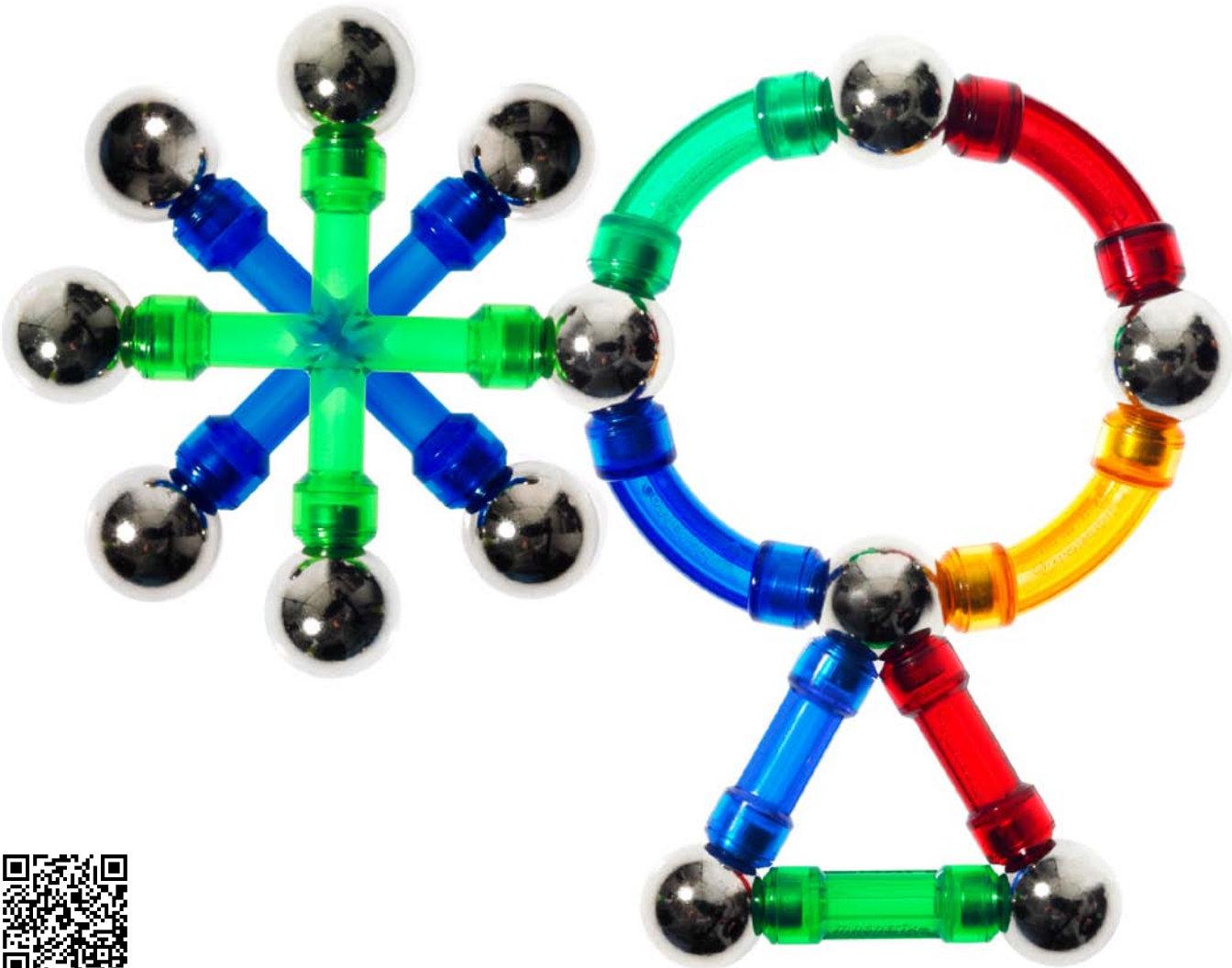


Technology, Media &
Telecommunications
Predictions
2012



Contents

Foreword	3
Technology	4
Consumer tech demand defies the economic headwinds	5
It takes two to tablet: the rise of the multi-tablet owner	7
Billions and billions: big data becomes a big deal	9
Hard times for the hard disk: solid state storage surges	11
Ambient radio frequency power harvesting: a drop in the bucket	13
3D printing is here – but the factory in every home isn't here yet!	15
Media	17
Targeted television advertisements miss the point	18
The schedule dominates, still	21
All aboard for the catch-up commuter thanks to the portable DVR	23
A “brand” new day for online ads	25
Market research is all in your head: MRI machines and media	27
Extracting the premium from social games	29
Online coupon intermediaries: from novelty, to celebrity, to sizeable niche	31
Telecommunications	33
The \$100 “smartphone” reaches its first half billion	34
NFC and mobile devices: payments and more!	36
Web bypass: delivering connectivity without the Internet	38
Here come more data caps: it's the end of the (wire)line for unlimited Internet	40
So many apps – so little to download	42
Endnotes	44
Recent thought leadership	53
Contacts	54

Our aim with Predictions is to catalyze discussions around significant developments that may require companies or governments to respond.

Foreword

Welcome to the 11th edition of Deloitte's Predictions for the technology, media & telecommunications (TMT) sector.

This annual publication presents Deloitte's view of key developments over the next 12-18 months that are likely to have significant medium- to long-term impacts for companies in TMT and other industries.

We would like to stress that latter point this year: across every global industry, knowing what will come next in TMT trends has become a key competitive differentiator. From big banks harnessing big data to auto manufacturers using MRI machines to fine-tune their marketing messages, this year's report has analyses that most C-level executives should find relevant.

As in 2011, this year's Predictions report is published as a single report rather than three separate ones. Deloitte's view is that developments in each sub-sector are now so inter-linked and interdependent that TMT executives need to be cognizant of key trends across all sectors.

I am often asked what differentiates Deloitte's Predictions different from other perspectives. I believe it is all about the methodology:

- **Rigorous research:** We use both primary and secondary sources, fusing quantitative and qualitative analysis, based on hundreds of depth discussions, polling tens of thousands of individuals, reading thousands of articles.
- **Robust testing:** We test out emerging hypotheses with Deloitte member firm clients, analysts and at conferences throughout the year. For example, Deloitte held a special Predictions session for key Asia Pacific leaders in Beijing in June 2011, and their contributions are reflected in this year's report.
- **Innovation:** We publish only perspectives that we think are new or counter to existing consensus. This includes calling a market where most commentators expect there to be none, or identifying markets where the hype is ahead of reality.

- **Accountability:** Our aim is to provide clear Predictions endpoints, so that our accuracy can be evaluated annually. In 2011, we were just over 80 percent accurate, up about 10 percentage points on 2010.

Our aim with Predictions is to catalyze discussions around significant developments that may require companies or governments to respond. We provide a view on what we think will happen, what will occur as a consequence, and what the implications are for various types of companies. We never however presume that ours is the last word on any given topic: our intent is to kindle the debate.

We hope you and your colleagues find this year's Predictions for the TMT sector useful. As always, we welcome your feedback. In addition to the text version of Predictions in this report, a discussion around each Prediction is available as a video, a podcast and an app.

Whether you are new to this publication, or have been following our Predictions for years, we thank you for your interest. And to the many executives who have offered their candid input for these reports, we thank you for your time and valuable insights.

We look forward to continuing the conversation.



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As used in the Predictions, "Deloitte" refers to the Deloitte Touche Tohmatsu Limited (DTTL) Technology, Media, and Telecommunications (TMT) Industry Group – a group comprising DTTL member firm TMT professionals.

Technology



Consumer tech demand defies the economic headwinds

Deloitte predicts that overall global demand for consumer technology will likely grow in 2012. Record numbers of smartphones and tablet computers are likely to be purchased, and more computers of all descriptions are likely to be bought. Global television sales may see only modest growth on average, but sales are forecast to be robust in emerging countries¹. Even countries that are experiencing stagnant growth or mild recessions should see overall growth in consumer technology unit shipments, although the total dollar value may be flat as prices come down due to Moore's Law and new form factors.

While global economic growth forecasts for 2012 are weaker than those at the start of 2011, the outlook remains positive for most regions². However, developed markets are likely to see the weakest growth. In these countries, consumers may defer spending on big-ticket items while maintaining spending on smaller items, including consumer technology³. Emerging markets, where the installed base for many types of consumer technology remains relatively low, should still enjoy relatively robust overall growth (mid to high single figures). Lower entry-level prices for computers, as well as the availability of a widening range of less expensive smartphones, should further drive demand for devices in those countries.

Personal technology in 2012 will likely provide outstanding 'bang for your buck'. Although it may seem that modern society spends a lot on technology, the actual amounts are less than one might expect: the average US household spent only \$1,200 on consumer technology in 2011, or less than 2.5 percent of median income⁴. Consumer tech purchases start at the low tens of dollars for basic mobile phones, and rise to hundreds of dollars for high-end smartphones, tablets, laptop computers and televisions.

It is an exceptional tech purchase that cracks four figures in dollar terms today, while a decade ago the average PC or big screen TV typically cost more than \$1,000. Three decades back, the average television cost an inflation-adjusted \$1,800. Today that \$1,800 could get you two large flat screen televisions, two tablets, two netbooks, three smartphones, and still leave change to take the family out for dinner.

Most consumers do not quantify value for money to the exact cent when buying or upgrading a device or service. But many are likely to have a rough idea of how much they might use it. Consumer technology generally fares well in this type of analysis. The average \$500 tablet is used for 350-700 hours per year, implying an hourly cost as low as \$0.70, assuming the tablet is kept for just one year⁵. The average living room TV is typically used for three to five hours per day. Given that the price for an entry-level flat panel television is about \$400, the hourly cost is \$0.45 or less, again assuming the TV is kept for one year only⁶. By contrast, the cost of a car, overseas vacation, music concert or sporting event is at least ten dollars per hour, and major events can cost hundreds of dollars per hour.

Consumer tech provides such good value for several reasons. Moore's Law allows vendors to offer ever-improving devices for ever-lower prices. Another driver is the high degree of competition for many categories of consumer technology⁷. Margins for some TV vendors have been estimated by analysts at below two percent⁸; for others they are negative. Margins for some tablets are in the low single figures, with profits being primarily generated from accessory sales⁹.

Spending on consumer technology in 2012 may also be stronger than expected due to a structural shift in priorities. A growing number of individuals, across all regions, may be placing more emphasis on purchasing, owning and enjoying technology than ever before. At one time, the rite of passage for becoming an adult may have been buying a car and then a house. However, in 2012 the rising cost of running a car¹⁰ and buying a house¹¹ may well cause priorities to be reset. Renting may become more acceptable, and taking public transportation, taxis and renting cars may become preferable to owning them, particularly in cities with highly congested roads¹². Spending less on housing and transportation enables more money to be spent on technology devices.

In emerging countries, consumer technology seems likely to remain a key purchase as households emerge from a subsistence-level existence. A television set is often one of the first items purchased in emerging countries with demand for TV sets even ahead of refrigerators, showers and electricity (many TV sets are powered by car batteries)¹³. In emerging markets the entry-level price for a television can be significantly lower than in developed countries, with thicker flat screen TVs (four centimeters vs. one centimeter) and cathode ray tube (CRT) TVs still selling well¹⁴.

Bottom line

Consumer technology has many reasons to perform well in 2012, even in markets with little growth, declining incomes and rising prices. There are several major advantages that should be emphasized: new markets enabled by the seemingly inexorable rise in different types of consumer technology; a steady increase in value for the money of many devices; and the growing importance of technology as a status symbol.

Consumers' budgets may be limited, but how they allocate their spending varies. In many cases, consumers can be readily persuaded to shift spending between seemingly un-connected categories – and marketing should exploit these tendencies. For example, consumers with constrained budgets may not be willing to choose between a television or computer; instead they may opt to stay close to home for vacation and then use the resulting travel savings to buy both devices¹⁵.

It takes two to tablet: the rise of the multi-tablet owner

Deloitte predicts that in 2012 almost five percent of tablets sold will likely be to individuals or households that already own a tablet, which equates to five million tablets¹⁶ worth between \$1.5 and \$2 billion in revenue. Although this represents a small percentage of total tablet sales, given that the tablet market is only three years old it likely marks the most rapid 'multi-anything' market penetration in history. It is also worth remembering that in January 2010, aside from the Predictions estimate, the most aggressive forecast for total next-generation tablet sales that year was one million units.

It took several decades after introduction for more than five percent of households to have more than one car, phone, radio or TV. More recently, over ten years passed before five percent of homes had more than one personal computer or cell phone.

The emergence of a multi-million strong cohort of users with two tablets in 2012 is part of a long-term steady increase in the number of computers used and owned per person¹⁷. Often called "scatter cushion computing" the main driver for multi-tablet individuals and households will be size, new form factors, price points and vendor business models.

The 75 million modern tablet computers sold since they launched in 2010 have clearly proven the demand for a device with dimensions and processing power somewhere between a smart phone and a laptop¹⁸. But thus far tablet demand has been largely homogeneous, even if the offer has been varied¹⁹: over 80 percent of all tablets to date have been roughly 10 inches in size, with a single LCD capacitive touch screen, weighing about 650 grams, Wi-Fi but no 3G radio, and an average selling price of about \$600²⁰.

In 2012, the supply of tablet choices is likely to become even more varied, and demand is likely to follow suit. As with smart phones, a category which now describes multiple types of devices²¹, tablets will become increasingly diversified by size, processor power, operating system and business model.

Size will be a key driver for multiple tablet ownership. There is likely to be a marked increase in the number and popularity of smaller tablets, ranging in screen size from five to seven inches²², with tens of millions sold by year-end, compared to a few million in all of 2011.

Purchasers of lower cost seven-inch tablets are likely to comprise first-time tablet owners, as well as existing 10-inch tablet owners simply wanting an additional smaller, lighter tablet that fits into a purse or pocket²³.

Smaller tablets are likely to be used differently than their ten-inch equivalents, due to the reduced processing power that many smaller tablets are likely to have. Smaller tablets may be more frequently used for reading books, using apps designed for phones, showing photos to friends and family, and reading e-mail²⁴. But smaller tablets may be less useful for browsing full versions of Web sites, flicking through magazines, reading business documents, analyzing data, writing documents, reviewing presentations, or watching long-form video.

Seven-inch tablets will likely mainly be sold at a lower price than 10-inch equivalents, from as little as \$100, but more typically at \$200. The principal impact of quality tablets at a lower price point will likely be a wider addressable market; however one group of purchasers of these lower-priced tablets will likely include individuals who have been issued a high-end, relatively powerful tablet for work purposes but who also want an additional tablet for private, home or family use.

The business model should also have an impact. A growing share of the tablet market is likely to be taken by devices with a purchase price that is at or below the manufacturer's cost, with all margins being made on subsequent service revenues, in the forms of content purchases (predominantly books, games and music), subscriptions and rentals. Content owners (from music companies to handheld games publishers) and retailers may want to actively forgo hardware gross margins on smaller tablets as a way of encouraging existing customers to move to digital, lower-cost distribution models.

Another driver of multiple ownership will likely be enterprise deployment of specific tablet models that workers are required to use, instead of generally available tablets. Possible reasons for this deployment approach include greater security, better compatibility with existing operating systems, and improved ruggedness²⁵.

Bottom line

Device vendors, content owners and connectivity providers should all get ready to respond to the rise in multi-tablet households.

Content owners should ensure that the content and services available are optimized for different types of tablets based on size, type, capabilities and target market. Tablet usability will be compromised if content is repurposed from existing devices such as smartphones and other tablets with different capabilities.

Just as customers have shown a willingness to purchase multiple variants of the same product for everything from smartphones to sweaters, demand for tablets will likely follow suit as the devices become more specialized. Any vendor that is able to offer seamless content sharing among families of devices – as well as a common user interface – is likely to enjoy a competitive advantage. Content owners should enable owned digital content to be accessible across all devices (to the extent that regulations allow it). This may well involve replication of data across devices, rather than assuming constant access to media in the cloud.

Network operators should expect a steady rise in tablet ownership, and evaluate the impact this will have on connectivity. Tablet utility will depend on connectivity: the more useful and used a tablet, the more bandwidth it is likely to consume. End-users will of course hope for faster bandwidth and bigger monthly data allocations, all at a lower price. The demands for faster bandwidth and more data are not necessarily impossible to accomplish if users shape their data consumption to align demand with network availability, rather than expecting on-demand service at all times. Users can and should be encouraged to download tablet content, such as magazines, TV programs and movies, during off-peak periods, ideally using Wi-Fi; data back-ups between tablets and other devices can be sent via short-range networks, such as Bluetooth and Wi-Fi Direct, bypassing the Web altogether²⁶, yet still satisfying the need for connectivity. Operators should not assume that the places where tablet users want to connect will be the same as those for smartphone users, much in the same way that mobile data has a different usage footprint than mobile voice.

Primary and secondary tablets are likely to continue driving significant Wi-Fi traffic; hotspot providers will probably need to upgrade technology, deploy a denser grid of access points, and provision more and faster backhaul. Many hotspots were deployed at a time when tablets had not even been invented; demand for Wi-Fi connectivity will likely surge along with the growth in ownership of all types of mobile data devices.



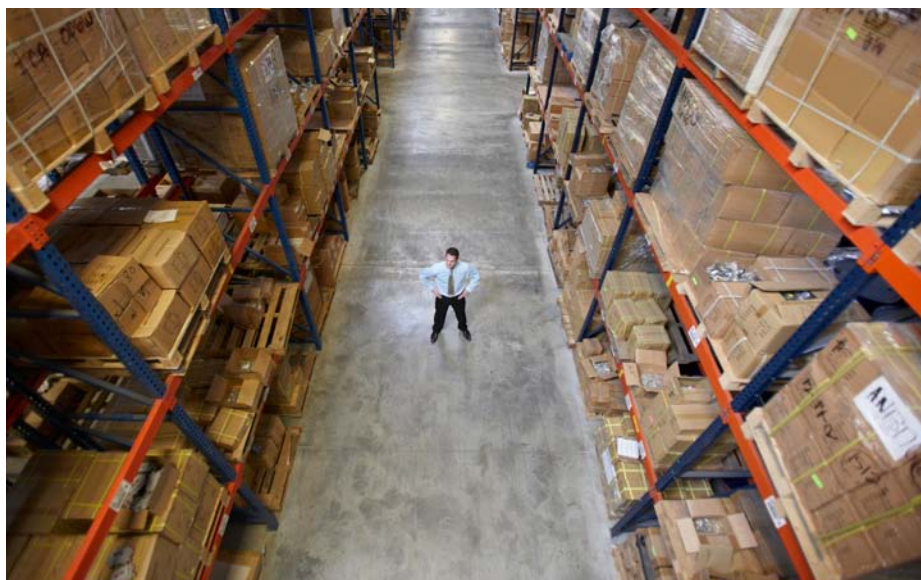
Billions and billions: big data becomes a big deal

Deloitte predicts that in 2012, “big data”²⁷ will likely experience accelerating growth and market penetration. As recently as 2009 there were only a handful of big data (BD) projects and total industry revenues were under \$100 million. By the end of 2012 more than 90 percent of the Fortune500 will likely have at least some BD initiatives under way. Industry revenues will likely be in the range of \$1-1.5 billion. But the industry is still in its infancy. Big data in 2012 will likely be dominated by pilot projects; there will probably be fewer than 50 full-scale big data projects (10 petabytes and above) worldwide.

Historically most of the world’s accessible data has been located in traditional relational databases, accessed and managed with a certain set of tools and analyzed and reported on with business intelligence software. The ability of those tools and software applications to cope with larger and larger data sets has grown over time, but in general any set of data that was viewed as being “too big” or needing results “too fast” was seen as requiring an entirely new set of tools, most commonly referred to as big data tools.

Until the last year or two, traditional data tool capacity had more or less managed to keep pace with the growth in data sets. However social networks, real time consumer behavior, mobility, sensor networks and other data generating sources have caused many organizations’ data warehouses to overflow. Data sets an order of magnitude (or two) larger than before are either happening today, or are seen as likely within the next 12 months. Even when the size of a data set has not grown so quickly, if organizations now want to do analysis in real-time, sometimes traditional tools are not adequate and big data is again being considered.

From being the sort of tool that was only needed for meteorology or physics simulations, big data has recently moved into the mainstream: individual big data conferences²⁸ are drawing thousands, BD companies are attracting funding rounds of over \$50 million²⁹, BD venture funds are being created³⁰, and large existing software players are validating the markets by partnering with or acquiring outright early stage leaders in the space³¹.



Not all industries are likely to benefit from big data projects equally, and uneven distribution of BD across verticals is already perceptible. Not surprisingly, the first movers were Internet companies: in fact, the most popular big data tools are being built on top of software that was originally used to batch process data for search analysis³². The fast follower sectors are likely to be public sector, financial services, retail, and entertainment and media³³.

Like many emerging technologies, BD can be easy to read about, but hard to picture in real world applications. A recent example from the media industry may help:

“The Financial Times uses big data analytics to optimize pricing on ads by section, audience, targeting parameters, geography, and time of day. Our friends at the FT sell more inventory because the team knows what they have, where it is and how it should be priced to capture the opportunity at hand. To boot, analytics reveal previously undersold areas of the publication, enabling premium pricing and resulting in found margin falling straight to the bottom line.”³⁴

Like many nascent IT spaces, big data has been difficult to size³⁵. Estimating the market size is challenging for several reasons: there are varied definitions of what BD is, it is still early in the adoption cycle of big data technologies, and most of the companies who are doing BD do not disclose their spending. Another barrier is that BD work is primarily based on open source code: the initial software is free, and the real spending comes from internal IT staff adapting the code. Unlike measuring sales of a new kind of router, BD spending is not easy to count.

Assuming moderate growth in 2012 over 2011, global spending on all information technology is projected to be roughly \$3.7 trillion³⁶. Of that, total enterprise software should be about \$270 billion. And of that, database management systems spending (DB) will likely be over \$27 billion, enterprise resource planning (ERP) software about \$25 billion, and business intelligence (BI) roughly \$17 billion. Combining the DB, ERP, and BI markets the total could be about \$70 billion.

According to some sources, more than 90 percent of analytic systems/data warehouses have less than five terabytes of data, and can be handled by traditional database tools and analytics³⁷. This would suggest that the value of the DB+ERP+BI requiring big data solutions would be at most \$7 billion in 2012. Further assuming that it is still relatively early in the adoption cycle, 15-20 percent of that total might be converted in 2012, which drives a range of roughly \$1-1.5 billion³⁸.

Bottom line

Traditional DB, ERP and BI companies will likely not be hurt in 2012, or even the longer term: big data will coexist with the existing DB management stack. At a recent BD conference, a survey showed that over 60 percent of respondents believed that their "Existing data warehousing/BI analytics supplier...will deliver big data technologies and solutions."³⁹

Further, just having the BD tools isn't enough, enterprises need to know what questions to ask, actually ask them, and then translate that into strategy or tactics. Moreover, a recent survey of chief marketing executives found that "...more than 60% of knowledge workers at large enterprises say their organizations lack the processes and the skills to use information effectively for decision making"⁴⁰.

Even though BD is still in its early stages, the growth suggests that the industry needs to develop talent with big data skill sets: 140,000 to 190,000 skilled BD professionals will be needed in the US alone, over the next five years⁴¹.

It will be important for enterprises to develop new policies around privacy, security, intellectual property, and liability. BD isn't just about technology and employees with the right skill sets, it will also require businesses to align work flows, processes and incentives to get the most out of it⁴². It is important to note that enterprises should not concentrate on big data at the expense of "current data", or business information as normal. There is still a lot of value left to be extracted from the information inside their traditional databases!

There are plenty of reasons to be skeptical about the BD market. But big data probably deserves a place in overall enterprise IT strategy for generating business insight. Best practices include generating a list of important challenges or questions that the current approach to data does not address. Could big data deliver the answers enterprises are looking for? If so, then it's all about discipline. A disciplined, targeted approach to big data – one focused on answering very specific questions for the business – is one that many companies can probably take on today without abandoning their current efforts⁴³.

Big data's potential is likely to pivot on context: when organisations recognise that big data's ultimate value lies in generating higher quality insights that enable better decision making, interest and revenues should accelerate sharply.

Hard times for the hard disk: solid state storage surges

Deloitte predicts that in 2012 the storage world will likely reach a turning point. Although the traditional hard disk drive (HDD) is far from extinct, there will likely be a dramatic increase in adoption of solid state drive (SSD) technology across a number of markets.

By the end of 2012, storage for small mobile devices – such as MP3 players, smartphones and tablets – is likely to be over 90 percent SSDs⁴⁴, versus just 20 percent in 2006. By year-end, up to 15 percent of laptops and netbooks are expected to use SSDs, four times higher than in 2010⁴⁵. Finally, even in the data center market – long an exclusive bastion of HDDs – SSDs could be used for up to 10 percent of new storage.

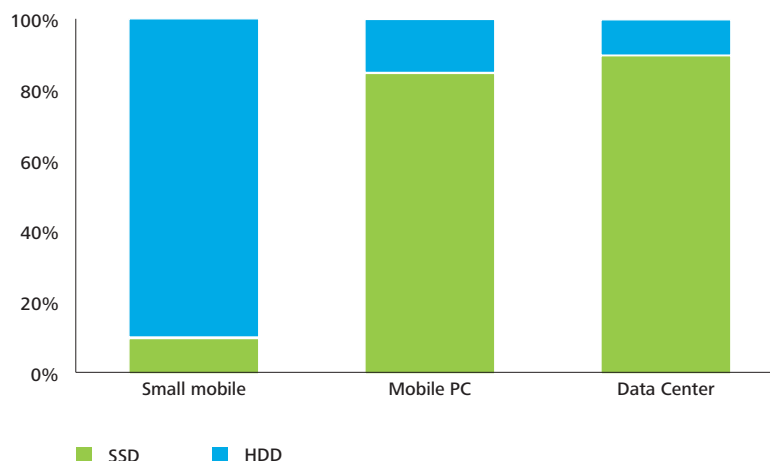
The hard drive is not dead by any means. Global storage demand in all forms continues to rise, and both storage technologies are likely to grow in 2012 and 2013⁴⁶. What has changed is SSD's rapidly rising share in some markets.

Solid state drives are not new. The technology has been around for decades in various forms⁴⁷, but has suffered from some fundamental limitations. While making a storage device out of silicon chips instead of spinning disks was technically possible, the resulting device had too little capacity and was too expensive. In 2005, the largest commercially available SSDs cost thousands of dollars and could hold only a few gigabytes (GB). And in 2008, a PC with a 64GB SSD drive cost \$1,000 more than the same machine with an 800GB HDD.

SSDs have become steadily cheaper, following a Moore's Law progression, with price per GB declining about 50 percent every 18 months. However, HDD prices have declined even faster than expected over the past three decades – at a remarkably rapid and constant rate of about 50 percent every 14 months⁴⁸. Solid state drives are still roughly ten times more expensive per GB than hard drives. However, there are a number of other factors that are making storage buyers look beyond the price/GB metric.

Solid state drives may not be as large and affordable as hard drives, but their size and cost is sufficient for many applications – even computer use. Although HDDs will continue to be bigger and less expensive than SSDs, their capacity will increasingly overshoot the needs of most computers.

Figure 1. Projected use of storage technologies for new storage in 2012



Source: Deloitte Global Services Limited, 2011

In the 1980s, many PC manufacturers and buyers questioned the need for the 20MB hard drive option, confident that no one could possibly require more than 10MB. However, rapid exhaustion of hard drive capacity quickly led to the belief that storage needs rise inexorably and that 'there is no such thing as too much storage.' Now, we could be seeing the end of that trend. Even in an era of 18 megapixel cameras, more MP3 music files than a person will ever listen to, and hundreds of hours of HD video, the capacity of high-end storage devices may be growing larger than the average consumer can use or justify⁴⁹.

Even people who store massive amounts of data may not need a hard drive on every computer they own. In many markets, PC penetration is mirroring the adoption of smartphones, music players and tablets, with individuals owning multiple devices in the same category⁵⁰. Laptops and netbooks are often used as secondary PCs, and for this purpose 120GB (or even 60GB) may be more than adequate – putting them into the range where SSDs can compete. Also, more and more consumer data is being stored or backed up in the cloud, potentially reducing the need for HDD-sized storage and making SSDs a viable option for a growing number of buyers.

The two biggest advantages of a solid state drive are size and power. On average, an SSD takes up half the space of an HDD, weighs half as much, and uses half the power. In a smartphone or similar sized device, these considerations virtually require the use of SSDs. Tablets and netbooks, with their small form factors and relatively small batteries, also benefit greatly from an SSD's compactness and power efficiency. These benefits are less significant in standard laptops, but as 'ultrabooks' (thin and light laptops) become more popular, SSD use will likely grow⁵¹. Further, SSDs can be created with non-standard form factors, which allows for potential new designs and products.

Even corporate data centers are proving to be an interesting and surprising market for SSDs. Historically, data center storage purchases were driven almost entirely by cost per GB, meaning that SSDs were seldom considered. However an increasing number of data centers are facing physical constraints: they have a limited footprint; finite heating, ventilating and air conditioning (HVAC) capacity; and they can't keep using more electrical power. All of a sudden, small, cool, power-sipping SSDs are becoming an attractive option for some locations⁵². The environmental benefits of SSDs are significant too. One study suggests that global data centers shifting even partly to SSDs could save 167,000 megawatt hours over a five year period⁵³.

Solid state drives are also quieter, more reliable, and enable faster start up. SSDs are completely silent, which can be a critical advantage for music applications and quiet environments. They are also significantly more reliable. Devices that use SSDs are less sensitive to shock, and failures tend to be less catastrophic⁵⁴. Devices that use SSDs also boot up to full functionality about 25 percent faster than devices using HDDs⁵⁵.

SSD adoption has temporarily benefited from the disastrous flooding that hit Thailand in October 2011. Before the floods, half of all HDD parts were manufactured or assembled in the affected areas. The resulting plant closures and supply interruptions created a global HDD shortage and caused prices to spike 20-30 percent. Many device manufacturers could not procure enough HDDs and had to use SSDs instead to get products onto store shelves in time for the peak winter selling season. Others shifted toward SSDs because higher HDD prices narrowed the price premium and made SSD's other advantages more compelling. Although normal HDD supply levels are expected to resume by late spring 2012, the increased momentum toward SSDs may prove difficult to reverse.

Bottom line

In the past, most consumers were not involved in picking their storage technology: they simply accepted whatever the manufacturer installed. But in 2012 and beyond, buyers may have the option to consciously choose between SSD and HDD storage. Many people do not know one technology from the other and will need to be educated about the costs and benefits of each. Consumers that hoard data will likely opt for the higher capacity of HDDs, while those most concerned about battery life or weight will likely choose SSDs.

At some point, hard drives may no longer be offered on some devices. But during the transition period, device manufacturers will need to adapt their sales processes, after-market support, and hardware designs so that buyers can get the full benefits of each technology.

Data centers will need to develop best practices around a more heterogeneous storage environment. Hybrid solutions that combine the speed and rapid access of SSDs with the superior storage capacity and price to GB ratio of HDDs are already being tested. The result could be performance synergies that go beyond the standard SSD benefits of reduced size and power consumption.

Ambient radio frequency power harvesting: a drop in the bucket

Deloitte predicts that in 2012 ambient Radio Frequency (RF) power harvesting products will likely remain a niche market with only moderate growth potential due to fundamental limits with the technology itself. While it is expected that beamed power products⁵⁶ will enjoy relatively greater success, combined global revenue for both products is likely to remain modest – probably below \$100 million. While revenue may rise in the coming years, increases will likely be steady rather than dramatic. Those who imagine a future in which handheld devices and tablets are powered by the sea of ambient RF energy that surrounds us are almost certain to be disappointed.

Since 1898, when Nikola Tesla first proposed the concept of wireless power transmission⁵⁷, the idea of extracting ‘free’ energy out of the air has excited public interest. The concept is particularly appealing given today’s ever-expanding constellation of mobile devices and the constant risk of experiencing a dead battery in your smartphone, tablet, GPS or other portable data device.

Several high-profile laboratory demonstrations have showcased ambient RF energy harvesting: in 2009, scientists were able to power a digital thermometer with a large antenna array pointing at a nearby TV tower⁵⁸. But in other real-world applications there are a number of serious challenges – including the laws of physics – that fundamentally limit the technology’s usability⁵⁹.

It can be challenging to understand the limits of harvesting ambient RF power because of the many units (volts, amps, and watts) and metric prefixes (millis, micros, picos and femtos) involved. While most people know how bright a 60W light bulb is, many are less familiar with a milliwatt or microwatt. To facilitate comparisons, all units are stated in microwatts (μW). Using this scale, the familiar 60W light bulb now equates to 60,000,000 μW !

Ambient RF harvesting faces four fundamental challenges:

There is not enough ambient RF energy available.

Given the seeming ubiquity of RF transmitters, it may seem that transmissions from TV stations, cellular network towers and Wi-Fi hot spots would bathe us in a steady source of energy just waiting to be tapped. However, this is not the case: there is 25 times more ambient solar energy available than RF. Putting a solar panel on the back of a wireless device would be more practical than installing an equivalently-sized RF harvesting antenna. Existing communications networks are unlikely to generate significantly more RF energy in the future: current FCC guidelines⁶⁰ limit RF exposure to the general public to less than 1000 $\mu\text{W}/\text{cm}^2$. This is the highest level of RF power one would normally expect to encounter. Currently, though, there is much less power coming from cell towers, which are limited to 580 $\mu\text{W}/\text{cm}^2$ at ground level⁶¹. Compare this to an average of 25,000 $\mu\text{W}/\text{cm}^2$ of solar radiation that is typically available.

Distances are too great. Just like all electromagnetic radiation, RF is subject to the inverse square law. Increasing the distance between the source and receiver by four times results in a 16-fold drop in power. Directional antennas can be used on the broadcast side in other wireless power transmission schemes to reduce this effect but these techniques cannot be applied to ambient power harvesting as these are mobile targets with no fixed location or orientation. The result is that power density falls off dramatically as one moves away from an RF source, meaning the amount of power to be harvested can vary considerably depending on where you are and which way you are facing.

Converting ambient energy into usable power is too inefficient. At high power densities, such as those at or near FCC exposure limits, RF harvesting systems can be relatively efficient, with some vendors demonstrating conversion rates of 60-70 percent⁶². However, as power density drops, so does conversion efficiency. Simply walking a few meters further away from an RF source can drop conversion efficiency from 60 percent to less than five percent⁶³. This is in addition to the drop in power density caused by the increased distance. Antennas and power conversion devices are tuned to operate most efficiently at specific frequencies: an 850 MHz device designed to efficiently harvest ambient 3G energy will be largely ineffective with Wi-Fi at 2.5 GHz⁶⁴. Supporting multiple frequencies is possible, but requires additional conversion hardware, cost and complexity⁶⁵.

Environmental factors interfere with RF power harvesting. Objects around an RF device can reflect and absorb radio waves, causing areas of increased and decreased power. This is best seen through the number of “bars” on a wireless device and how much they can vary over time and across location. Simply placing a phone into a pocket, next to all of the RF absorbing water in the human body, can virtually eliminate the power available for harvesting⁶⁶. Further, while a single device harvesting ambient RF may be able to extract some power, a bus full of people with similar devices would reduce the amount of power available to almost nothing.

Bottom line

The combination of low power density, distance, efficiency and interference, means that under real-world conditions ambient power harvesting systems with practical antenna sizes can recover only 10-100 μ W of electrical power. Since the typical tablet battery has a capacity of 15,000,000 – 25,000,000 μ Wh, recharging it with a RF harvesting antenna is like filling a backyard swimming pool with a shot glass. Even under ideal conditions, charging a smartphone’s smaller battery would still take decades⁶⁷.

While a smartphone powered or even recharged by ambient RF will not likely be available any time soon, there are niche areas where the technology can be useful. Small sensors, that periodically build up enough charge to report back, or that rely on separate readers to give them the RF surge needed to transmit data could be powered by RF⁶⁸. An example would be a sensor to monitor ceiling temperature where there is no power supply and is too high to easily change batteries.

There is also potential for beamed or broadcast power solutions that use similar technology combined with tuned RF sources to power or charge devices at a distance of several meters. Next generation TV or game consoles could be equipped to wirelessly charge associated remotes and controllers from across the room. Also, heating, ventilation and air conditioning (HVAC), warehouse and building-telemetry solutions based on short-range (tens of meters) wireless power transmission are starting to enter the market⁶⁹.

In summary, harvesting ambient RF power will likely remain a niche solution with moderate growth potential in 2012. While this technology is impressive on the lab bench, physical constraints and real world limitations will likely prevent widespread adoption. Although some of these challenges could likely be surmounted by increased research, others such, as distance and interference, are dictated by fundamental laws of physics. That being said, adjacent technologies, such as beamed power, could have greater long-term potential.

3D printing is here – but the factory in every home isn't here yet!

In 2012, Deloitte predicts that 3D printers will likely become a viable segment in several markets including the \$22 billion global power tools market⁷⁰, and the industrial manufacturing market with growth rates of greater than 100 percent versus 2011. 3D printers are also expected to enjoy success in several niche areas such as the “do it yourself” home hobbyist market and various after-market support chains with long tail characteristics (such as small appliance and auto repair). There is also significant interest in the application of 3D printing in the biomedical sector⁷¹. However, total combined printer sales will likely remain in the sub \$200 million range, and those expecting a “replicator” for use at home will be disappointed.

Although 3D printers hold considerable promise, one must be wary of the hype surrounding the technology. Some have heralded 3D printers as the first step toward the “democratization” of production⁷², calling them “desktop factories”⁷³; others have speculated that consumers will soon be able to download open source designs for anything they can imagine and then use 3D printers to instantly fulfill their needs and desires⁷⁴. However, the current technology is subject to several significant limitations. While some of these will be overcome in the medium term, others are the result of fundamental constraints that are unlikely to be resolved.

Today, 3D-printed objects are rarely as durable as their traditionally manufactured counterparts. While some exceptions do exist, using a 3D printer tends to be extremely expensive and is only practical when conventional production techniques are not feasible. For example, a printed wrench, while functional, will simply not last as long as one produced through drop forging, which can potentially survive generations of hard use.

Mass produced objects are still substantially cheaper to manufacture than their 3D-printed counterparts due to the costs of feedstock material. So although a consumer could print dinner plates at home, they would cost 30 times more than simply buying them at a store⁷⁵. In the same way, while most people already have the capability to print novels and textbooks at home, they find it cheaper and more convenient to buy books through online or local bookstores.

3D printers are extremely useful for creating prototypes, highly customized items, or small production runs, but they do not scale well beyond 10 items. Due to economies of scale, traditional manufacturing techniques are likely to always be much faster and far more efficient when mass production is required. In this way, 3D printing is a lot like paper printing. Making fifty copies on a printer or photocopier is economical and reasonable, but making a thousand copies shifts the advantage to an offset press.

While there have been recent experiments in embedding electrically conductive traces into printed objects⁷⁶, 3D printers are not capable of producing complex electronic components such as processors, memory or other integrated components. So while someone could easily print a new case for their smartphone, no one will be printing a complete smartphone at home.

3D printing is generally limited to producing relatively homogeneous objects made up of a small number of distinct materials (and for most entry-level units, just a single material). This means that printing items requiring multiple materials, such as a running shoe⁷⁷, is not possible without substantial increases in complexity. Nor can 3D printers capitalize on the material equivalent of “primary colors” that traditional paper printers use to generate a rainbow of hues from a limited set of different inks.

Lastly, many items derive their utility from the physical properties of the materials they are made from – for example, Pyrex cookware, or NiChrome heating elements. 3D printers are not capable of “synthesizing” these materials and are entirely dependent on the feedstock material provided. To produce even a subset of consumer goods used in the average household would require dozens to hundreds of different feedstock materials, many of which are not suited to the processes used in 3D printing.

Despite these limitations, there are significant markets where 3D printers will likely enjoy success in 2012. Entry-level prices are expected to drop below \$1,000⁷⁸ in 2012, placing them well within the range of hobbyists and determined consumers. While it is not expected that 3D printers will become mainstream in the next 12 months, early adopters will likely demonstrate that a viable market does exist, and one can expect to see growing interest from larger appliance, tool and industrial machinery producers.

At the low-end consumer level, the dominant process will likely remain single color thermoplastic extrusion. This method uses a print head to deposit small amounts of melted ABS (or other plastic) in a manner similar to an inkjet printer. There are several limitations with this method, most significantly the high cost of raw feedstock plastics, which will likely remain in the \$35-\$45/kg range⁷⁹. For 2012 the niche for these consumer units will typically be limited to artists, crafters, hobbyists and those within the growing “maker” community⁸⁰. An equivalent comparison in the home market would be table saws versus toaster ovens: the former is limited to large numbers of enthusiasts, but the latter is in virtually every home.

While the consumer market will likely grow in 2012, most revenue will likely come from commercial users. Continued price pressure on commercial 3D printers with some products approaching the \$10K price point can be expected⁸¹. The diverse set of processes used within commercial 3D printers will help ensure a broad range of price points with technologies including multi-color thermoplastic extrusion⁸² (similar to the process described above), photo-catalyzed resins⁸³ (using light to harden liquid plastics), deposited binders⁸⁴ (applying resin binders to powders) and laser sintering⁸⁵ (using lasers to melt powder together).

The range of materials supported by 3D printing is expected to broaden, with some advanced processes allowing objects to be printed with extremely accurate dimensions, including those with moving parts⁸⁶. Businesses requiring rapid prototyping and highly customized or small production runs will likely continue to be the primary customers for commercial 3D printers in the near term, but new niches may begin to develop as prices and sizes begin to come down. One area where early adoption is likely in 2012 is in after-market service industries that need to manage a long tail of large inventories made up of unique items with low individual demand, such as small appliance and automotive repair^{87, 88}. Rather than having to stock rarely used replacement parts, or make customers wait for ordered parts, the required parts could be printed on demand. In this scenario, it is not unreasonable to envision a 3D printer in a technician’s vehicle or garage allowing him to print parts as needed.

Bottom line

While 3D printers will likely remain a niche product in 2012, with purchases primarily made by early adopters, several developments that might demonstrate the technology are becoming mature and have begun to “cross the chasm”. While the technology has several unique applications and is expected to experience considerable growth in the long run, for the foreseeable future it will likely remain a specialized application that for the most part will complement, not replace, traditional forms of production.

Media



Targeted television advertisements miss the point

In 2012, Deloitte estimates that targeted TV advertising will likely represent less than one tenth of a percent of global television advertising revenues, which is less than \$200 million out of a total market of \$227 billion⁸⁹. A targeted TV ad, also known as an 'addressable ad', is a conventional TV commercial spot served specifically to a television set or computer. The ad is selected according to contextual data, such as income level, purchasing history or stage of life, for an individual viewer or household⁹⁰.

The clamor for targeted television advertising dates back to the origins of TV ads. One of advertising's fundamental objectives is to target specific customer segments, such as those who allocate a household's spend on cleaning products, or specific demographic groups. Yet television is a mostly mass-market medium, which means that many people who view a TV ad are not its main targets. On this basis, TV advertising could be criticized as wasteful and inefficient, particularly when compared to the targeted advertising that the Web is perceived as delivering⁹¹.

Targeted television advertising seeks to mitigate the inherent inefficiency of TV ads while incorporating the best of traditional media and new technologies: keeping the power of TV, but only showing an ad to an audience that is most likely to be receptive. Targeted advertising would enable ads to be selected for the specific viewer, using principles similar to those for Web-based advertising⁹². For example, dog food ads would only be shown to pet owners; luxury car commercials would only be shown to viewers likely to purchase top-of-the-line models; and ads for a local restaurant would only be shown to people who live nearby⁹³.

Every year, the technology to deliver targeted advertising improves. The array of data on customer purchasing patterns, income levels and browsing behavior is constantly growing; and the processing power available to analyze this data increases every year. Options for delivering targeted ads are constantly improving as well. One approach, for example, is to download commercials appropriate for a household to a set-top box (also known as a cable or satellite box). These ads can then be inserted during commercial breaks. Targeted ads can also be inserted at the point of transmission when delivering individual streams of video to a household.

The ability to deliver television signals on-demand via the Web enables advertising to be allocated according to geography, even down to specific streets in a neighborhood.

Some metrics show targeted TV ads to be more effective than regular television advertising. Viewers shown targeted ads appear less likely to change the channel during commercial breaks⁹⁴, and brand recall can be higher⁹⁵. Hundreds of millions of dollars have been invested in companies focused on delivering targeted TV advertising⁹⁶.

Targeted TV ad campaigns enhanced by technology are certainly attractive in principle, but execution remains a challenge. And in 2012, it is unclear whether the need to deliver further degrees of advertising is sufficiently widespread to justify the required investment: many broadcasters offer hundreds of different customer categories, but advertisers rarely ask for more than 10 different segments. This is why, despite the hypothetical attraction of targeted TV ads, the market in 2012 is likely to remain small.

The high cost of creating a television commercial means that advertisers are very unlikely to make multiple versions for a single campaign. TV ads are generally becoming more expensive. The cost of creating a TV advertisement focused on brand-building is likely to exceed \$500,000, while major campaigns with well-known celebrities or complex special effects often cost more than a million dollars.

The rising cost of producing a television commercial makes it less likely that small businesses with modest marketing budgets (who might want to target ads just to households in their area) will be able to advertise on TV. Although airtime may be available for relatively low cost, creative costs are far harder to economize on.

Traditional TV ads, while relatively expensive to produce, can enjoy major economies in preparation and allocation compared to targeted advertising. Determining who exactly to target can be resource intensive. Aligning multiple sets of data, such as matching households to individual purchasing history, or identifying viewers most likely to be interested in premium kitchen utensils, can require significant resources. Traditional TV campaigns, the largest of which involve billions of impressions, lack this degree of precision but require much less labor-intensive preparation.

In addition, delivering targeted ads via a set-top box requires boxes with uniform specifications and capabilities. Yet the installed base of set-top boxes varies widely, with some units up to ten years old⁹⁷. Advertisers generally want TV ads to have as wide a reach as possible – even if they intend to target specific households within this base.

Current TV advertisements are already targeted to a considerable degree, a fact that is often overlooked. Every TV program attracts a certain, relatively predictable type of viewer, against which relevant advertising that is likely to resonate with the program's expected audience can be sold. Multi-channel television, available in any country with digital distribution of a TV signal, enables general and specialized programming to be broadcast. With the guidance of a good media agency and planner, this can provide sufficiently accurate allocation of commercials on a per-program basis.

Although such targeting may not be precise down to the household level, deeper targeting based on detailed data analytics may deliver only limited incremental benefits – often at significantly higher costs. That said, it should be noted that in many markets advertisers do not pay for “wastage” (reached viewers who are not the core target for the campaign). Ads are not sold in terms of total audience, but total target audience. Advertisers purchase a volume of targeted individuals, such as decision-makers for purchases of cleaning products. Anyone else who views the ad in that household is not charged for, even if they may be influencers of near-term purchases or potential customers in years (or even decades) to come.

Joint decision-making on some items means that the shotgun approach to delivery that is inevitable with traditional TV advertising is potentially more effective than strictly targeted advertising, since it reaches a large number of influencers as well as decision-makers⁹⁸. Purchases of high-priced items, such as vacations and cars, are often based on collective decisions. While one individual may pay for an item, other members of the household are likely to have a significant influence on the choice. For example, a parent purchasing a car may well base part of his or her selection, consciously or otherwise, on the approval of his or her children⁹⁹.

Joint viewing of television, particularly in the living room, means that one aim of deeply targeted advertising – delivering a commercial specific to an individual – would still result in wastage if others in the room were not also targets for that particular campaign. Thus, the most fertile ground for targeted advertising is likely to be video-on-demand TV programming that is watched on a computer or smartphone, which is more likely to be viewed alone. While video-on-demand is growing, viewing volumes are still relatively small, at less than ten percent of all viewing of video content. And online viewing of TV programs is less than a tenth of that¹⁰⁰.

Bottom line

There are actually very few TV ads that will never influence what we purchase, either today or in the future. Ads for diapers and pet food are often cited as examples of campaigns that are irrelevant for vast segments of the population, since many people will never own a pet, or will not be buying diapers at any point in the future. Yet product categories such as these are rare indeed.

Before TV executives become either petrified or over-excited by precision targeted advertising, they must understand how big this market really is: online advertising, after all, has so far been led by search, not contextual advertising. And online advertising's biggest growth is likely to come from display ads that do not rely on context.

The main advantage of TV targeting is that the audience is self selecting. Viewers do the hard job of matching themselves to ads that are expected to be relevant to them through their viewing choices. If planners have done a good job of matching advertisements with programs, ads shown should be mostly relevant to the audience. With Web-based advertising, serving relevant ads can actually be harder. If the context for selecting an ad is browsing history, this can mislead as a high proportion of computers are shared. Furthermore, some individuals use multiple machines, and browsing on these machines is not necessarily amalgamated.

One of TV's biggest roles is launching new products and brands – an activity where companies do not always know exactly who is going to be in their target market. In situations like this, a shotgun approach may well be an advantage. When people watch television, they are generally passive, and a variety of marketing messages tends to work well in this context.

Television advertising should be blended more closely with online advertising; however, the focus should be on matching TV viewing to browsing patterns. TV's ability to influence search patterns is well documented¹⁰¹: it can effect an 80 percent uplift in searches on a brand over the duration of a TV ad campaign¹⁰². Yet, at present, there is little widespread conjoined monitoring of TV viewing's impact on search. Mapping an individual's TV viewing to his or her searches could quantify a TV campaign's ability to influence people's interests and purchases.

The schedule dominates, still

In 2012, Deloitte predicts that 95 percent of television programs watched will likely be viewed live or “near live”, that is within 24 hours of broadcast. This is little changed from a decade ago. People will allow the TV schedule to guide almost all of their viewing choices, regardless of whether they are watching shows on a conventional TV, computer, or smartphone; and regardless of the network technology used be it cable, satellite, phone line or conventional antenna.

Contrary to some expectations, technology has not shattered the TV schedule, but rather made it stronger by making it more flexible¹⁰³. Adherence to the broadcast schedule does not appear to be an artifact of limited choices imposed by technology, but rather a fundamental aspect of TV viewing for most people.

As in previous years, in 2012 technology that enables the schedule to be averted will likely reach deeper into our homes, with ever improving specifications. Digital video recorder (DVR) storage will likely increase and penetration rates will likely rise¹⁰⁴; in several major TV markets, including the US and the UK, DVR penetration has already exceeded fifty percent¹⁰⁵. Devices that further enable consumers to watch non-broadcast television, such as PCs, tablets, game consoles and connected TVs¹⁰⁶, will likely be found in a growing number of homes¹⁰⁷. In some markets, penetration rates for computers may near 80 percent of homes.

These devices are connecting to ever faster and popular¹⁰⁸ video-friendly broadband networks. Broadband speeds are increasing by double digits; video compression technologies are reducing the bandwidth required for video streaming; streaming services offer adaptive bit rates to reduce the load on the network; fiber optic technology is being rolled out further; and content delivery or distribution networks (CDNs) move frequently-watched video files closer to the consumer¹⁰⁹. These advances improve the video-on-demand proposition and can make network congestion and the resulting buffering almost a thing of the past over wired networks.

Finally, every year the library of video content available online stretches closer to infinity¹¹⁰. Much of it is on Websites for zero cost, or for just a few seconds of pre-roll and mid-roll ads.

Despite these factors that should be luring consumers away from traditional broadcast TV, the schedule remains surprisingly powerful¹¹¹. Humans seem to prefer structure, stability and predictability. In one study, the predictability of a reward stimulus was more important than the actual stimulus¹¹². We may be biologically and neurologically “hard-wired” to prefer schedules and routine, no matter how often we profess a desire to watch “what we want, when we want, where we want.”

What’s on TV can signal our brains about the time of day, day of week, and season of the year; a good scheduler knows how best to arrange programs to align with and reinforce these expectations. Anyone who has watched a Christmas special in July will understand why the schedule exists.

The schedule has been variously portrayed as a straitjacket, a waste of precious spectrum¹¹³, and dictatorial. But for the majority it is a resounding positive; a well-constructed schedule provides structure for what to watch and when to watch.

The best channels maintain their popularity due to their ability to commission and purchase programs which they know will appeal to their audience at each time of day.

Choice is cherished, but choosing is a chore¹¹⁴. Beyond a certain point, the more choice there is, the more likely we default to a guide. This applies across all aspects of our lives: we look to the Oscars to guide our choice of movies, to sommeliers to select our wines, to radio stations to choose the music we listen to. And we value television channels partly because of their ability to curate what we watch. Their challenge is to show programs that we are most likely to enjoy watching.

The tedium of choosing is why hundreds of millions of pay TV subscribers with subscriptions that include hundreds of channels constrain most of their viewing to just a handful¹¹⁵.

For thousands of years, humans consumed content communally. Whether enjoying Shakespeare at the Globe, gladiators in the Coliseum, or merely a well-positioned table in a café, being part of a group enhanced the experience. As indicated by the phrase “the thrill of the crowd,” there can be as much pleasure in the massed spectators’ reaction as in the spectacle itself. Compliments and heckles alike have far less resonance and relish when they are not shared. TV viewing is more often prolonged when undertaken with company than alone.

And for many decades, rigidly-scheduled broadcast TV programs have largely defined the “national conversation.” The events covered on last night’s news, and the happenings on last night’s serial or sitcom are often the most common topics of conversation with co-workers and friends. A common viewing schedule brings us together and gives us something to talk about.

Online social networks are likely to enhance the schedule’s appeal, not diminish it. Social networks enable the commentary on programs to be shared not just with those in the same living room, but also with friends, families and strangers anywhere else. Social networks and their many-to-many communications can create additional interest about a program, with the greatest buzz typically for programs with youth audiences¹¹⁶. Whether contributing or only consuming the social chatter on a program, you need to be watching it when everyone else is.

The video-on-demand platforms that are likely to be most successful in 2012 are those with the closest proximity to the regular schedule; other platforms whose content is further from the schedule are likely to have less success, no matter how vast their libraries.

The dynamics that maintain the schedule’s strength are not one-off, or even cyclical. Those betting against the schedule are likely to be disappointed not just this year, but in years to come.

Bottom line

The public’s use of television technology to cling as closely as possible to the regular schedule raises the question of how exactly viewing should be measured. Current classification of viewing by technology, such as on-demand, DVR or live broadcast may not accurately reflect underlying consumer behavior.

On-demand platforms can be used to watch a program live, but they count as an on-demand view¹¹⁷. DVR playback may be just a few minutes later than live, but again this may not be counted as live, even if the viewer subsequently caught up with the live feed. To better understand why people watch when they do, measurements and terminology should reflect consumer behavior, rather than the underlying delivery platform. After all, viewing behavior is driven primarily by content, not technology.

In a world where schedules are sticky, conventional broadcasters will want to build on the power they hold. They can show advertisers the advantages of the schedule, and why it is not going away any time soon. Further, to stress their competitive differentiation versus other media, broadcasters can continue or even increase their efforts to build themed chunks of time, such as “comedy Thursdays.” Equally, broadcasters will likely continue to use “counter-programming” (scheduling shows with a specific demographic target at the same time as a competitor’s show that targets a different demographic) to boost their audience and ad sales.

Businesses providing alternate solutions for viewing video may want to rely less on “schedule-shifting” as their primary value proposition. A large video-streaming company has already acknowledged it is not competing directly with scheduled television, jestingly referring to itself as “re-run TV.”¹¹⁸ Similarly, DVR companies may want to stress how their devices can be used to let viewers better enjoy the TV schedule, rather than focusing on schedule aversion. When DVR viewers miss the first few minutes of a show, they can use the DVR to catch up and thus have the same experience everyone else is having.

Advertisers and agencies will likely still need to think about ad campaigns within the context of a schedule, rather than buying spots or inserting product placements under the assumption that shows will predominantly be viewed at random times.

Finally, city planners will still need to specify their water system requirements with the TV schedule in mind. If viewers stick to the schedule, there will continue to be sudden changes in water pressure as millions of sports fans simultaneously take a break at half time!

All aboard for the catch-up commuter thanks to the portable DVR

In 2012, Deloitte predicts that full-screen smartphone owners and tablet owners will likely use their devices as portable digital video recorders (DVRs) to catch up on five billion hours of TV while commuting on public transportation. This assumes an installed base of at least 400 million full-screen, high-end smartphones¹¹⁹ and over 100 million tablets¹²⁰ at mid-year, and once weekly usage¹²¹.

This will represent an acceleration in the use of commuting time to watch programs – especially among younger viewers who typically have the most devices, and who currently spend the least amount of time in front of a TV¹²². Almost all of the video content will have been pre-loaded onto the device at home; network congestion, data caps, and uneven or inadequate mobile broadband speeds mean that TV streamed while commuting will likely be less than one percent of all video watched¹²³.

Commuters have always needed something to pass the time, and many of them discuss the previous night's television shows with colleagues and friends at the office. Combine these two habits with the increasing ubiquity of tablets and full-screen smartphones and it is easy to see why the catch-up commuter concept is taking off.

People hate missing their favorite TV shows. Two of the most popular recent innovations in television watching – the DVR and on-demand services – are primarily used to catch up on missed shows within seven days of the initial broadcast.

Tablets and smartphones can be thought of as portable DVRs. The falling price of memory means that storing video in sufficient quality is not a major challenge – a 32 GB SD card, sufficient to record tens of hours of content, is now available for under \$40¹²⁴. Downloading content at home, either through a Wi-Fi connection or even over a short-range wired or wireless connection from a living room DVR removes the reliance on cellular mobile to stream content while travelling.

Catching up on television is likely to become an attractive option for commuters to while away their journey, in addition to reading paid-for and free newspapers, playing video games or listening to music.

As cities experience increased traffic congestion, the appeal of catch-up TV during the commute should also increase.

Catch-up commuting is likely to be hindered in 2012 by the technological complexities around recording television content onto phones and tablets. And in some cases, it isn't even legal to do so. As rights owners, broadcasters, and device manufacturers work more closely together, the copying of content should become increasingly automated, and demand will likely rise accordingly.

The use of commute time to watch television will be bolstered by the growing availability of TV programs and movies for download on airplanes, long-distance trains and buses. Seat-back entertainment has been common on planes for decades, but represents a major capital investment, as well as significant operational cost. Transport providers are increasingly offering Wi-Fi networks to passengers¹²⁵. Adding a pre-loaded multimedia server into any plane, train or bus that already offers Wi-Fi enables video to be streamed to the devices customers are already travelling with. In the medium-term this could even enable transport companies to remove existing seat back systems, which would reduce maintenance costs and increase fuel efficiency by reducing the carried weight in the vehicle¹²⁶.



Bottom line

Catching up on television while commuting is a service for which there is already strong latent demand. A minority of commuters on public transportation already watch television programs and movies on their phones and tablets, sometimes by modifying the device firmware to enable easier content transfers.

Making TV content available to commuters can do much to increase perceived value provided by various players across the entire business ecosystem.

For content providers, offering TV shows to commuters should be broadly positive, as it will generally mean more time for their content to be consumed. Catch-up commuters are unlikely to reduce the amount of time spent watching television at home; rather, they will probably watch more of the content they like. This is similar to what happened with DVRs: households ended up watching more television, not less¹²⁷.

For pay TV platform owners, catch-up commuting should be a way to manage churn among existing customers. It could provide an additional way for customers to access premium content.

Commuters watching pre-loaded video on mobile devices could be a benefit for mobile network providers. Watching stored programs instead of streaming Web content or video frees up bandwidth, enabling stressed networks to handle more lucrative traffic¹²⁸.

For content providers that already serve commuters, such as publishers of free newspaper and video game vendors, the consumption of TV while commuting is likely to be a threat. Even if the overall amount of commute time is steadily rising due to greater urbanization and worsening congestion, the growth in on-the-go TV viewing may well be greater.

A “brand” new day for online ads

Deloitte predicts that in 2012 global spending on brand advertising online will likely grow faster than either traditional advertising or direct-response online advertising. This is not a zero sum game: all advertising will likely grow five percent in 2012¹²⁹ and all Internet advertising is likely to grow 11 percent¹³⁰. However, total advertising and overall Web advertising will likely grow slower than online branding, which we expect to rise 50 percent year-over-year to \$20 billion as marketers realize and invest in online advertising’s ability to build long-term value for brands.

Direct-response online advertising is defined as embedded email ads, lead generation and paid search. Online branding is defined as banner ads, rich media, sponsorships, social media and video. A shift toward online brand spending would be a new trend: online advertising has historically been dominated by direct response ads. Of the \$26 billion of online advertising in the US in 2010, about \$20 billion was for direct response campaigns¹³¹. Brand spending was only 23 percent of all online dollars¹³².

This contrasts sharply with the traditional media world, where branding accounts for 61 percent of all spending: \$91 billion out of \$149 billion¹³³. Some products are only advertised through direct response and some are only advertised through branding techniques; however, most are marketed using a combination of the two. Direct is good for stimulating short-term results and is more easily measured. Brand spending is more powerful over the long term, but is harder to measure. Based on a couple of centuries of advertising experience, the optimal mix appears to be about 3:2 brand:direct for the global industry, with variation by product and by region.

The pronounced difference in the branding/direct spending mix between the online and traditional media worlds has prompted some to speculate that brand might not be well suited to online: one critic labeled online “the greatest branding disappointment ever.”¹³⁴ Online, it was argued, is not effective at building up the emotional connection that makes for effective brand advertising; advertisers have no control over where their ads appeared, leading to possible brand dilution. And as with branding in the traditional world, success is much harder to measure than for online direct-response.

Direct-response online ads gave advertisers a new and much valued tool: the ability to precisely measure cost per thousand views (cost per mille, or CPM), click through rates (CTR) and return on investment (ROI). This precision was often the first thing that lured some portion of ad budgets online, and direct-response spending benefited disproportionately from 2000-2010. Meanwhile, the metrics that worked so well for direct online seemed to suggest that online brand advertising was not performing well: fewer than one in a thousand display ads were clicked on¹³⁵.

During 2011, the ad industry began to question whether CPMs and CTRs were the only metrics that mattered – or even if they were useful at all for determining the success of online branding. After all, in the traditional advertising world, no one ever clicks-through on a billboard or TV ad. But those two media account for a combined 50 percent of global ad dollars. Further, consumers were spending more and more time online: almost 2.8 hours per day, second only to time spent watching TV¹³⁶. Given all those hours, it seemed as if there ought to be some way to make online brand spending work better.

Data from 2011 shows that advertising buyers were starting to accelerate online branding spend. In the third quarter, online display spending grew 21 percent while search was up seven percent. That was off a low base – by our estimates online display grew from \$3.3 billion to \$4 billion, while search grew from \$10.2 billion to \$11 billion, so absolute search dollars grew more than online. Although brand advertising was gaining market share, so was online advertising as a whole: up 10 percent versus five percent for traditional ad spending¹³⁷.

What is causing the online pie to be carved up differently?

The most important factor is the development of new tools that allow ad buyers to have control over placement. In the past, major consumer brands worried that a traditional display ad buy might end up advertising their product or brand on an unsavory Website or adjacent to other ads or content that were not suitable for their brand image. Real Time Bidding (RTB) technology changes that by allowing brands to specify exactly where and in what contexts their ads will appear¹³⁸. RTB enables a buyer to see every other ad that will appear on the Web page, as well as to be “above or below the fold” (in traditional ad parlance), while automating what had previously been a labor-intensive process¹³⁹.

In addition, the options available for online branding have broadened. In the early days of online advertising, the only option was the standard banner ad, albeit in different sizes. But in 2011, advertisers also spent money on brand ads in videos and social networks. Successes included video ads for soap and scent that increased sales and attracted hundreds of millions of views¹⁴⁰, and social pages that allowed packaged goods makers to reduce ad spending while growing both reach and engagement, and boosting sales¹⁴¹. One large advertiser has stated that 20 percent of its total ad spend is now on social media¹⁴², suggesting that online brand is already larger than online direct – at least for that particular company.

Finally, online branding has been climbing a learning curve. In the past, many display ads were simply traditional brand ads resized for a smaller screen, or used techniques that were technologically easy to implement but offensive to consumers. Today, flashing text and pop-ups that won't go away are in retreat. Advertisers are increasingly producing special content for the online world, rather than just re-purposing print ads. Further, targeting technology and geo-location are making even traditional banner ads more relevant and effective.

Although online branding is growing from a low base, if advertisers can make it deliver ROI similar to traditional branding, at some point it will likely match the market share for online direct-response advertising – perhaps as early as 2015.

Bottom line

When thinking about brand advertising online, it may be necessary to unlearn some old habits. Most traditional media is consumed passively, and the most successful ads (such as TV ads) seem to be best delivered in a passive way. Traditional online advertising tricks such as pop-ups might not work for online brand building, as they may conflict with consumer preferences for passive consumption.

Talent may need to change as well. Ad buyers, media companies, and ad agencies all will likely need to increase, acquire or develop new skills. In the future, online advertising will go far beyond display ads and search: new talent will be needed for social, video, and real-time bidding – and these competencies are likely to be in high demand for the immediate future.

Moreover, talent may need to be organized differently. When online branding accounted for less than a quarter of all online ad spending (and therefore less than 5 percent of total ad spending) it made sense to run it from a company's online department, usually overseen by a search expert. But in the future, if online brand advertising reaches parity with online direct, it might be better to structure companies along the lines of brand and direct divisions, rather than splitting them into traditional and online departments.

Finally, it is still unclear how online branding can best tap into the human emotions that make traditional branding so effective. Although some online video campaigns have been very successful and had an emotional impact similar to the best TV commercials¹⁴³, further work can be done using neuromarketing tools such as functional Magnetic Resonance Imaging to increase the overall impact of online brand campaigns.

Market research is all in your head: MRI machines and media

Deloitte predicts that the marketing and advertising industry will likely have brains on the brain for 2012. Technology called functional Magnetic Resonance Imaging (fMRI) that provides a real-time, non-invasive window into the activity of living human brains will be used for market research and media creation. In 2012 an increasing proportion of all MRI machines and MRI hours will likely be spent fine-tuning products, services and marketing messages¹⁴⁴.

Fifty years ago, advertising executives relied primarily on their own instincts and industry knowledge to create an ad campaign. Twenty years ago, market research was conducted by polling thousands of consumers and interviewing smaller focus groups. But there have always been two big problems with asking people what they want to buy: they might not always tell the truth; and they might not know themselves.

Traditional MRI machines can cost millions of dollars, and are the size of an average car. They use very strong magnets to affect the atoms inside our bodies, causing certain atoms' nuclei to spin and produce magnetic fields that can be interpreted by sensors, eventually producing a detailed picture that is particularly good at imaging soft tissues. For example, MRI can show damage in knee ligaments that an X-ray cannot.

fMRI machines are essentially identical to the MRI machines one might see on a TV show, but have a different purpose and way of working. Our blood has very slightly different magnetic properties when oxygenated or deoxygenated. As areas of our brains become more active, they use more oxygen, and it shows up on functional MRI images. In 1991 scientists were able to show that an fMRI taken of the brain over time could show areas of activity within the brain. Because certain brain functions are relatively localized to one area, neuroscientists believe fMRI can show that activity in certain regions correlates with specific emotions and types of thinking. This isn't mind reading, so it cannot determine whether a subject is thinking of a black cat or white dog; however, it can show that a photo of an adorable puppy activates the emotional pleasure centers of the viewer's brain.

The first study of using fMRI for market research purposes, known as neuromarketing,¹⁴⁵ was published in 2004. It showed that a relatively small number of subjects (only 67, in this case) were needed to provide statistically significant data that shocked the ad world. An initial blind soft drink taste test revealed that the subjects had a modest preference for Brand A, and the parts of the brain that showed activity were not surprisingly those associated with the physical mechanisms of taste. But when specific brand logos and imagery were shown as the subjects tasted the soft drinks, they instead preferred brand B by 3:1, and the activated brain areas were those associated with memory, presumably of all those ads they had seen. Put simply, the test showed that advertising actually works – and why¹⁴⁶

There have been criticisms of the concept of analyzing brain images to study consumer preferences. Some suggest that results should be treated cautiously¹⁴⁷, some point out the very real limitations¹⁴⁸, and others dismiss it as a fad and go so far as to call it "iffy technology."¹⁴⁹

But the advertising and marketing communities do not seem as skeptical. Major market research firms are investing in neuromarketing companies, or acquiring them outright¹⁵⁰. There are a large (and growing) number of firms that offer neuromarketing research services¹⁵¹. Long established brands of baby food, soup and cookies are redesigning their packaging, and even their flavors, based on neuromarketing studies¹⁵². Movie studios are still doing advance screenings – but now, while the audience is watching the big screen, scientists are watching their brains on small screens. Movie trailers are being tweaked with neuromarketing insights; and scripts, characters and scenes are sometimes being determined by daily MRIs, rather than by reviewing daily footage¹⁵³.

Being able to optimize packaging, ad campaigns and actual media content through use of fMRI is likely to be a growth market, and is even contributing to the push for newer and more powerful MRI machines. A normal MRI machine costs about \$1 million and produces magnetic fields around one to two teslas, the international unit that denotes the magnitude of magnetic flux density. But the effect fMRI relies on becomes much more detectable with higher field strengths, and work is ongoing on machines of eight to 12 teslas¹⁵⁴.

Most fMRI work has looked at the brain and how it perceives media or advertising at a single moment in time, with an eye to improving the media or the marketing. New studies are indicating another possible application for fMRI data: improving the human brain itself.

The adult human brain is not as static as once thought: it is not set in stone at age 14. Instead, due to a process called neuroplasticity, the human brain can be like a muscle enlarged through exercise. Certain regions can become larger or denser through increased use, or become smaller or less dense through lack of use. The most famous example is that the hippocampus – a region of the brain responsible for spatial sense – grows over time in people who become taxi drivers¹⁵⁵.

In a recent experiment, students who had more than a certain number of friends on a popular Web-based social networking site turned out to have well-developed brain regions that are associated with sociability. The result was highly statistically significant¹⁵⁶, although the researchers cautioned that they couldn't be sure which was the cause and which was the effect. Did using the social network make those areas bigger, or were they already bigger in those subjects, causing them to have more friends¹⁵⁷?

Another study using MRI images, published in late 2011, provides some evidence that there may indeed be a causal link. In an animal study, primates had their brains imaged before and after being placed in social groups of certain sizes. Those placed in larger social groupings demonstrated superior growth in areas of the brain associated with social cognition and social success¹⁵⁸. To quote the researchers: "Social network size, therefore, contributes to changes both in brain structure and function."

Social media is not the only form of media that has been shown to affect or at least be correlated with brain structures. Recent studies suggest that brain activity and possibly structure could be altered by as little as one week of playing video games¹⁵⁹, and TV watching in children has also been shown to be correlated with changes in brain activity¹⁶⁰.

It is important to note that the use of fMRI in analyzing media and advertising is in its infancy. However, based on the increased frequency of scientific papers¹⁶¹ and published corporate studies, as well as the unique insights offered by these reports, it appears that fMRI and neuromarketing will likely be a key tool for 2012 and beyond.

Bottom line

The implications are intriguing, with media articles suggesting that one could deliberately harness the putative ability of social networks to re-shape human brains to enhance social, and perhaps selling skills. Some companies still ban their employees from using social networks at the work place, believing it will lead to lower efficiency. Could we one day see companies requiring employees to be on social networks a certain number of minutes per day, in an effort to make them better salespeople?

Best practices suggest that MRI and fMRI work best as part of a broader package. They do not replace traditional focus groups or years of experience or insight from a marketing executive. Also, they can be combined with other biological measurements like eye-tracking software, blood pressure readings, pulse measurement and EEG to provide a more complete picture of the human reaction.

fMRI is not cheap, but it is important to stress that the use of this technology for marketing purposes does not appear to be having any negative impact on the cost of machines for the health system; i.e., demand is not driving up the price. Nor are marketing uses of MRI machines diverting hours from required health care uses.

The most important caveat is that the links between brain structure, brain activity and media or marketing impacts are poorly understood at this time. Correlation and causation are confounding factors, plus the science is still in its early stages. We will learn more over the next five years, but in 2012 the media industry would be well advised to explore this new window on the human brain – but to also remember that it may be a pretty foggy window.

Extracting the premium from social games

Deloitte predicts that in 2012 revenue growth for the social games industry may slow to less than 20 percent. This compares to the period 2008 to 2010, when social gaming revenues grew 20-fold¹⁶². Slowing growth makes it probable that social games makers will begin experimenting with different business models. Shifting the mix to more advertising and less virtual goods looks likely, and at least some games companies are likely to move away from the hallowed “freemium” model and start charging for games up front, especially for those games with higher production values and complexity.

Social games are online games, typically played within a Web browser via a social network. They typically include light multiplayer elements and asynchronous (not real time) activity. The predominant business model up until now has been freemium: it costs nothing to start playing the game and there is no subscription to pay. Aside from advertising, monetization occurs when players pay for extra content, such as additional virtual artifacts or access to new levels of games.

Social games enabled the addressable market for video games to reach men and women of all ages: effectively anyone with a computer of any description, from a MP4 player and up. One sixth of social gamers are over 60¹⁶³. The majority are female¹⁶⁴. As recently as 2008, the traditional console game player was predominantly male, and aged 18-49¹⁶⁵.

Due to their crossover nature, mass market audience, platform-neutrality, and low entry costs for players and developers alike, social games were expected to transform the entire industry. At first, this seemed likely: the easy-to-enter freemium revenue model coupled with social rewards¹⁶⁶ rapidly proved a compelling combination for hundreds of millions of consumers.

However early growth numbers have proved difficult to sustain. By some metrics, and for some developers on certain platforms, the trend was actually negative in 2011¹⁶⁷. The social games user base grew very little over the past two years¹⁶⁸, even though revenues have continued to grow. Although the percentage varies across games and over time, it appears that only about one to three percent of those playing social games spend real money on virtual goods (known as the conversion rate¹⁶⁹). Further, the core group of paying users, or “whales”¹⁷⁰, already provides an outsize portion of social game revenues. 46 percent of one company’s revenue comes from the top one percent of users. This group may be reluctant to up its spend beyond the hundreds, and in some cases thousands of dollars invested per year in their virtual ecosystem.



Social gaming companies can also generate revenues from other sources such as in-game advertising, but at present virtual goods remain the largest piece of the pie. One large social games company gets only five percent of its revenues from advertising¹⁷¹, and even across the broader industry the average ad contribution appears to be only about 14 percent¹⁷².

If the audience cannot be grown, and users are reluctant to play, one approach for social games companies could be to increase the number of titles each user plays or the number of hours they spend on each game. But the average person is already spending almost eight hours per month on even the most popular social networks, and that number has risen only slightly in recent quarters¹⁷³.

Another approach is to add another layer to the social games business model: pay. This may seem counter to the spirit of social games. But today's leading social games boast ever higher production values and storyboarding. In other media, and in other gaming sectors, consumers are willing to pay for content that they previously received for free, especially if it is perceived as being of high quality. Pay TV is a prime example of this in traditional media, and in the games sector, enthusiasts already pay for access to massively multiplayer online role-playing games (MMORPGs), or to access the online services for consoles.

Bottom line

Social and casual games are likely here to stay, but it may prove challenging to increase their share of the total \$63 billion global video games market significantly beyond its current two percent¹⁷⁴, if the monetization model remains constant.

Social games' path to higher revenue may lie in iterating the business model, and charging to play games. Revenue models for social games have been primarily dependent on three factors: increasing the installed base, usually measured as "monthly active users" or MAU; increasing the portion of users who pay for content; and increasing the amount that each user pays. All three approaches are valid, but it may now be the time to add a fourth approach – charging to play at the outset.

The social games sector should also learn from the console gaming industry. Developing strong franchises and quality sequels may not be cheap, but it can be very lucrative. The media title that reached \$1 billion in revenues faster than any title in history is not a famous 3D movie about aliens... but a video game from a franchise in its eighth iteration and over eight years old¹⁷⁵. It may be time for the leading social games companies to recognize the much-changed quality of their latest titles and charge for them.

Online coupon intermediaries: from novelty, to celebrity, to sizeable niche

Deloitte predicts that in 2012 the number of people signed up to receive online coupon newsletters may decline moderately, as may the number of online coupon intermediaries (companies that aggregate discounts from retailers and distribute them to potential consumers via e-mail). However, the total value of coupon deals enabled by intermediaries around the world should remain in the tens of billions of dollars, and the revenues to those intermediaries will likely remain in the billions – a small amount within the context of all consumer retail, but still a significant sum.

Everyone loves a discount... except for most retailers, who remain focused on their bottom lines¹⁷⁶. The intermediated online coupon model has its appeal and its limitations: discounts drive consumer interest, but erode margins. And when an intermediary is paid a commission on every coupon sold, the profit hit is even greater. Also, offering discounts too frequently can lead existing customers to expect perpetual discounts – a perilous predicament for retailers.

For this reason there likely will never be many major retailers whose business model is predicated on continuously offering coupons via third-party intermediaries. While some retailers may take this approach occasionally, for most it is simply not sustainable. Long-term discounting is only possible for companies that have high nominal gross margins, and little or no direct competition (which makes direct comparison difficult). Service companies, such as those offering non-standard beauty treatments (e.g., teeth whitening), leisure experiences (e.g., hot air ballooning) and other relatively irregular services may fall into this category¹⁷⁷.

In 2012, the majority of companies that hire intermediaries to offer discount coupons for their products and services are likely to be small businesses that lack the marketing capability to raise brand awareness on their own and have a hard time coping with the fire hose of demand that Internet aggregation can send their way¹⁷⁸. Larger companies are likely to have their own distribution lists and will offer discounts directly to their own customers¹⁷⁹, rather than using a third party – especially one that charges up to 50 percent commission¹⁸⁰.

Although the online coupon business is relatively young, it may already be approaching maturity. There are already hundreds of millions of subscribers to online coupon newsletters. And in two of the largest markets, China and the US (which are also two of the world's largest Internet markets), there are thousands of companies offering online coupons¹⁸¹. One reason the online coupon business has grown so quickly is that barriers to entry have been relatively low – requiring little more than a Web site, a sales force, and good copywriters. There are arguably few magic algorithms involved, although over time brand will become increasingly important.

One of the challenges of the online coupon model is that, unlike other online services such as search, it is not a self-service, largely automated business. An online intermediary needs writers to create advertising copy for the newsletter. Further, the sales model relies on a dedicated sales team, as well as a strong technology team. So as sales volume grows, the organization must grow as well.

The sector's rapid evolution means that it is likely to lose hundreds of players (out of thousands) in 2012 as competition ramps up and margins decline¹⁸². Despite this gloomy forecast, additional companies are likely to enter the market, particularly in places such as emerging economies where Internet use and digitization are rapidly rising. Yet the overall number of intermediaries globally should decline.

Online coupons offered by intermediaries are not going to go away, much as discounting or paper coupons will never disappear. However, the notion of a growing market of consumers responding on a frequent basis to a daily stream of discounted products and services is unlikely to materialize.

The online coupon intermediary industry began as a novelty; as demand ramped up in 2011 it became a celebrity; and in 2012 it is likely to settle into a small niche, albeit one that can still generate billions of dollars in revenues globally. While it may not be the future of retail marketing, it is likely to remain an important component.

Bottom line

End-customers that use online coupons will continue to do so as long as there is a continued flow of offers that appeal to them. However, part of the appeal hinges on obtaining a significant perceived discount on products and services they wish to consume. A major challenge for online coupon intermediaries in 2012 will be to increase the quality and variety of offers available. Another key challenge could be how to increase interest from retailers who may have been less than happy with their first experience¹⁸³. Although satisfying consumers and retailers is likely to become markedly harder in 2012, it won't be impossible. But in order to succeed, online coupon intermediaries will likely need to rapidly evolve what they offer.

In the near-term, intermediaries may have to accept lower commissions on sales of coupons. This could entice more retailers to consider using their services, which in turn could increase the variety of offers available.

Intermediaries also should consider whether to focus on narrower categories of products and services across a wider geographic area, rather than just pushing deals within the subscriber's local neighborhood. Intermediaries might then be able to sell more coupons based on their ability to offer an appealing, specialized range of products and services, instead of relying on size of discount as their major selling point.

In addition, the industry should address one of the major criticisms leveled against it – that of encouraging bargain hunters to make one-off purchases. One way to address this would be to offer coupons that focus on economies of scale (e.g., repeat visits to the same establishment), rather than just discounts on one-time visits or purchases.

By shifting the focus from discount size to value, utility or even rarity, online coupon intermediaries could change the perception of their offering from a last-ditch sales effort to a deliberate and innovative part of a company's marketing strategy.

Telecommunications



The \$100 “smartphone” reaches its first half billion

In 2012, Deloitte predicts that by year-end over 500 million¹⁸⁴ smartphones with a retail price¹⁸⁵ of \$100 or less will likely be in use worldwide¹⁸⁶.

The definition of a smartphone for this prediction is based on consumer perceptions of what a smartphone is, rather than the standard industry definition, which pivots on the type of operating system (OS) used. Many consumers, particularly middle majority adopters, are likely to consider phones as smart if they have touch screens or full keyboards and not what intangible OS is under the hood¹⁸⁷. Consumers may regard \$100 smartphones as superior to feature phones from the same manufacturer, even though the two form factors might well share many components.

The \$100 smartphone could be considered analogous to the netbook – a lower priced, less powerful version of the PC, which has served the needs of tens of millions of individuals who want a computer, but do not necessarily require the computing power, memory, graphics capability or broad functionality of a standard laptop.

Deloitte predicts that the \$100 smartphone will sell at least 300 million units in 2012, representing about 20 percent of all mobile phone shipments in 2012, and about a third of all smartphone production (based on our broader definition of smartphones). Deloitte estimates that the installed base of \$100 smartphones stood at roughly 200 million at the end of 2011¹⁸⁸.

As for connectivity, most \$100 smartphones that ship in 2012 are likely to have GPRS and EDGE. Few \$100 smartphones are expected to have 3G, unless the cost of an integrated 2G and 3G chipset falls to that of an EDGE chipset, whose cost should be well under \$10 in 2012¹⁸⁹. A key upgrade in the \$100 smartphone between 2011 and 2012 will be the incorporation of Wi-Fi as a standard part of the feature set.

The devices are likely to support e-mail and instant messaging (IM) services, and to feature a selection of pre-loaded apps and widgets including a Web browser that works best with, but is not restricted to, mobile-specific sites and apps. In many \$100 smartphones, the OS may be closed, curtailing the ability to download apps; however, this may not matter to customers interested in low-end smartphones. What is possible on these devices is still far superior to what most feature phones offer. Further, a closed OS has lower processing requirements, enabling lower-cost CPUs¹⁹⁰.

At the start of the year, the processor in a \$100 smartphone is likely to be about 200-600 MHz, well below the processing power of high-end smartphones, some of which will have multiple cores and clock speeds of over 1.5GHz¹⁹¹.

The \$100 smartphone will also likely include a basic camera with at least 2 megapixel resolution that is good enough for basic snapshots in natural light and ad hoc videos.

Due to the lack of widespread 3G data network coverage in some target markets, \$100 smartphones will often come preloaded with a suite of apps and features that a typical user would be most likely to use and value. Mapping and navigation features may also be included to drive sales, but weaker digital mapping data in the developing world may limit utility in those markets.

The \$100 smartphone is likely to appeal to many different market segments.

The largest of these is likely to be the hundreds of millions of mobile phone users that have not yet acquired a smartphone¹⁹². In developing markets, consumers may consider the \$100 smartphone as their first trade-up, having previously owned a feature phone. In those countries, penetration of personal computers and home Internet access is also relatively low: often less than 20 percent of households. But with demand for communication and information rising everywhere, the \$100 smartphone may offer the easiest, most affordable way to satisfy communication and information needs in the developing world, even if \$100 for a device will still remain an inaccessible price for hundreds of millions in emerging countries.

In developed countries with stagnant economies the device might offer a way of retaining the smartphone look, but at much lower cost.

The price may also appeal to parents looking for the perfect teenage 'starter' phone.

The \$100 smartphone is also likely to appeal in markets where the cost of devices is not subsidized, and to pre-paid customers who want to upgrade from their existing feature phones.

Bottom line

Operators should consider how best to ease these customers into using data; to that end, predictability of the data bill will be absolutely key. With voice service there is a relatively simple relationship between time spent and cost, but with data the bill for watching a few minutes of video could deliver a "bill shock" to a new data user – causing them to shy away from all future data services. Data offerings that are more appropriate for people with constrained budgets, such as apps with bundled connectivity, may entice more customers to use data.

Handset vendors should constantly revise their \$100 smartphone offering; a specification that was perceived as market leading at the start of 2012 may well be considered market trailing by year-end. The price of many components is steadily falling – for example the cost of touch screens has dropped by about 30 percent annually in the recent past. This will enable the specification of the \$100 smartphone to continue rising for years to come.

App developers should note that \$100 smartphone users might not download very much content and may be even less likely to pay for it. Some users will have less technical ability than existing smartphone owners and could find downloading apps over the air more mystifying than magical. And some may not have data network access. Also, many \$100 smartphone owners will not have credit cards. In some cases operator billing might be the answer; in others, sales of pre-paid cards might be a better solution.

In addition, app developers may need to create variants of their apps that are suitable for lower priced smartphones that come with relatively low-powered processors.

Growing sales of \$100 smartphones are likely to cause downward pressure on prices for the whole supply chain. Component manufacturers may come under growing pressure to lower their prices¹⁹³; this could give component suppliers from emerging markets an opportunity to break into the smartphone market¹⁹⁴.

NFC and mobile devices: payments and more!

Deloitte predicts that in 2012 shipments of devices equipped with near field communications (NFC) capabilities will likely grow about 100 percent to almost 200 million. In 2013 there may be as many as 300 million NFC smartphones, tablets and eReaders sold. This compares to a 2010 when fewer than 50 million devices were purchased¹⁹⁵. Over the long run, NFC-enabled devices are likely to find a wide array of uses – especially for payments. But even in 2012, NFC capability will likely be used for a surprisingly diverse range of non-payment applications, including gaming, security, authentication and information.

NFC technology enables a secure exchange of information between devices over a very short distance (usually up to four cm) at a relatively low transfer rate¹⁹⁶. NFC is not suited for high-bandwidth applications such as video but is ideal for transmitting small amounts of information with minimal set-up time and power consumption. In these respects it outperforms other wireless technologies such as Bluetooth, SMS and infrared¹⁹⁷.

It has long been believed that a critical mass of NFC readers at retailers – combined with ubiquitous smartphones and tablets – would provide the required environment for the ‘digital wallet’ to take off¹⁹⁸. In the short term, however, consumers may not yet be comfortable using a mobile phone as a payment device. In one recent survey, over a quarter of respondents were concerned about security, battery life, or simply preferred to use their phone only for voice – perhaps out of habit¹⁹⁹. That could change quickly though. One analyst has forecast \$50 billion of NFC-enabled payments by 2014²⁰⁰. Currently the global payments market turns over more than \$30 trillion per year, generating revenues of \$900 billion²⁰¹.

Mobile banking and payments have already enjoyed significant success in emerging markets where many people have cell phones but few have credit cards or banks accounts²⁰². It is possible that NFC mobile devices could do well in similar markets, particularly in major cities, which are more likely to have NFC-enabled point-of-sale (POS) terminals. Numerous initiatives between local operators and financial services providers have been launched²⁰³. It is expected that 700 million people in emerging markets will be using mobile money services by the end of 2015, and many of those services could be enabled by NFC²⁰⁴.

But what about 2012? Many consumer perceptions and concerns in the aforementioned survey are not well-founded. NFC uses barely any battery power and is significantly more secure than many other forms of payment technology, including magnetic stripe credit and debit cards²⁰⁵. But until the industry can correct those misperceptions, consumer adoption of NFC for payments may lag. Although virtually all new retail POS terminals are capable of interacting with NFC-enabled mobile devices, the large installed base of older POS terminals might hold NFC transaction levels down until early 2013. Only two percent of merchant locations in the United States had incorporated NFC readers as of mid-2011, and terminals are only replaced every seven to ten years²⁰⁶. Finally, consumer adoption of NFC payment using smartphones may be slowed by alternative contactless payment solutions, principally the 200 million contactless credit and debit cards forecast to be in circulation by the end of 2012²⁰⁷.

Even if 2012 turns out to be what one payments executive referred to as “a transitional year for mobile payments,”²⁰⁸ those NFC chips on smartphones won’t go to waste.

An obvious near-term market for NFC is replacing the access cards that adorn hundreds of millions of workers around the world. Carriers working with phone manufacturers have already launched trials for phones that replace those cards²⁰⁹, and 2012 will likely see larger rollouts. While replacing one card, NFC phones can also help get rid of another: with a single tap, all of the information on a traditional paper business card (and more) can be seamlessly transferred to another phone’s contact file²¹⁰.

The video gaming industry is always looking for fresh ways to engage with players. One online video shows some early ideas of how an NFC-enabled phone could be used in gaming. The examples are fairly simple, with children playing card-matching games, or gaining new levels by tapping phones together²¹¹, but the concepts are interesting (and simple concepts can hold surprising mass-market appeal²¹²). Other gaming applications include the ability to interact with real-world objects, such as figurines or even bird-shaped plush toys, in the case of one popular casual game often played on mobile devices²¹³. Or the technology could enable a real-world treasure hunt used to promote a movie or film festival²¹⁴. The gambling industry is also experimenting with NFC phone enhancements.

Another market that will likely emerge as an NFC success in 2012 is as a potential replacement to QR codes. Those 2D-barcodes are ubiquitous, but seldom scanned. They convey limited information, and many users find them unreliable or finicky to use. In fact, only five percent of US adults scanned a QR code in 2011²¹⁵. As a result, some technology companies are embracing NFC solutions that can be read by phones as an alternative to QR codes²¹⁶.

Other vertical markets examining the use of NFC phones include the automotive²¹⁷ and healthcare industries²¹⁸. NFC phones could work with a car's sound system or act as the vehicle's key. And in a home health care setting, NFC could be used to transmit patient vital signs and other physiological measurements to healthcare workers at a central site.

As over 200 million NFC-enabled mobile devices are deployed in 2012, many headlines will probably focus on how much or how little they are being used for payments. The vast market potential for payments justifies this focus; however, it is worth remembering that there will be literally thousands of other applications for NFC, and that payments are not the whole story.

Bottom line

Given the possibly slow adoption of payment solutions on NFC phones, device manufacturers need to weigh the benefit of adding NFC technology to mobile devices. The incremental cost is relatively small (probably around \$3-\$5 at present, but declining sharply as volumes rise²¹⁹) but it is not zero. mobile phone vendors need to assess the value of offering an NFC-enabled mobile device as a source of competitive differentiation. They may also need to encourage the development of non-payment applications, and work with standards bodies to help NFC take root.

Application developers need to be involved in the NFC ecosystem in order for non-payment applications to emerge. The promise of increased in-app purchases could help entice developers to create NFC-enabled applications. Corporate adoption of NFC phones as ID cards could also be a key driver and significantly enhance the perceived value of owning an NFC-enabled phone.

The complexity of the NFC value chain is a possible barrier to expanding the NFC payment market. Increased adoption of NFC payment services could be influenced by improved collaboration between the different players in the space. Operators, who have existing billing relationships with customers, merchants, OEMs and financial institutions, need to ensure that the business model they choose will ultimately benefit the end-user. To promote NFC adoption, they need to offer a wide range of merchants and value-added services, including promotional discounts and coupons via smart tags, as well as loyalty schemes that consumers find appealing.

Web bypass: delivering connectivity without the Internet

Deloitte predicts that by year-end 2012 over 80 percent of all wireless traffic going over short-range (under 10 meters) connections will likely be data; the volume of data carried over those connections will likely have doubled year-on-year, and that over one percent of all wireless data will likely be exchanged directly between devices instead of being routed through the Internet – a 100 percent year on year increase. Although wireless data traffic will likely still be dominated by cellular and Wi-Fi for the near future, short range wireless connection technologies are likely to double in bits carried every year through 2015 and most likely beyond²²⁰.

Short range wireless connections are far from new. In the 1990s, the most common approach to exchanging data directly between computers and mobile phones was via infrared (IR). This worked, but was slow, and required precise positioning: pairs of IR ports needed to be in each other's line of sight.

Bluetooth, in all its iterations, offered an upgrade to infrared as a way to connect devices and has been used predominantly for voice communications, connecting hundreds of millions of phones to personal hands-free kits and to hands-free car kits. However Bluetooth has seldom been used for data.

In 2012, a spike in demand and an improvement in supply are likely to lead to a doubling in the volume of data sent via short range wireless networks.

Data demand from fixed and mobile subscribers continues to grow at a double digit rate. Growth in fixed network traffic is rising at such a pace – over 30 percent year-on-year – that over 100 million fixed broadband users may be migrated to a capped service in 2012²²¹. Mobile users have already largely been moved over to caps, which in turn has caused a change in network behavior, as more and more data exchanged between mobile devices has been sent via Wi-Fi, a practice known as “Wi-Fi bypass” or “Wi-Fi offload”²²².

Demand for data connectivity is likely to grow in line with the installed base of data-centric devices in the market. In 2012, tens of millions of tablets and hundreds of millions of computers²²³ and smartphones²²⁴ will likely be added to the world's installed base of connected devices. Added to that, a growing number of media devices, from Internet connected TVs, and Wi-Fi radios (which receive at up to 300 Kbit/s) will likely further strain the Internet²²⁵. And that strain will likely grow, regardless of the connection to the Internet: wired, Wi-Fi or cellular.

Further, the growing number of devices owned by individuals and households is catalyzing the offer of services that harmonize data, such as music files, photos and videos, across all owned devices. The updating of all devices, if undertaken entirely via the Web, could represent significant additional traffic.

How can demand for connectivity be satisfied while also containing capital investment in access and core networks?

The answer is likely to lie in a greater use of short-range wireless connectivity, which will be increasingly used to exchange data directly between devices, rather than via the Web. This is a logical progression in the evolution of data connectivity. Much as data transmission from mobile networks does not necessarily need to go via cellular networks, file transfer between devices does not necessarily need to be routed via the Internet.

Exchanging files between groups of workers on the same project team, and working within the same project room; relaying media files to wireless speakers and displays; sending photos from a smartphone to a tablet computer or printers will likely all increasingly be undertaken using short range wireless technologies.

Web bypass will not just take data traffic off the Web: it will also catalyze the flow of data between devices in close proximity. Video files that are generally too large to send via even the most generous of e-mail services will now be sent between devices when they are within close proximity.

To meet this demand, a growing number of wireless technologies are likely to be promoted. Iterations of Bluetooth, wireless USB and further proprietary technologies are all being launched²²⁶.

But the biggest supply shock may simply be the ultimate disruptor – ease of use. Multiple short range technologies are becoming increasingly available, and they all have different capabilities in terms of power consumption, power up time and data transmission speeds. The short-range wireless technology that ends up becoming dominant may well be that which offers the best user interface, rather than the one with the best technology.

Bottom line

Networks offering high utility will always tend to become congested. As bottlenecks approach there are two solutions. One is to increase capacity, the other is to smooth or lower throughput. The capacity of public and private wireless networks, such as cellular mobile and Wi-Fi will keep expanding. But demand for data capacity appears to be growing at a faster pace – it may prove hard to build a network, based on a single technology that can cope with a doubling in demand every year – and still make money²²⁷.

Fortunately connectivity needs vary and so do network technologies. It is not optimal to use the same network technology for all communication needs. It is making less and less sense, for example, to use the Web as the default network for exchanging data between devices that are within close physical proximity.

Network operators should therefore consider Web bypass as a third approach to delivering wireless connectivity, in addition to cellular mobile and fixed broadband connected Wi-Fi. Operator differentiation is likely to become dependent on their ability to offer their customers an appropriate range of network technologies, and to manage most, if not all of the network deployment and network selection challenges. The network operator is becoming more and more a *networks* provider, and their value add will be in simplifying the underlying complexity of multiple co-existing network technologies.

Device vendors should evaluate all available short-range wireless connectivity options and determine which individual or multiple technologies to incorporate and promote. Battery usage and throughput may be key factors. Device vendors should also include software that determines which network technology is best to use for each type of communication, be this an e-mail or a video.

Short range wireless technology vendors are likely to need to work with device vendors, chipset vendors, app developers and other entities to ensure that their technology attains critical mass. But they should also note that there is likely to be room for more than one provider in this space.

Here come more data caps: it's the end of the (wire)line for unlimited Internet

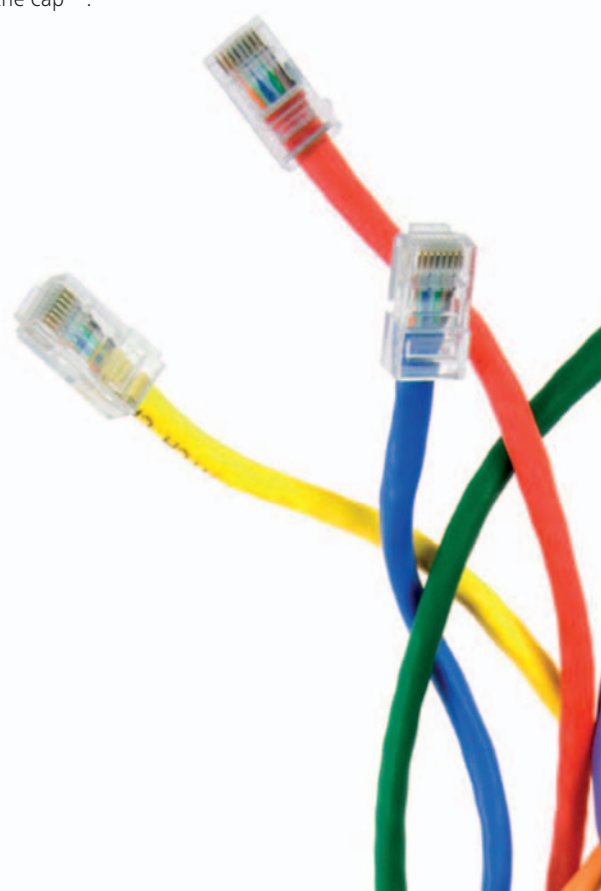
Deloitte predicts that in 2012 a further one hundred million Internet users will likely need to start watching the meter on their wired broadband connection. Although most users of wireless data around the world have become accustomed to monthly bandwidth caps, the majority of broadband connections – over phone, cable or fibre – have been unlimited until now. But a recent acceleration in data usage is causing Internet Service Providers (ISPs) to rethink their all-you-can-eat pricing approach. At least an additional 20 ISPs, in five countries, serving more than 100 million users (or about 20 percent of the more than 500 million broadband subscribers globally²²⁸) will likely have explicit monthly bandwidth caps by the end of the year.

OECD data from late 2010 demonstrates how rare bandwidth caps have been for landline Internet access. Across 34 countries surveyed, there were just four countries all of whose ISPs had caps. In another five countries, 50 percent or more of the ISPs surveyed had caps. In the remaining 25 countries no ISP or only a minority of ISPs had a cap – and these represented many of the largest countries in Europe, Asia and the Americas²²⁹.

What would cause the end of all-you-can-eat data plans for wireline? The same phenomenon as in wireless: if you offer unmetered data, users, particularly a small proportion of them, will take full advantage of that offer. Until 2010, Internet access was primarily for services that benefited from broadband, but were not reliant on high speed, especially Web browsing and email. More recently, growth in streaming video, social networks, torrents, cloud services and gaming have thrown a tidal wave of demand at ISPs' networks. As various wireless carriers have moved away from unlimited data plans, many consumers have pushed as much of their data traffic from cell phones and tablets onto their home Wi-Fi networks. This has helped ease cellular wireless congestion, but at the cost of the wireline congestion.

According to one study, the demand for data per subscriber is growing at over 30 percent year-on-year, to almost 15GB per month. Email is only 0.23 percent of that traffic. Video is over 100 times larger, at 26 percent, and expected to keep growing faster than overall data demand²³⁰. Further, that demand is neither evenly spread over the day nor across all users. Average data demand in ISP networks between 7 am and 11 pm is four times higher than between 2 am and 5 am, and 25 per cent of all downloaded data is consumed by less than one per cent of subscribers²³¹.

Uneven data demand by time and user puts stress on ISPs' networks. Pressures to maintain profitability and constrain capital expenditures while retaining market share mean that relentlessly adding network capacity is likely to become increasingly challenging, so many ISPs are instituting bandwidth caps. There is tremendous variability in the caps being proposed: globally they can be as low as 1 GB per month or (from one ISP in Japan) as high as 900GB²³². While there are no reliable surveys of average data cap size around the world, it appears that roughly 100-250GB per month is increasingly frequent²³³. At the 250GB level, it appears that less than one percent of all users will be affected by the cap²³⁴.



Many methods are used to enforce the bandwidth caps. Some ISPs bill overage charges automatically, others send a warning for a first time over the cap, and then bill for subsequent overages on a per GB basis. Also used (at varying levels of transparency) is speed based enforcement: as users go over the bandwidth cap their data rate is throttled back, sometimes to as low as 64 Kbit/s²³⁵.

But whether it is a billing-based cap, or a speed-based cap, the net intent is to moderate demand.

Bottom line

A few years ago, it was assumed that any ISP that had previously offered unlimited data would find it impossible to “put the genie back in the bottle” and impose a cap. More recent experience has shown that if consumers are involved in a conversation about the benefits of caps (less network congestion, higher speeds at peak times) and the facts that caps are likely to affect only a very small minority of subscribers, the consumer reaction can prove entirely manageable.

Most users whose behavior causes them to hit the ceiling have been consuming data at that rate because it was unmetered. Once the meter is on, their usage patterns generally change. This helps reduce network congestion, but means that data caps are not likely to be material revenue generators for ISPs.

Further, ISPs can offer ways of softening the impact of a cap, which may not necessarily mean that consumers have to curtail their data use. For example, consumers can use various short-range data transfer technologies, rather than using the Internet to send videos, photos and other files between devices. (See 2012 Prediction “Web Bypass: delivering connectivity without the Internet”). Over time, as ISPs install more sophisticated technologies, including Deep Packet Inspection (DPI), there is also the potential for more flexible data caps. For example, caps may be more restrictive during peak-usage periods; but more generous otherwise. Or caps could vary by application, with steeper caps for latency-sensitive traffic like video or gaming; lower-priority, “best efforts” traffic for e-mail could be unlimited.

Finally, the trend towards more capped wireline data plans is likely to be reversed over the long term. As caps are used to manage network congestion, the rollout of much higher capacity wireline technology like the various fibre optic technology solutions may mean that either caps are removed, or are set so high as to be practically unlimited for virtually all users.



So many apps – so little to download

In 2012, Deloitte expects the number of apps available from all application stores to exceed two million²³⁶. The size of the apps market more than doubled in 2011, reaching one million in December²³⁷. As the global supply of apps grows, the proportion that are paid for (or even downloaded) by anyone other than the developers and their immediate families is likely to become ever smaller²³⁸. Even considering branded apps alone, only 20 percent are downloaded more than 1,000 times²³⁹.

This dearth of downloads does not necessarily mean the 'apps model' is fundamentally flawed. Instead, it reflects the 'winner-takes-all' nature of most online content markets, ranging from music tracks to television shows to online videos²⁴⁰.

In fact, what the market really needs is more and newer apps, not fewer. And the supply is likely to reflect this. Even when the two million milestone is reached, the number of apps should continue to rise. The principal driver for this growing catalog is the rising installed base of smartphones and tablets. This base is becoming increasingly heterogeneous, reflecting the continued strength of the five main operating systems for mobile devices, the evolution of new apps markets in emerging countries, and the widening capability gap between high-end and entry-level smartphones and tablets.

In the future, the global apps market will likely be characterized by the co-existence of multiple platforms, countries, languages, genres, manufacturers, file sizes and even model-specific application stores. To reach more than 90 percent of all apps users, a developer may need to create versions for five different operating systems (plus HTML5), five major languages, three different processor speeds, and four different screen sizes. In other words, 360 variants of a single app may need to be created in order to fully cover the global market. Each variant would count as a distinct app.

The feature and capability gap between high-end and entry-level smartphones is likely to grow, which will likely necessitate multiple versions of the same app, optimized for different processor speeds. In 2012, the fastest smartphones will likely offer quad-core 1.5-2.5GHz processors²⁴¹ while the growing number of \$100 smartphones is likely to have processors with speeds between 200MHz and 600MHz.



Today's largely homogeneous tablet market may also become far more diverse in 2012 in terms of operating systems, processors and screen sizes²⁴².

In developing countries with emerging application stores, apps are likely to be simpler and more reminiscent of the first ones for mobile phones, which appeared in 2009. In these markets, apps built in garages or bedrooms may still be able to achieve critical mass; with their success possibly driven by how well they provide locally made content in local languages.

In countries with more mature apps markets, production and marketing costs are likely to be far higher as competition intensifies. In 2012, the most expensive apps could cost millions of dollars to produce²⁴³.

The file size of apps is also likely to become more diverse, with the largest apps being several gigabytes in size²⁴⁴. Large apps are fine in countries with fast, extensive networks; but in other countries apps might need to be built with lower speeds in mind. This means including less video, lower resolution images, and perhaps breaking app downloads into multiple parts.

Bottom line

As the catalog of apps continues to swell, the gulf between the blockbuster hits and everything else is likely to continue widening in 2012 and beyond.

A few years ago, it was feasible for developers to write apps in their spare time that might rank as a Top 10 download. In mature apps markets, those days are largely over. The market has become more professional, and is increasingly dominated by major content developers, although there are still many tens of thousands of smaller companies and individuals developing new software.

Apps should exploit what the technology is able to deliver. But showcasing technology should not be an app's primary objective, but rather a by-product of it. App developers should be careful not to 'kitchen-sink' their creations – that is, throw every piece of functionality and every piece of multimedia content into it. Leaner apps may be just as appealing. They will also be cheaper for developers to create, and quicker for users to download.

As smartphone penetration rises around the world, the need for apps in local languages is likely to grow. 'Early adopter' users of apps were, given the price of devices, more likely to be professionals and people who have travelled and can speak English. The need for local language content was probably lower. As of December 2011, many top selling apps in non-English-speaking countries around the world are in English²⁴⁵.

In emerging markets, application stores need to ensure they have billing relationships with local network operators to accommodate users who do not have a bank account.

The more apps that are available, the higher the marketing costs are likely to be for those apps that are marketed at all. Most apps will never benefit from significant marketing campaigns, a predicament common to other media formats. Only a tiny proportion of unpromoted apps will likely become successful, as too few potential customers will be aware of their existence.

To stand out, application store providers should consider improving and assuring the quality of their programs. A store that can offer apps with superior power management, security and ease-of-use is more likely to catch the eye of potential customers.

Application stores that are looking to differentiate themselves may want to consider subscription models that offer hand-picked apps from various genres – apps bundles, in effect²⁴⁶. Emerging app developers may welcome such an approach as a way of introducing their content to a wider audience.

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- Printing custom prosthetics (such as titanium knee joint components);
- Printing cartilage scaffolding for use in growing replacement hearts;
- Full scale printing of artificial organs.

Source: Wake Forest Institute for Regenerative Medicine Website: <http://www.wakehealth.edu/WFIRM/>

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- The Lugn plate (stoneware) weighs 1lb and costs \$0.79, while natural ABS filament for a 3D printer runs ~\$43 per kg (3D printing is 27 times more expensive) – Source: IKEA Products, IKEA Website: <http://www.ikea.com/ca/en/catalog/products/00133123/>
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80 Maker Magazine Website is devoted to the maker community – literally, a group of people who like making things: <http://makezine.com/>

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