated, limited in choice, and had to last years, apps are throw-away items – instantly obtainable . . . and discardable. Mobile devices, moreover, are always with us and always connected, extending the time we each spend with our *most personal* computer. This vastly expands the arena of potential consumers – and thus, in a virtuous circle, the arena of producers. Diversity and quality grows.





Some apps are merely optimized versions of webpages, offering a better experience on a small device than a mobile Web browser can deliver. But many apps would never have been conceived as websites. A substantial number of apps make special use of the new mobile computers' integrated cameras and GPS capabilities for location-based services.

The history of digital technologies is radical integration, and mobile is no different. Amazon finally succeeded in creating a flourishing market for ebooks with its Kindle device. The Kindle, however, was quickly "appified" and its functionality integrated into any smart device. Millions of Garmin GPS mapping de-

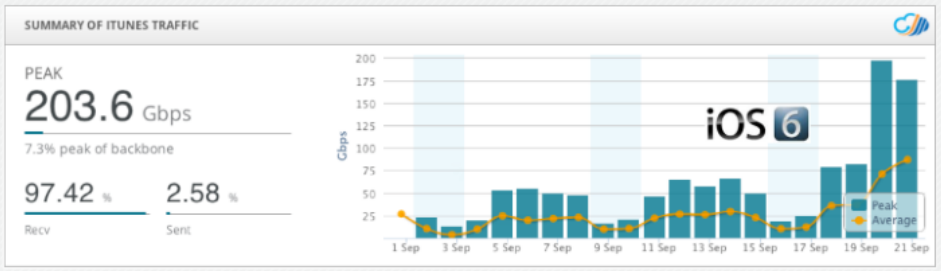
vices similarly have likewise been swallowed up by apps. The same thing happened to GameBoys and other portable game machines. The most extreme hardware integration may be the camera. The stand-alone digital camera only achieved widespread adoption circa the year 2000, yet less than a decade later this radically new device was already being enveloped by the mobile handset. The technology and wealth that yielded this hyper-integration and wiped out the old camera market then created a large new market for high-end DSLR cameras.

Digital technologies have a way of cycling and turning back on themselves. Several years ago, we thought of putting a few apps onto a phone. Now "phone" is just one of endless apps on a mobile computer.

Some apps are products. Some apps link customers to services. Some are "freemium" offerings. Others are based on advertising. Still more are just part of integrated communications strategies or tools built for specific events.

The browser/Web combination offered many of the same advantages over the previous PC/OS/program paradigm. Yet the mobile world needed a more optimized solution. As Clayton Christensen often told us, in an arena of undershoot, where performance isn't yet good enough, it often takes an integrated, optimized solution to perfect the interfaces and produce a smoothly functioning product. This was the mobile device before the iPhone. It took Apple to integrate its sleek, touchscreen hardware, iOS software, and well-conceived App Store, to make the sys-

Right: *iTunes traffic surged to 7-12% of all N. American backbone traffic upon release of iOS 6 this autumn. (source: DeepField Networks)*



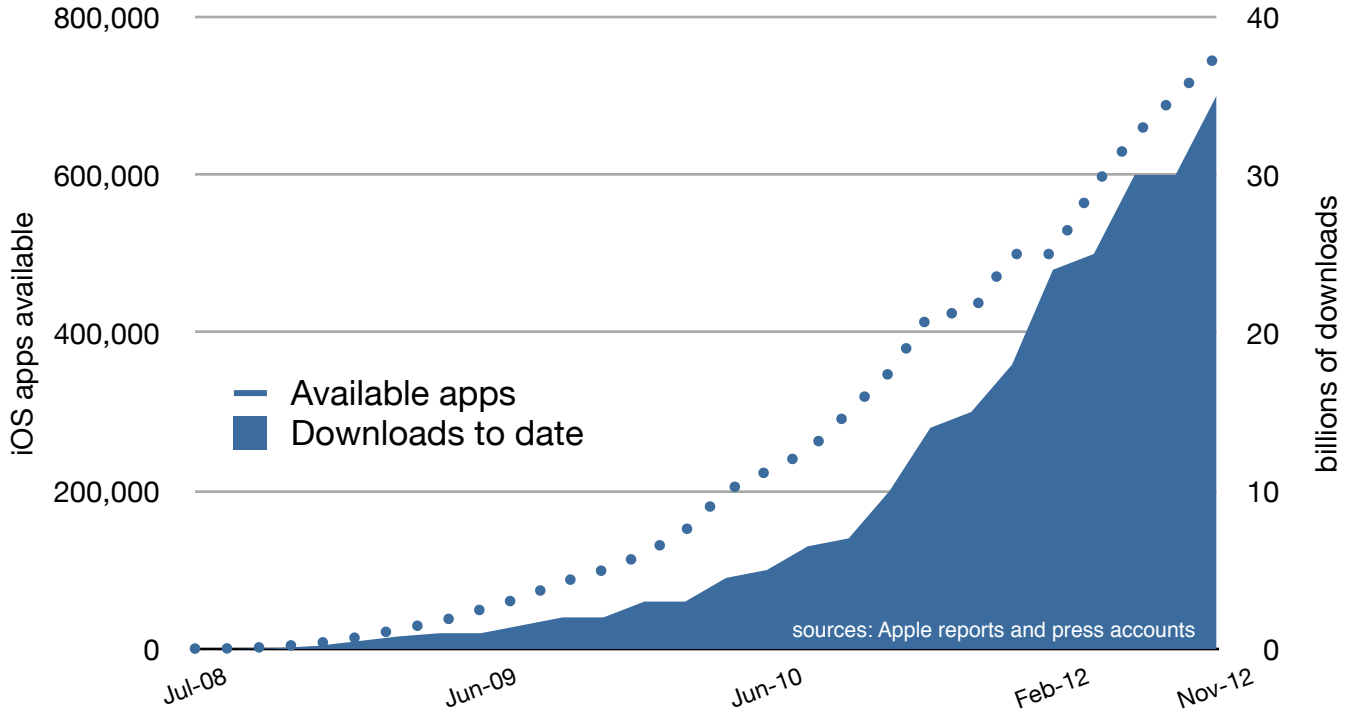
Graph of daily traffic peaks for iTunes across several North America providers this month. iTunes traffic surges to 7-12% of North American backbone traffic immediately after the release of IOS6. All data comes from anonymized benchmark data shared by participating providers.

Below: *Google Play and iTunes app downloads account for the 7th and 9th largest share of wireless data traffic, respectively. (source: Sandvine)*

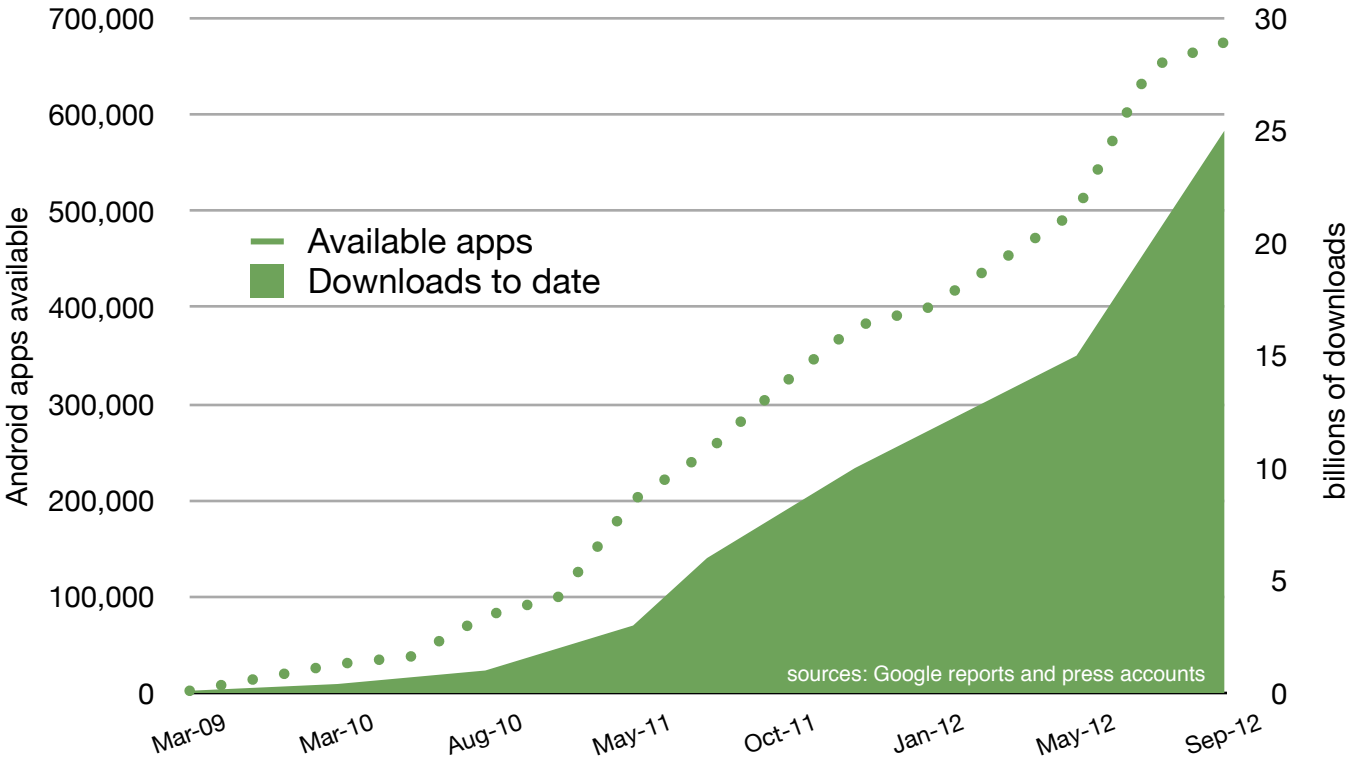
	Upstream		Downstream		Aggregate	
Rank	Application	Share	Application	Share	Application	Share
1	Facebook	15.43%	YouTube	30.97%	YouTube	28.03%
2	HTTP	13.60%	HTTP	14.37%	HTTP	14.28%
3	SSL	13.26%	SSL	8.92%	SSL	9.49%
4	YouTube	7.91%	MPEG	8.90%	Facebook	7.95%
5	Google Talk	2.23%	Facebook	6.83%	MPEG	7.93%
6	MPEG	1.92%	Pandora Radio	5.15%	Pandora Radio	4.74%
7	Pandora Radio	1.90%	Google Play	3.27%	Google Play	2.96%
8	Skype	1.56%	Netflix	2.69%	Netflix	2.42%
9	SMTP	1.52%	iTunes	1.46%	iTunes	1.34%
10	Yahoo! Mail	1.49%	Flash Video	1.18%	Flash Video	1.05%
	Top 10	60.82%	Top 10	83.74%	Top 10	80.19%

sandvine

Apple iOS growing fast



Google Android growing faster



tem work well. Apple even partnered with AT&T to make sure the network supported new smartphone functionality. Then we were off to the races.

Although Android has achieved dramatic overall success, the more modular pairing of Android with various handset manufacturers still exhibits some of the typical problems of unoptimized solutions.

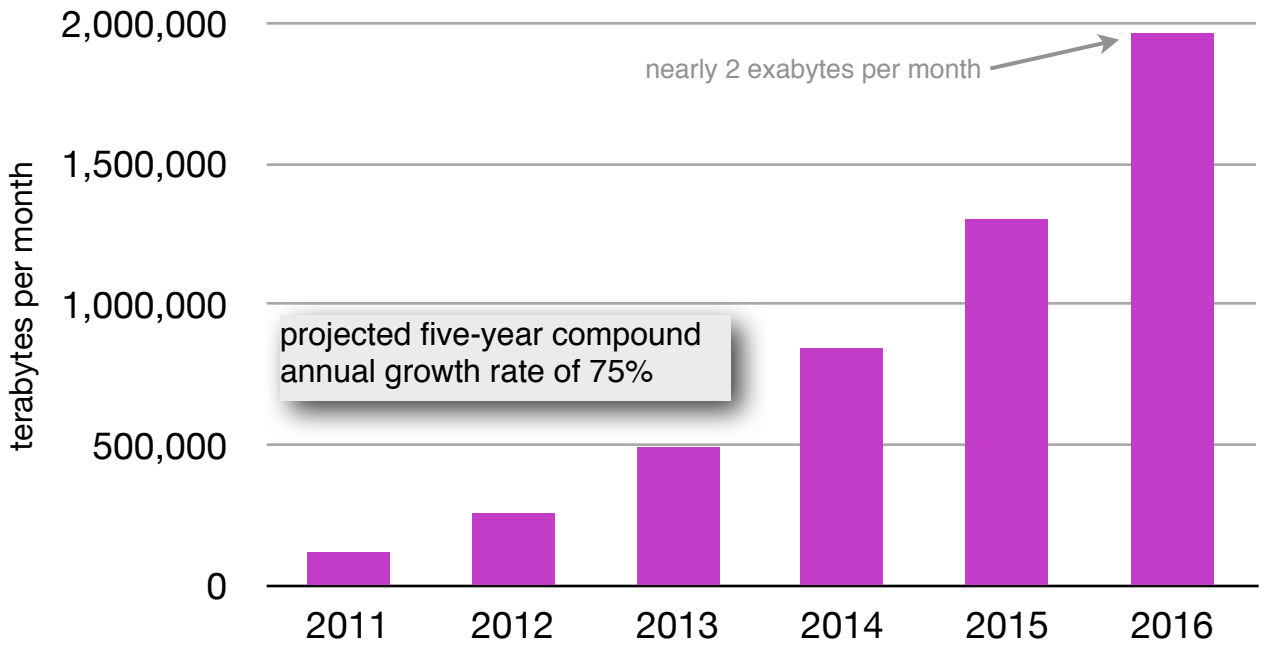
As devices, networks, and Web resources improve, some portions of the ecosystem will become more modular. It is possible that HTML5, the next generation of the basic Web language, will prove highly effective at mimicking the optimized functionality of apps while retaining the platform neutrality of the Web, among other Web virtues. Technology always cycles between integration/optimization and modularization/standards. The point is not that native apps, per se, will always be superior. But the fact is that optimized apps were required to show the true power of mobile. As the open Web replaces some (or many) low-end apps, we will likely conceive other, more advanced tools that will have to be built, at least initially, as native apps.

Whatever the case, both native apps and Web apps will be powered by increasingly sophisticated and pervasive cloud resources: storage, computation, collaboration, transactions, location services, content distribution, and remote 3D video rendering.

Big Data companies will collect and parse vast location, preference, and identity information. “Post-Big Data” ventures, like Jeff Hawkins’ Numenta, aims to analyze not stale databases, as he might put it, but real-time bitstreams flowing in from all the world’s data tributaries. A new, largely invisible infrastructure is being built to power apps from afar. At his new company, Talko, Ray Ozzie, the Lotus Notes founder and former Microsoft executive, is reportedly building a host of cloud-based support services so app developers can lean forward and focus on their own products and customers while plugging into to an existing back-end platform.

Mobile data traffic to grow 16x in five years

Cisco projection for North America



This dependence on the cloud will require ever increasing network coverage and speed. This means more cell towers, more small cells, more Wi-Fi, more advanced technology like LTE and MIMO, more spectrum, and of course more investment.

In its semiannual state-of-the-industry report, CTIA showed that as of June 2012 U.S. mobile subscribers totaled 321.7 million (more than 100% penetration), and smartphone users jumped 37% to 130.8 million. Mobile data traffic for the year preceding June 2012 was 1.16 trillion megabytes (or over one exabyte), a 104% increase over 2011. For fall 2012, Sandvine, using its own distinct measurement tools and network samples, reported mean mobile data consumption in North America of 317.2 megabytes per month. This yields an annual rate of around 1.22 exabytes. AT&T says in the last five years its mobile data traffic has grown 25,000%.

One hundred percent increases produce very large numbers very fast. And the mobile network companies have been investing vast sums to both drive new innovation and keep up with this data exaflood.

Macrosoft

The App Economy is not only a story of new tools and consumer benefits, it is also about entrepreneurship and jobs. People conceived and wrote the code for those 1.425 million available apps. They developed business models around them and hired other people to support the apps' content and services.

Economist Michael Mandel has analyzed the employment effects of the App Economy in greater detail than anyone. In a February 2012 study, Mandel found that by the fourth quarter of 2011 apps supported employment of 466,000 Americans. Mandel's newer September 2012 report estimates 519,000 App Economy jobs in the U.S. as of April 2012. The two studies use different methodologies, so the two figures are not directly comparable, but it's clear the employment effects of apps are large.

In analyzing these employment effects recently, the *New York Times* also showed that many apps and app-developers don't succeed. They invest lots of time and money, often for naught. "Despite the rumors of hordes of hip programmers starting million-dollar businesses from their kitchen tables," wrote the *Times*,

> "only a small minority of developers actually make a living by creating their own apps, according to surveys and experts. The Grimeses began their venture with high hopes, but their apps, most of them for toddlers, did not come quickly enough or sell fast enough.
>
> "And programming is not a skill that just anyone can learn. While people already employed in tech jobs have added app writing to their résumés, the profession offers few options to most unemployed, underemployed and discouraged workers.
>
> "One success story is Ethan Nicholas, who earned more than $1 million in 2009 after writing a game for the iPhone. But he says the app writing world has experienced tectonic shifts since then.
>
> "'Can someone drop everything and start writing apps? Sure,' said Mr. Nicholas, 34, who quit his job to write apps after iShoot, an artillery game, became a sensation. 'Can they start writing good apps? Not often, no. I got lucky with iShoot, because back then a decent app could still be successful. But competition is fierce nowadays, and decent isn't good enough.'"

But this kind of churn, uncertainty, competition, failure, and possible wild success is a necessary and unsurprising occurrence in a burgeoning entrepreneurial sector. Firms like Code Academy and Menlo App Academy (the

latter founded by two 13-year olds) are teaching wider circles of people, often non-programmers and adolescents, how to build apps. Software will be a growing part of the economy for decades to come. These skills are important – they are the kind of knowledge skills of which we say we need more.

The mobile ecosystem will evolve. But already we know it is an important foundation for the economy. It is a Knowledge Platform. Knowledge Platforms expand the choices and possibilities of wider circles of people. Gutenberg's press was a platform for content distribution and thus accelerated reading *and writing*. The Internet is of course a Knowledge Platform. Even the Industrial Revolution was a Knowledge Platform because new knowledge of mechanical power freed the masses to focus not only on agriculture but endless new products, projects, and previously unknown arenas of learning – in and outside of commerce.

The possibilities of this new Knowledge Platform are far-reaching. They range from mundane daily practicalities to Sci-Fi wonders. There is Square, a project of Twitter co-founder Jack Dorsey, which now processes $10 billion of annualized transactions and is disrupting the major credit/debit card paradigm. Then there is the Tricorder X-Prize, which set as a goal the invention of a full-featured medical diagnostic device in your hand, like the Star Trek "tricorder." In recent days, reports have emerged of major advances in using imagery of our inner eyes and analysis of our breath to diagnose broad ranges of conditions and infirmities. These possibilities show the Tricorder may not be fantasy.

An old saw of the PC era was, "What Intel giveth, Microsoft taketh away."

The glass-half-empty view said that Intel's hardware advances were inert. As Intel delivered ever-more transistors at a Moore's law pace, with ever-faster frequencies, Microsoft would – just as fast – design ever-larger software programs, crammed with new features (and bugs) that would eat up all the new transistors and produce a technological stalemate.

This view, however, was wrong. One of Microsoft's great acts was to creatively "waste" the abundant transistors Intel was putting in each new generation of microprocessors. Yes, the result was often bloated software. But their was no stalemate. The overall advance of the digital economy was rapid, even transformative.

In same way that Microsoft expanded its software to exploit each new microchip miracle, apps will grow to consume the available computer and communications power of the mobile ecosystem. Apps, however, are not only limited to the resources of a device and its wireless link.

Unlike the Wintel union, as powerful as it was, apps are not constrained by the innovations of just two companies or a computer under your desk. It is true, because of the small form-factor of mobile devices, they are limited in storage, compute, and power budgets. These are relative scarcities. What is abundant and must be exploited, however, is the collective power of the cloud. Apps can call upon (and contribute to) the storage, compute, and information resources of thousands of data centers and billions of smart devices. They will link to exacloud supercomputers, putting petaflops in your palm. They will interact with mobile users across the globe and with every node in your hyper-local environment, from your TV to your pacemaker.

All of this distributed power, however, can only be tapped with more, bigger-bandwidth links – to the cloud and among devices. We will push our devices and networks to the limits – and then beyond. The cycle is nowhere near an end.

Soft Power requires hard investment. **EE**