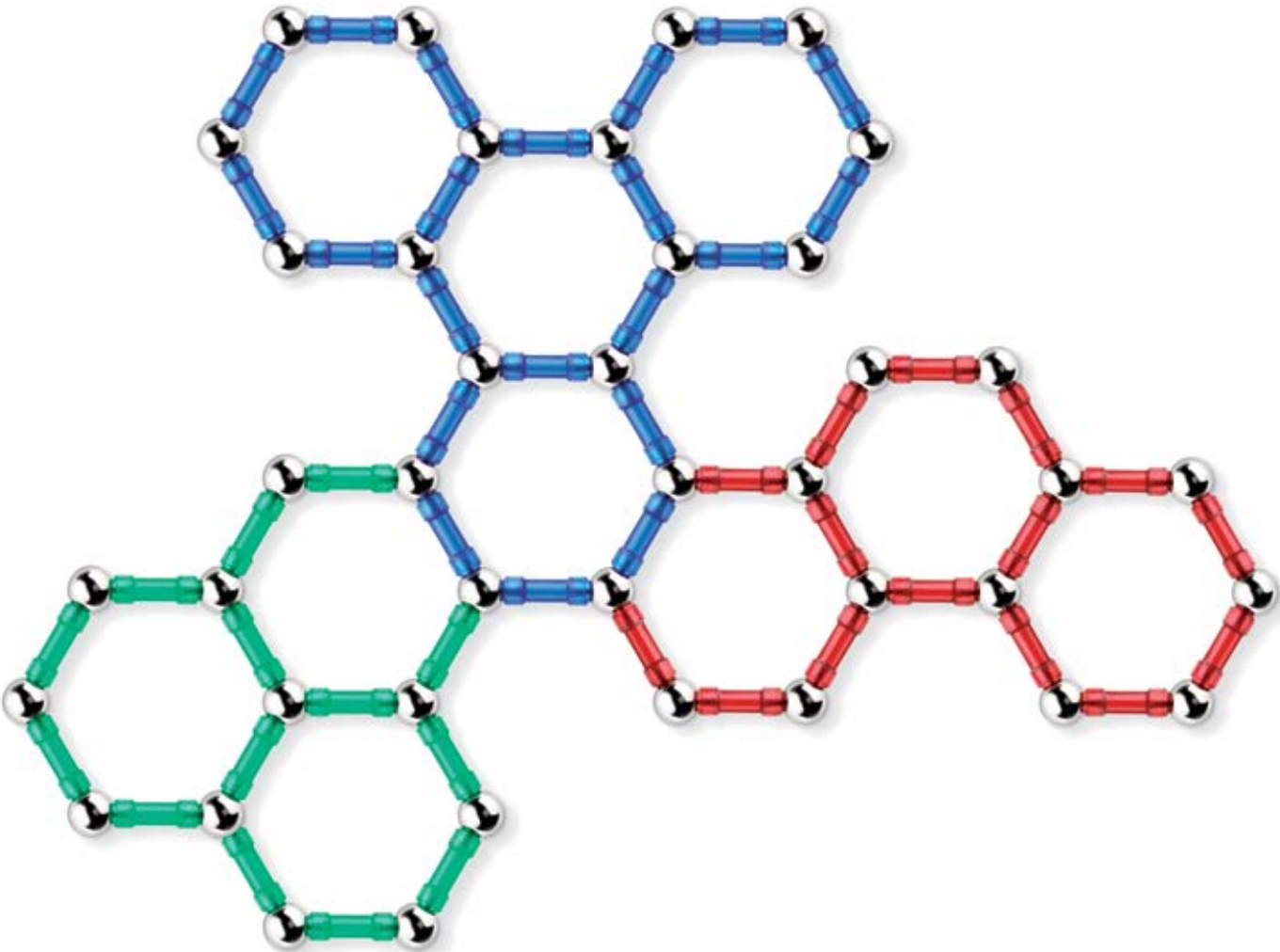


Technology, Media &  
Telecommunications  
Predictions  
2013





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“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 do not however presume that ours is the last word on any given topic: our intent is to stoke the debate.”

# Foreword

Welcome to the 12th edition of Deloitte's Predictions for the technology, media & telecommunications (TMT) sector.

This 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.

As in the previous two years, this year's Predictions report is published as a single report rather than split by technology, media and telecommunications. 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.

We are often asked what differentiates Deloitte's TMT Predictions from other perspectives. It is all about methodology.

- We have a dedicated global research team.
- We undertake extensive primary research which blends thousands of depth discussions every year with online surveys of tens of thousands of respondents in twenty countries.
- We test our predictions with clients, industry analysts and conference attendees in the months leading to publication.
- We publish only perspectives that we think are new or counter to existing consensus and which we believe our readers should know about.
- We predict change and – where we disagree with the consensus view – lack of change.
- We aim to provide clear Predictions endpoints, so that our accuracy can be evaluated annually. In 2012 as in 2011, we were just over 80 percent accurate.

We are also asked why we create a Predictions document. Our answer is simple. Our view is that across every global industry, knowing what is likely (and unlikely) to come next in TMT trends is a key competitive differentiator.

For 2013, we expect key changes to include an upsurge in momentum behind Long Term Evolution (LTE) mobile networks, the start of preparations for the next generation of high definition television, known as 4K, the first one billion shipments year for smartphones and increased challenges for standard passwords.

And we believe key non-changes include many hundreds of millions of new smartphone owners continuing to use their data capable devices mostly for voice and text messages; further we expect the PC to remain a dominant device, as measured by usage rather than just units.

We hope you and your colleagues find this year's Predictions for the TMT sector useful. As always, we welcome your feedback. We remind readers that 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 likely occur as a consequence, and what the implications are for various types of companies. We do not however presume that ours is the last word on any given topic: our intent is to stoke the debate.

In addition to the text version of Predictions in this report, a discussion around each Prediction is available as a video and podcasts.

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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Managing Director  
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Deloitte Touche Tohmatsu Limited

*As used in the Predictions, "Deloitte" refers to the Deloitte Touche Tohmatsu Limited member firm TMT practices.*



# Technology

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# The PC is not dead: it's about usage not units

Deloitte predicts that in 2013, more than 80 percent of Internet traffic measured in bits will continue to come from traditional desktop and laptop personal computers. In addition, more than 70 percent of the hours we spend on computing devices (PCs, smartphones and tablets) will be on a PC. Time at work accounts for a large portion of that, but even in our non-work lives we are likely to use PCs more than 50 percent of the time<sup>1</sup>. For most people, the PC will continue to be the primary computing device. We are not in a 'post-PC era.' We are in the era of 'PC Plus.'

Strong sales of tablets and smartphones have prompted some to suggest that the PC is becoming an anachronism. From 2010 to 2012, combined sales of tablets and smartphones<sup>2</sup> have grown from over 350 million to around 1 billion units<sup>3a</sup>. This is far greater than the volume of PC sales. PC sales also grew over that period, just at a lower rate. PC sales were 350 million in 2010, 353 million in 2011 and are likely to be about 355 million units in 2012<sup>3b</sup>.

So while not matching the growth of tablets and smartphones, PC sales have remained strong. Also, the total installed base of PCs should continue to increase in 2013, albeit at a slower pace than over the past two decades.

There will likely be almost 1.6 billion PCs in use in 2013, up from 1.4 billion in 2010<sup>4</sup>. The installed base of tablets will be about a quarter of a billion in 2013, and the base of smartphones whose data capability is used on a regular basis will be more than 1.5 billion<sup>5</sup> (For more information about smartphone usage in 2013, see 2013 Prediction: *Smartphones ship a billion but usage becomes simpler*). As replacement cycles lengthen, flat or even moderately declining annual sales figures may not imply a decline in the number of PCs owned.

Why has the PC endured and why is it continuing to endure? The simple reason is that although PCs, tablets and smartphones all have processors, memory, storage, connectivity and user interfaces, each form factor has a unique mix of these attributes that makes it better suited to certain tasks.

The most important reasons why more than a billion people will continue to perform the bulk of their computing on traditional PCs in 2013 are basic physical attributes: PCs have larger screens, full- or mid-size keyboards and mice or trackpads.

Whether reviewing documents, browsing the web or watching video, the image offered by a PC screen dwarfs that on a mobile device. A four inch smartphone screen offers a viewing area of just under seven square inches; a seven inch tablet has 21 square inches; a 9.7 inch tablet has 40 square inches. By comparison, a 14 inch laptop screen has 84 square inches and a 25 inch standalone desktop monitor gives our eyes 267 square inches to feast on. The diagonal measurements used by display makers are deceptive: for example, a desktop monitor with a diagonal measurement six times larger than a smartphone screen actually has a screen area that is 39 times larger.

Preference for larger screens manifests itself in other products, such as televisions. Hundreds of millions of people bought 40 inch TVs in the past five years through 2011, the fastest growing category in 2012 was 50 inch TVs<sup>6</sup>. In the United States, the average person watches over 30 hour per week (of TV) on large TV screens, but only minutes per week watching on four inch mobile screens<sup>7</sup>. The conclusion is that size matters. Billions of people will – when they have the option – almost always choose to look at the largest screen available.

Further, people sometimes need to create content, not just view it passively. And while it is fairly straightforward to review a spreadsheet on a tablet, using the tablet to edit even a single cell of a spreadsheet is much more difficult. What's more, creating a spreadsheet on a tablet is almost impossible. Writing a 50-word email is fine on a smartphone or tablet, but longer writing demands a full keyboard. The cutoff appears to be about 500 words<sup>8</sup>.

Certainly, there are hundreds of millions of people who almost never need to use a spreadsheet or type hundreds or thousands of words. However there are hundreds of millions who do. And for those consumers, it would be practically impossible to replace their PCs with a smartphone or tablet.

Large screens and keyboards may work in a synergistic fashion. A recent survey asked smartphone owners which device – smartphone, tablet or PC – they preferred to perform 13 common tasks. Across every single use case queried, the respondents said they preferred to use their PC<sup>9</sup>.



For many users, it does not appear to be a question of processing power. In 2009, the central processing unit (CPU) in a mid-range PC might have had four cores running at 2.5 GHz, while a mobile processor often had a single core running at 0.45 GHz. In early 2013, most PC CPUs will still have the same number of cores (now at 3GHz) but some high-end mobile devices will have CPUs running up to 2.5 GHz with four cores as well<sup>10</sup>. Nor is it applications; by and large the software that runs on PCs also has versions for tablets and smartphones.

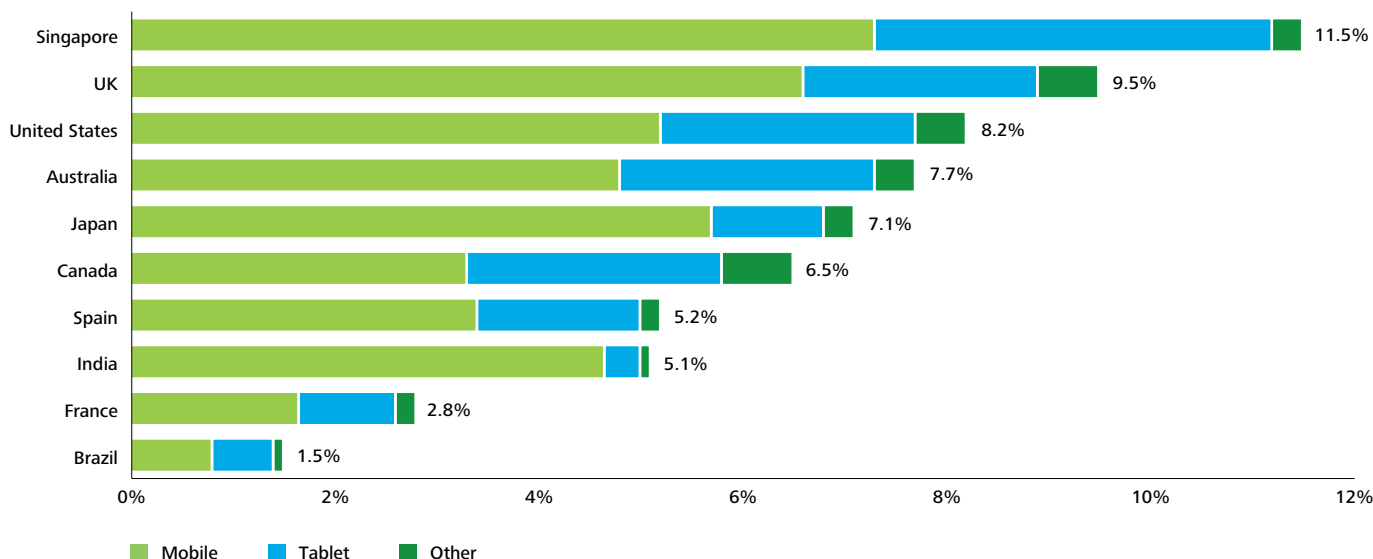
Although the difference in processing power has narrowed between PCs and mobile devices, PCs offer the unique advantage of expansion capability. The average price of a basic PC is under \$800<sup>11</sup>; however, high-end computer gamers can spend up to five times that amount on machines with more memory, ultrafast processors and thousand-dollar graphics cards. The installed base of these high-end machines is estimated at more than 50 million in 2012<sup>12</sup>. That's a small percentage of the total PC installed base, but no tablet or smartphone can duplicate the experience.

There is also a significant difference in usage patterns between PCs and mobile devices. Smartphone owners always have their device with them, and their interactions tend to be frequent but brief. One study found that owners checked their phones over 30 times a day, typically for less than 30 seconds at a time<sup>13</sup>. In contrast, PC sessions tend to be longer, especially in the workplace, and PC time outside of work is more than an hour per day<sup>14</sup>.

Despite the seeming ubiquity of smartphones, PCs still drive the vast majority of connected device traffic. In a study published in April 2012, 91.8 percent of all connected device traffic in the United States was from PCs, with only 5.2 percent from smartphones and 2.5 percent from tablets<sup>15</sup>. Further, that mix is at the high end for mobile device use globally: as seen in Figure 1, non-computer traffic across 10 countries ranged from a high of 11.5 percent to a low of 1.5 percent.

Although the share of connected device traffic from mobile devices is rising, even with very strong mobile and tablet growth their share will be no more than 15 percent worldwide by the end of 2013.

**Figure 1. Non-computer traffic for selected markets (December 2011)**



Source: comScore Device Essentials, December 2011<sup>16</sup>

### **Bottom line**

About two billion people, or one third of the global population, are online<sup>17</sup>, but that third is skewed toward developed markets and more affluent people. Of the 1.5 billion PCs currently in use, many are owned by enterprises and consumers who can afford to buy a PC, a smartphone and a tablet<sup>18</sup>. That almost certainly will not be true for the next billion people who want to access the Internet. For economic reasons many will pick one, or at most two, devices out of the three primary form factors.

It seems likely that in the developing world the PC will be substantially less dominant, and in many cases displaced by the smartphone or tablet. That being said, as Figure 1 shows, the current percentage of non-computer traffic is not higher in developing markets. Although the data is only for a sample of 10 countries, the two developing markets in the sample show lower non-computer traffic than all but one developed market.

Many people assume that young consumers around the world will gravitate toward cheaper and newer form factors such as tablets, particularly because they tend to have less money than other demographic segments. However, at least one survey shows the exact opposite. When asked which device was most important, 68 percent of all surveyed users chose a laptop and only 32 percent chose a tablet. However, responses varied widely by age: 92 percent of 18-24 year olds said the PC was their preferred device, compared to only 60 percent of those age 66-75<sup>19</sup>. This suggests that the demographics of PC use are likely to be more complex than first thought.

Website designers are devoting significant resources to creating mobile versions, which is sensible given the rapid growth in those markets. However, the traditional PC-based sites ought not to be neglected: most visits will still come from computers with keyboards and large monitors, form factors that require different design rules.

Although a search of “tablets replacing enterprise PCs” generates over 24 million hits, the actual number of PCs that have been supplanted by tablets is probably much lower. Back in 2011, Deloitte predicted that tablets would be popular in the enterprise market, and so far companies around the world have purchased about 30 million of them. However, it’s likely that only 10-15 million of those units are currently being used as PC replacements. In fact, one thing that many of the most publicized examples of enterprise tablet usage have in common is that they replace paper, not PCs – whether it is pilots taking tablets into the cockpit, doctors reviewing medical records in hospitals, restaurants showing wine lists or boards of directors using them as binders. While the enterprise PC installed base is about 500 million<sup>20</sup>, at most 15 million enterprise tablets are being used as someone’s principal computing device. Also, fewer than 5 million of these are complete PC replacements where employees had PCs taken away and now rely solely on tablets to do 100 percent of their work tasks.

# Bring your own computer: a tale of two interpretations

Deloitte predicts that in 2013, very few additional companies will adopt a bring-your-own-computer (BYOC) policy, and some of those that already have one will abandon them. At the same time, Deloitte also predicts that more than 50 percent of Fortune 500 companies will allow employees to bring their own computers. The reason for the dual prediction is that there are two common (but different) interpretations of what BYOC means.

The first arises from the bring-your-own-device (BYOD) trend, which was one of Deloitte's 2010 predictions<sup>21</sup>. Within the enterprise, employees were choosing to use smartphones that were not enterprise-approved models. Enough people did this or wanted to do it that many companies moved to allow a more diverse range of smartphones, across multiple manufacturers and operating systems.

In the BYOD model, a worker would buy a smartphone themselves – and in many markets, the price they paid was subsidized by a two or three year contract. They would then be allowed to connect that device to access corporate emails, and would have the company pay for their monthly data and voice plans, which could amount to \$1,200 or more over two years.

But PCs don't usually come with data plans or subsidies; instead the biggest cost is the upfront purchase price for hardware and software. So one version of BYOD for the PC has meant that the company, instead of providing the employee with a standard PC, will give the employee a set allowance (a voucher, or an expense reimbursement) with which they can go out and fund their own laptop<sup>22</sup>. The employee is then permitted to connect that device to the corporate network and work in the same way as on a traditionally procured PC.

There are companies that have tried and are trying this version of BYOC. But not many, and it doesn't seem to be as successful as hoped. One analysis found that only about five percent of firms have this kind of BYOC policy<sup>23</sup>. This flavor of BYOC appears higher among technology companies, where some firms have offered this for years, and the benefits touted include lower costs, higher productivity and happier employees. One enterprise that has had BYOC since 2008 has seen less than a quarter of employees enroll in the program<sup>24</sup>.

If this form of procurement worked so well with mobile devices, why not with PCs?

The enterprise PC upgrade cycle has lengthened in the last few years<sup>25</sup>. Budgets have been tight, and many employees have home PCs that may be more up-to-date than their corporate hardware, and they start asking for BYOC policies. According to research, merely offering them freshly upgraded computers could significantly reduce the volume of BYOC requests<sup>26</sup>.

Next, there are tax issues. In many countries, a PC funded through stipend or expense reimbursement is a taxable benefit to the employee, and the employer will generally not be able to reclaim VAT. If the budget allotted for a traditionally procured PC were \$1,500, the amount available for employees in the higher income tax brackets would be closer to \$750. Firms could increase the stipend so that the after tax value was equivalent, but that would add to the cost of the BYOC program<sup>27</sup>.

An additional barrier may be technical support. One of the tradeoffs of offering BYOC is that it may also involve BYO IT as well. When BYOC is only among the early adopters and/or the technologically able, then technical support can be self-provisioned, i.e. the person asks around, goes on the web, or via an online community of technically savvy users, possibly through an enterprise social network. But that may work less well for mainstream workers, e.g. a sales team. In some companies the recommended solution has been that people buying their own computer also take out a contract with a third party provider of technical support. So as well as buying the computer, they also have to buy a support contract which might cost \$200. This may work in some cases, but may not be as rapid a response as traditional IT support, is unlikely to provide a 'loaner' PC from a pool and allowing remote access to the PC for the third party help desk may well violate the firm's security policies.

On the other hand, there is an entirely different kind of BYOC that will be much more widely adopted in 2013. In this version, the enterprise continues to procure PCs for some percentage of its employees in the usual manner. But any employee who does not wish to use the employer provided PC may use their own personal computer for all work-related tasks. The employer pays no stipend, and offers no support for the machine.

In the United States, over 84 percent of households whose members are employed own a computer<sup>28</sup>. It is estimated that in some markets, a third of the working population does at least some contract work<sup>29</sup>. Some 54 percent of US businesses expect more than half their workers to work remotely by 2017<sup>30</sup>.

And another subset of employees may have very strong attachments to specific versions of computer hardware, operating systems or software.

Almost every firm will have some portion of their employees falling into one or more of the above categories, and for those workers, a BYOC policy that allows them to keep using their personally-owned machine for work purposes is a win-win situation: they get what they want, and the company doesn't have to buy, maintain, support or upgrade a device that may cost thousands of dollars per year<sup>31</sup>.

The services made accessible by the enterprise will almost always include email access, but will usually be much more than that. It may support the communications services, like conference calls and webinars. They will also usually support access to the enterprise social network, HR functions like, onboarding, training videos, online learning, expense submissions, payroll and time logging.

#### **Bottom Line**

Since the basis of this Prediction is that the stipend-based version of BYOC is unlikely to be widely adopted, the bottom line focuses exclusively on the model under which employees use their own devices for work purposes.

Allowing employees to bring their own computers, even when the enterprise pays nothing for the PC or the software on it, is not without costs. Some enterprise software may need to be available in web versions, and re-engineering those can cost hundreds of thousands or millions of dollars.

Users may also need to access certain enterprise functionality through a virtual desktop. There are a number of solutions, and they tend to cost in the hundreds of dollars per employee, although they provide relatively high levels of security: under this structure, at no point does the employee owned device ever connect directly to the corporate IT network. However, Virtual Private Network (VPN) solutions tend to require more bandwidth, and occasionally may work less well for access through cellular or home networks.

Security is a crucial aspect of allowing employee-owned PCs to connect to the network. It is necessary to establish policies around what kind of connection is allowed, and over which networks. For example, a secure PC connecting to a secure corporate network, but over an unprotected Wi-Fi home network isn't secure any more. Access should be automated so that the appropriate level of security is always enforced, and not left to the employee's discretion<sup>32</sup>.

One of the most challenging issues around BYOC involves privacy. Employees may be willing, or even pleased to be able to use their own PCs for work. And they may be willing to comply with various security policies. But they are unlikely to be ok with their employer having full access to their PC, including personal files. This creates a challenge if a PC is lost or stolen, or the employee is terminated. Employers have the right and obligation to protect corporate data, but various privacy laws usually prevent them from (as an example) remote wiping all drives on a stolen employee PC. There are various technology solutions that allow for corporate data to be kept in its own 'sandbox', but employers should also consult privacy experts to ensure compliance with various laws, which vary by country, or even state or province.

Finally, firms must create and enforce policies that make clear to employees using BYOC they have responsibilities and liabilities. These policies should cover maintaining PCs in working order, including current versions of software is kept up to date, especially around security issues like virus protection.

# P@\$\$1234: the end of strong password-only security

Deloitte predicts that in 2013 more than 90 percent of user-generated passwords, even those considered strong by IT departments, will be vulnerable to hacking. Inadequate password protection may result in billions of dollars of losses, declining confidence in Internet transactions and significant damage to the reputations of the companies compromised by attacks. As the value of the information protected by passwords continues to grow, attracting more hack attempts, high-value sites will likely require additional forms of authentication.

**How do passwords get hacked? The problem is not that a hacker discovers a username, goes to a login page and attempts to guess the password. That wouldn't work: most web sites freeze an account after a limited number of unsuccessful attempts, not nearly enough to guess even the weakest password.**

**Most organizations keep usernames and passwords in a master file. That file is hashed: a piece of software encrypts both the username and password together. Nobody in the organization can see a password in its unencrypted form. When there is an attempt to log in, the web site hashes the login attempt in real time and determines if the hashed result matches the one stored in the database for that username.**

So far, so secure. However, master files are often stolen or leaked. A hashed file is not immediately useful to a hacker, but various kinds of software and hardware, discussed in this Prediction, can decrypt the master file and at least some of the usernames and passwords. Decrypted files are then sold, shared or exploited by hackers.

For years a password that was at least eight characters long and included mixed-case letters, at least one number, and one non-alphanumeric symbol was considered relatively strong. Although not perfectly secure, such a password was considered good enough for even relatively high-value transactions such as banking and e-commerce.

How strong were they? An eight-character password chosen from all 94 characters available on a standard keyboard<sup>33</sup> is one of 6.1 quadrillion<sup>34</sup> (6,095,689,385,410,816) possible combinations. It would take about a year for a relatively fast 2011 desktop computer to try every variation. Even gaining access to a credit card would not be worth the computing time.

However, a number of factors, related to human behavior and changes in technology, have combined to render the 'strong' password vulnerable.

First, humans struggle to remember more than seven numbers in our short-term memory<sup>35</sup>. Over a longer time span, the average person can remember only five. Adding letters, cases, and odd symbols to the mix makes remembering multiple characters even more challenging.



As a result, people use a variety of tricks to make recalling passwords easier. For example, users often create passwords that reference words and names in our language and experience. Users typically put the upper case symbol at the beginning of the password and place the numbers at the end of the password, repeating the numbers or putting them in ascending order. Although a keyboard has 32 different symbols, humans generally only use half-a-dozen of these in passwords because they have trouble distinguishing between many of them<sup>36</sup>. These tricks and tendencies combine to make passwords less random, and therefore weaker.

In a recent study of six million actual user-generated passwords, the 10,000 most common passwords would have accessed 98.1 percent of all accounts<sup>37</sup>. Non-random distribution allows hackers to create a file, or "dictionary," of common password words and phrases, and symbolic variations, making cracking an account thousands or millions of times easier.

But non-random passwords aren't even the biggest problem. The bigger problem is password re-use. The average user has 26 password-protected accounts, but only five different passwords across those accounts<sup>38</sup>. Because of password re-use, a security breach on a less-secure gaming or social networking site can expose the password that protects a bank account. This is exactly what happened in a series of breaches in 2011 and 2012, and there are now websites where tens of millions of actual passwords can be accessed<sup>39</sup>.

There have also been advances in the hardware used to crack passwords. Dictionary and behavior-based attacks are elegant, but 'brute-force' attack can also succeed. A brute-force attack simply applies each of the 6.1 quadrillion combinations for an eight-character password until one works. A dedicated password-cracking machine employing readily available virtualization software and high-powered graphics processing units can crack any eight-character password in 5.5 hours. The cost of such a machine was about \$30,000 in 2012,<sup>40</sup> but hackers don't even need such powerful machines. Crowd-hacking lets hackers distribute the task over thousands of relatively slow machines, each attacking a different part of the puzzle, to crack a password much faster than any single machine<sup>41</sup>.

With so many threats, we might expect users to be adopting longer and stronger passwords. That has not occurred, in part because of the difficulty of entering passwords on mobile devices. In general, mobile passwords tend to be less secure than those used on a PC<sup>42</sup>. On a standard physical keyboard, all 94 possible characters are easily entered; on a smartphone with a small physical keyboard, accessing all possible characters takes a bit longer; on a touchscreen-only device, a user may have to page through multiple screens just to find the "#" symbol. The average user takes 4-5 seconds to type a strong ten-character password on a PC keyboard. That increases to 7-10 seconds on a smartphone with a keyboard and 7-30 seconds on touchscreen devices. A quarter of the people surveyed admitted to using less-secure passwords on mobile devices to save time<sup>43</sup>.

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### Bottom line

The incentives for obtaining unauthorized access to accounts will remain strong so all organizations that keep passwords should follow authentication best practices. Usernames and passwords should never be stored in unencrypted form; at a minimum they should be cryptographically hashed so that hackers are limited to dictionary and brute-force attacks. A relatively simple and inexpensive technique called salting appends a random string of characters to the password each time the user enters it, effectively randomizing the hash and making hacking the code orders of magnitude more difficult<sup>44</sup>. It is also important to establish a password-creation system that rejects obvious passwords such as “password” and “abc123.” For example, one mobile device manufacturer has a blacklist of 106 commonly used passwords that are not allowed<sup>45</sup>. Finally, a strong password is useless if the password reset clue is too easily found (e.g. “mother’s maiden name”). Choosing less searchable reset clues makes the system more secure<sup>46</sup>.

Longer passwords could make systems more secure. Adding just one or two characters make brute-force attacks almost a thousand times slower. A ten-character password has 8,836 more possible combinations than an eight-character password, and the same password-cracking machine cited above would take more than 5 years to crack it. Truly random passwords would also decrease the threat from hackers. But given human nature and users who struggle to remember long passwords, refuse to regularly change passwords, and frequently re-use passwords across accounts, neither longer nor truly random passwords seem likely to be embraced. In addition, adopting longer or random passwords could increase the frequency of password resets, which tend to make the overall system less secure<sup>47</sup>.

Password-keeper accounts – single sign-on (SSO) accounts that hold several highly-secure passwords or provide access to multiple accounts – can improve adoption of long or random passwords. However, they also create a ‘honey pot’ problem: hackers will have a bigger incentive to target the password-keeper account<sup>48</sup>.

What other solutions might work better?

Multi-factor authentication is a strong candidate. Instead of requiring only an account name and password to gain access, multiple identification factors would be required. Examples of additional factors include: a password sent to a user’s registered cell phone, a dongle that plugs into a USB slot, or a biometric feature such as a fingerprint or iris scan<sup>49</sup>. Multi-factor authentication could also be attached to something most users already carry around, such as a cell phone or credit or bank card. This approach combines factors that users already possess (knowledge, behavior, passwords, computers, phones and cards in wallets) with behaviors users already understand (tapping a credit card with an embedded NFC chip, entering a short passcode).

Each type of additional factor has weaknesses, but the idea is that, while a hacker might know your username and password, they are unlikely to also know your cell phone number or have a copy of your fingerprint. While it is possible to obtain someone’s cell phone or fingerprint, it makes cracking accounts far more difficult<sup>50</sup>.

A number of technology and telecommunication companies will likely implement some form of multifactor authentication with their services, software and/or devices in 2013<sup>51</sup>. There is likely to be a direct relationship between the value of the information being protected and the complexity of the authentication process: bank accounts would be more demanding than social media networks, which in turn would be more rigorous than a computer game.

Password vaults are likely to become more popular for managing multiple accounts and minimizing password re-use, but they will require strong multi-factor authentication.

Finally, organizations must establish better password security policies. Current rules regarding password expiration, minimum length, use of the full symbol set, and password resets are vulnerable and need to be strengthened. In addition, every organization should continually monitor its systems for hacking attempts, and be ready to respond.

# Enterprise Social Networks: another tool, but not yet a panacea

Deloitte predicts that by the end of 2013 more than 90 percent of Fortune 500 companies will have partially or fully implemented an Enterprise Social Network (ESN), a 70 percent increase over 2011. ESNs are internal platforms designed to foster collaboration, communication and knowledge-sharing among employees. Because they are social, they are intended to be engaging, encouraging adoption and participation. However, many ESNs struggle to attract users. According to a recent survey, if registration is required, some 20-30 percent of employees will not sign up. Of those who register, only a third will read content once a week or more and just 40 percent will make an ESN post in the average month<sup>52</sup>.

While those numbers might appear low considering some of the more optimistic projections for ESNs, they reflect the challenges companies have always faced popularizing internal networking technologies. Enterprise tools for sharing internal information (Intranets) have been available since the mid-1990s<sup>53</sup> (albeit without the social aspect), but even when every employee's homepage is the Intranet, more than half don't use it on a daily basis<sup>54</sup>. In short, employee engagement may be a perennial issue for internal knowledge-sharing platforms.

How do the numbers from the survey correspond to consumer-oriented social networks? Some consumer-oriented social networks have large numbers of members signed up, but in general the proportion of active users is very much in line with this year's ESN survey. About 58 percent read posts once a week or less and 56 percent make less than one post a week<sup>55</sup>. A separate study suggests five percent of users create 75 percent of content<sup>56</sup>.

There may be a natural ceiling on social network usage, with any network eventually comprising a small group of super-users who contribute most content, a larger group that reads but doesn't create and a final group that doesn't create or consume<sup>57</sup>.

It might be expected that ESNs, being relatively new technologies, would primarily appeal to younger employees. In fact, the same survey said that 40-49 year olds were more than 40 percent more likely to have registered and more than 100 percent more likely to post more than four times per month than 20-29 year olds. This may not surprise those inside the enterprise who implement ESN solutions, but might surprise many outsiders who have a preconception about which age groups are most active on social networks.

There were significant variations in rates of registration, consumption of content and creation of content by geography. For example, the number of users who posted less than once a month ranged from a low of 41 percent to a high of 72 percent<sup>58</sup>. Regardless of whether ESNs are better or worse at engaging employees than previous technologies, almost all organizations are likely to desire higher engagement levels than they see today. Although the ultimate measure of ESN success ought to be the value they create, many executives will likely focus on what prevents employees from using networks and what can be done to encourage them to do so.

According to the same survey, a large proportion of employees feel that time restrictions prevent them from using ESNs regularly, or at all. Many don't have a clear idea of the potential uses and benefits, or may believe they are already overloaded with information and can't be bothered to keep up with yet another social network<sup>59</sup>.



What can companies do to improve the success rate of ESNs? The survey indicates that users feel their ESN experience could be improved if the company incorporated the ESN into existing business processes. In addition, a 'how to' guide and a list of potential uses and success stories would be valuable<sup>60</sup>. About a third of those who use an ESN say it has made a positive impact on their work. That number may generate a positive return, based on the investment in the tool; however, many organizations will likely wish to see a higher level of engagement.

A more positive way of appraising ESNs might be as a relatively low-cost, risk-managed, complementary method of communication and collaboration (internal and perhaps external) that may not be appropriate for every user and every communication, but which may be productive for some people in some contexts. Employees are being offered more and more tools, each of which is increasingly specialized. As the number of available tools rises, the number of tools not used also rises: an inescapable consequence of proliferating choices. On the other hand, the current generation of ESN tools is only a few years old. When email and cell phones were first introduced into the enterprise, they likely saw adoption rates similar to where ESNs are today.

Organizations that expect enterprise-wide ESN adoption in the very near term are likely to be disappointed; whereas those that regard ESNs as simply another form of communication that is better than instant messaging (IM) and email for certain groups at certain times are more likely to be satisfied. Further, the low marginal cost of most ESNs (many are free for the base version, bundled with other software, or no more than \$5 per employee per year) means that even small improvements in employee communication and knowledge sharing will likely produce a positive return on investment.

#### **Bottom line**

Benchmarking previous tools is a useful first step. Executives should assess what levels of engagement were achieved by previous tools, and how an ESN might be better. They can then decide what the goals for an ESN should be: Registration? Reading posts? Making posts? While it may be possible over time to achieve 100 percent registration, that level of regular consumption or contribution seems unlikely. What's more, it may not be necessary.

Age-related assumptions should be challenged. Based on the survey, ESN administrators cannot assume that enrolling younger employees will be easy, or that older workers will be resistant.

Variations by country suggest there are local best practices for encouraging productive use of ESNs. Firms may wish to look to their best performing regions and then apply what they learn to drive engagement across the global enterprise.

As with any change in the workplace, communication and training are key. Employees will likely need to be encouraged and taught how to make the best use of the ESN. Showing 'how and why' appears to be critical. Even more important is the need to clearly demonstrate the benefits of using the network; for example, showing that responses to information requests are faster and better quality via ESN than email.

Most critically, ESN needs to be part of their existing work flow and business processes. Making the ESN a part of everyday communicating, collaborating and creating seems likely to be the tipping point in building engagement and utility.

# Let's get together: crowdfunding portals bring in the bucks

Deloitte predicts that crowdfunding portals will raise \$3 billion in 2013, double the \$1.5 billion raised in 2011.

Crowdfunding portals are websites that enable large numbers of individuals to support financially a project or company, with each backer contributing just a small percentage (generally less than one percent) of the total funding. A typical crowdfunded project has thousands of backers.

Crowdfunding's growth matters to TMT for two reasons. First, some crowdfunded projects raise funds for new technological devices and media content such as computer games. Second, the portals themselves are likely to become a new type of Internet portal.

Media coverage of crowdfunding tends to focus on its role as an alternative to traditional venture capital (VC); however, there is much more to the concept. In fact, there are four distinct categories of crowdfunding that vary by type of portal and capital raised.

## Categories of crowdfunding portals

**Consumer lending** is the largest category. Financial institutions and payday lending companies have for many years lent small amounts of money at relatively high interest rates to consumers with bad credit histories. Now, these services are available online through crowdfunding. Between 2008 and 2012, crowdfunding portals likely lent more than \$1.5 billion. In 2013 these loans could exceed \$1.4 billion, up more than 50 percent from 2012<sup>61</sup>.

**Reward-based** is the second largest category of portal. Individuals go to a website and support a specific project in exchange for a reward. For example, those assisting with the development of a computer game may get a copy upon completion. Those investing more may receive a basket of games and a T-shirt. Backers of a new kind of remote-controlled light bulb might receive a quantity of light bulbs, depending on the level of investment made. Backers of a new play might get tickets to the opening; more generous patrons might be invited to a champagne reception. This category could raise more than \$700 million in 2013<sup>62a</sup>.

The next biggest category is the **donation market**. This overlaps with the reward market: many artistic endeavors that use reward crowdfunding also encourage funders to contribute very small amounts of money, typically less than \$25, without expectation of a return – except for the knowledge of having contributed to a worthy cause. Donors often receive a thank you in a program or liner notes. Traditional charities usually request donations to support their overall mission, and then decide for themselves how to allocate the funds. Crowdfunding portals can raise funds for individual projects, meaning donors can give to the project of their choice. This market may be worth more than \$500 million in 2013.

**Venture capital**, which gets the most media attention, is actually the smallest category. Traditionally, early stage startup companies are initially funded from credit cards and savings, and then reach out to friends and family. This usually covers the first \$250,000. Beyond that point startups look for money from individuals (angels) or established venture capitalists, with the first seed round raising perhaps \$500,000. Expected changes in North American securities regulation could make it possible for companies to raise money via a crowdfunding portal<sup>62b</sup>, with contributors receiving an equity stake in the company. This category is the wild card for 2013. It could raise more than a billion dollars if the rules change, but less than \$100 million if they don't.

Crowdfunding generally involves small contributions at the individual level. Although the top pledge packages can be more than \$10,000, on average the individual contribution is likely less than a thousand dollars in almost every category<sup>63</sup>. The funds raised for a particular project or investment tend to be in the thousands or tens of thousands of dollars, although on rare occasions they can be in the millions. For example, on one of the better known crowdfunded reward sites only 17 projects raised more than a million dollars and only two raised more than \$5 million<sup>64</sup>.

Still, across tens of thousands of projects and investments, the total funding can really add up. In the past five years, the 30 largest lending portals raised more than \$1.5 billion<sup>65</sup>. The largest reward platforms collected nearly half a billion dollars cumulatively. Donation sites raised hundreds of millions of dollars. Venture capital portals raised just tens of millions of dollars, but that number is expected to rise dramatically in the near future<sup>66</sup>. In aggregate, crowdfunding portals are already a multi-billion dollar industry, growing at more than 50 percent a year.

That being said, the \$3 billion that crowdfunding is expected to raise in 2013 remains small compared to comparable funding mechanisms. Traditional venture capital raises about \$40 billion annually<sup>67</sup>; charitable giving was almost \$300 billion in the United States alone in 2011<sup>68</sup>, and the pay day loan market in the United States was worth more than \$50 billion in 2008<sup>69</sup>. In each category, crowdfunding is growing much faster than traditional sources of funding, but still represents less than one percent of the total.

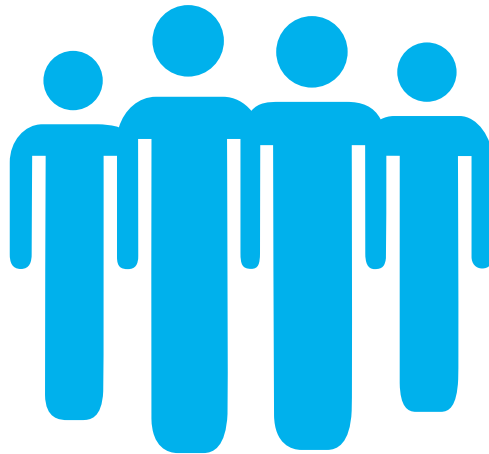
Given crowdfunding's impressive growth rate, it is worth looking at some illustrative examples. The reward-based market is expected to have the greatest impact on technology and media developers. In May 2012 a company sought \$100,000 via a popular reward-based portal to make 1,000 programmable watches, but ended up collecting \$10.3 million from 68,929 people – an average of \$150 per investor<sup>70</sup>. Most reward-based projects have tended to be for consumer products such as watches, smartphone accessories or games. In one recent survey, seven of the top ten products fell into these categories<sup>71</sup>. But there are many exceptions. Some non-consumer technologies, such as multiple-core chip architectures, also use the platform<sup>72</sup>.

Equity-based crowdfunding is often discussed as an alternative to VC for small to mid-size firms. Growth is accelerating as new platforms are launched, investor interest rises and regulatory constraints are reduced. In the United Kingdom, there are several platforms that provide equity-based financing for startups and growth capital<sup>73</sup>. In the US, a large crowdfunding portal raised \$15 million in venture capital to pursue expansion into equity crowdfunding<sup>74</sup>. In Canada, an alternative stock exchange has publicly stated its support for crowdfunding<sup>75</sup> and a provincial government is contemplating an exemption to the accredited investor rule for crowdfunding sites<sup>76</sup>, although the provincial regulator has publicly cautioned that “would represent a significant change to the current exempt market regulatory regime... [and] we may decide not to introduce a crowdfunding exemption in this or any other form”<sup>77</sup>.

Even if VC portals become larger due to beneficial regulatory changes, they may still only capture a small share of the VC market. Startup companies value the intangible contributions such as knowledge and networks that an experienced VC provides. Also, regulations protecting casual (non-accredited) investors may remain in place for many jurisdictions. Finally, investor enthusiasm may be dampened once crowd investors experience their first ‘burn’.

Crowdfunding will more likely have a role in complementing traditional VC, generating additional capital at the ‘friends and family’ stage of funding that generally precedes VC involvement. Indeed, crowdfunding could benefit the ‘A round’ market (where startup companies usually first try to access institutional money; typically for one to three million dollars) by helping more start-ups establish proof of concepts and secure their first paying customers. Further it could enable VCs to skip the riskier and more laborious early stage investing that many would rather avoid. In a recent survey, seed financing from VCs was down almost 50 percent year-over-year<sup>78</sup>, indicating that there may be a funding gap for crowdfunding to fill. Crowdfunding also brings the potential for more democratic or broader access to capital for startups and innovators without personal connections to capital.

The Jumpstart Our Business Startups (JOBS) Act in the United States has added to the excitement surrounding equity-based crowdfunding by requiring that the US Securities and Exchange Commission (SEC) consider the creation of new classes of investors who could participate in venture-like financing, in addition to the existing 'accredited investor' class. The SEC could decide to significantly loosen the rules, which would likely attract billions of dollars. However, there are many concerns about investor protection, disclosure and the potential for fraud<sup>79</sup>. If regulators don't alter the rules in a meaningful way, or if they add new barriers, the equity crowdfunding market is likely to remain small. It is unclear at the time of writing what the outcome of the SEC process will be, or even when a decision will be made: it was supposed to be by January 2013, but by mid-December, there were media stories suggesting that deadline will not be met<sup>80</sup>.



#### **Bottom line**

If regulations around equity crowdfunding are relaxed, there are likely to be increased risks – and not just for investors. While crowdfunding may open the floodgates, capital will largely flow to inexperienced inventors and project managers. Crowdfunded projects have a history of unanticipated delays as inexperienced teams struggle with project deadlines and manufacturing details<sup>81</sup>. Some research suggests that crowdfunded opportunities are a bigger risk than traditional IPOs, and that the potential for the average investor to misunderstand or misinterpret the promises of an early-stage startup are higher than for an experienced accredited investor<sup>82</sup>.

There are also risks for those who participate in reward-based projects. The time elapsed between contributing money and receiving the reward or product may not be very long, but it is longer than scooping a similar item off the shelf of a retail store, and during those few weeks or months the funded product may become obsolete, as happened for some iPhone-related projects when Apple switched to a new kind of connector<sup>83</sup>.

In the computer gaming industry, crowdfunding portals could be an important source of funding – primarily for smaller titles that need millions of dollars, not hundreds of millions<sup>84</sup>. But given the uncertain nature of the creative process, many game projects never get finished, take longer than expected or need more money. Crowdfunders are unlikely to be happy with any of those outcomes<sup>85</sup>.

# The button stays beautiful

A growing range (tens rather than hundreds) of high-end TV sets are likely to incorporate gesture or voice based controls in 2013, Deloitte predicts<sup>86</sup>. However, while the vast majority of consumers purchasing a TV set with gesture or voice capability will try out the functionality, more than 99 percent of those that use it may, in the medium term, revert to a standard remote control, due to the unreliability, impracticality or physical effort of using voice or gesture control technologies.

Manufacturers offer gesture and voice recognition for two main reasons. First, vendors need to differentiate their offerings: the user interface is a key differentiator. Second, and related to this, because it is more economically possible: the cost of providing gesture and voice recognition is constantly falling, thanks to Moore's Law.

Gesture and voice recognition work on similar principles: sensors detect arm movement or a viewer's voice, and then translate that into a command to the TV using computing hardware and software. The devices compare motions or noises to a database. The larger the database the quicker and more accurate recognition can be<sup>87</sup>. Processors get steadily faster, and memory gets ever bigger at the same price point. Moore's law matters particularly for gesture control, because movement is much more difficult for a computer to interpret than voice.

## **The computational challenge of voice and gesture recognition**

Digital computers are optimized for precise and fast numerical calculations. Numbers and text are easiest for computers to process: they are 100 percent deterministic. Phrases and sentences are slightly less so. Next in the hierarchy of data is sound, including voice. Images are even less deterministic and video is a whole other story, due to motion and time. Getting a device to understand that a person wants to change the channel while someone else in the room wants to pet the cat, or the cat is chasing a fly, and not directing the TV to raise the volume is far more complex. It will most likely happen in time, but not imminently. The challenge is algorithmic. Animal brains are constructed as neural networks which are weaker than computers at precise numerical calculations, but specialized at mapping something to 'just like'. This is largely a consequence of avoiding predation: humans don't have to see an entire lion or bear in a specific pose to know to run away. A machine optimized for arithmetic does less well with 'fuzzy' conclusions. To give an idea of the scale of the gesture control challenge, computationally and algorithmically, problems generally scale in complexity much faster than data bandwidth. If video occupies 50 times more bandwidth than voice, significantly more than fifty times additional computing power will be required to process video recognition relative to voice recognition.

The appeal to vendors of gesture and voice control is likely to increase over time, particularly as devices become more complex and the range of functionality accessible via a television set or home computer rises.

Standard remote controls, when used with the latest multiple function TVs, may oblige the viewer to navigate through multiple screens of electronic programming guides (EPGs) to get to the intended channel, or through numerous menus to access the desired function.

Finding a specific program from a large library is even more cumbersome with a standard remote control.

Gesture control could also be used to interface with the television, for example allowing children to interact with educational programs, much in the same way as games console vendors have incorporated motion detectors for games play.

One weakness of the remote control is that it is easily misplaced, usually to be found under the sofa or behind a cushion. Voice and gesture, meanwhile, are always at hand.

It seems probable that in 2013, and most likely for many years to come, the remote control will retain majority (and often absolute) control of the television set, even if gesture and voice control are used and are successful in other areas of the living room. The simple but fundamental reason why very few TV sets, including high-end models, will be controlled by voice or gesture comes down to three factors: how most TV sets are likely to be used, accuracy and practicality.

It is easy to predict that at the same price point the 2013 model of a given TV set will boast an enhanced level of functionality versus the 2012 version.

Most models of technological devices, from cars to irons, are improved each year through the addition of new features. This generally helps sell the latest model. But usage patterns change remarkably little. Deloitte's expectation is that in 2013 the majority of TV sets sold, or used in living rooms, will be predominantly employed to watch television programs and movies. They will not primarily be used to browse the Internet, play app-based games or listen to music<sup>88</sup>.

Deloitte's expectation is that the most commonly used applications for TV set controls will therefore be to change volume and channel, and that the median frequency of usage of the remote control will be dozens of times per hour, with the frequency changing in proportion to the quantity of ad breaks in the channel being watched. While TV remote controls typically have dozens of buttons, just four of these should be sufficient to provide the majority of control required. A standard remote control, with buttons ergonomically positioned to enable easy, accurate control of volume and channel, does the job. And not just a reasonable job; it almost never fails. A modern, standard remote control is 99.999 percent accurate<sup>89</sup>. If remote controls were not that accurate, we would be less inclined to moderate volume or change channel. In households with digital video recorders (DVRs), we would likely pause live TV less often and record less programs.

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Deloitte estimates that the rate of false positives or negatives for gesture control on televisions or other devices will be about 10 percent in 2013<sup>90</sup>. That is roughly four orders of magnitude, or ten thousand times greater, than traditional remote controls. Most consumers would not tolerate this level of inaccuracy for long. They would quickly go back to the standard, button-based remote control.

Voice control can be far more accurate – as discussed earlier it is a lesser computational task to interpret spoken commands where large databases of a language exist. However, to prevent the incidence of false positives, where a fragment of a conversation is mistakenly interpreted as a command, the viewer may first need to speak a control phrase, which is a sequence of words that would not occur in normal conversations to alert the TV to listen out for a command. This would work well on an occasional basis, but not dozens of time an hour.

Over time gesture control and voice control will become increasingly accurate. The efficacy of gesture control in dimly lit rooms should steadily improve and the need for viewers to be a specific distance or angle from the TV set should lessen<sup>91</sup>. Gesture and voice may become the fastest way to access specialized functionality on a video-on-demand menu. But if gesture and voice are to be dedicated to specialized or rare tasks, the next challenge will be to train users to memorize specific commands or movements for each of the potentially hundreds of functions a modern TV set offers. Users may find it easier just to scroll through the menu.

#### **Bottom line**

Gesture control – like audio control – is not impossible. But in 2013 it may be a hard and possibly overly expensive challenge to solve. In addition, some might argue it is a problem that does not require an urgent solution. The television set should evolve constantly but in 2013 the improvements and innovations that consumers may be most willing to pay for might relate to other aspects of the TV set, such as size, weight, depth, bezel, picture quality, sound or value for money.

Every improvement to a television adds cost. TV set vendors – and any other vendor considering incorporating voice or gesture control in its device – should carefully cost the impact on a set's bill of materials that adding accurate gesture and voice recognition would add. Accurate gesture recognition that works in dimly lit conditions may require additional processing capability, new cameras and other sensors in the television. This could add tens of dollars to the cost of components. Customers may prefer to trade off larger screen size in lieu of gesture recognition. The incremental cost of the components required for gesture recognition may mean that only high-end sets, the price of which may absorb the cost of additional materials, will offer this functionality.

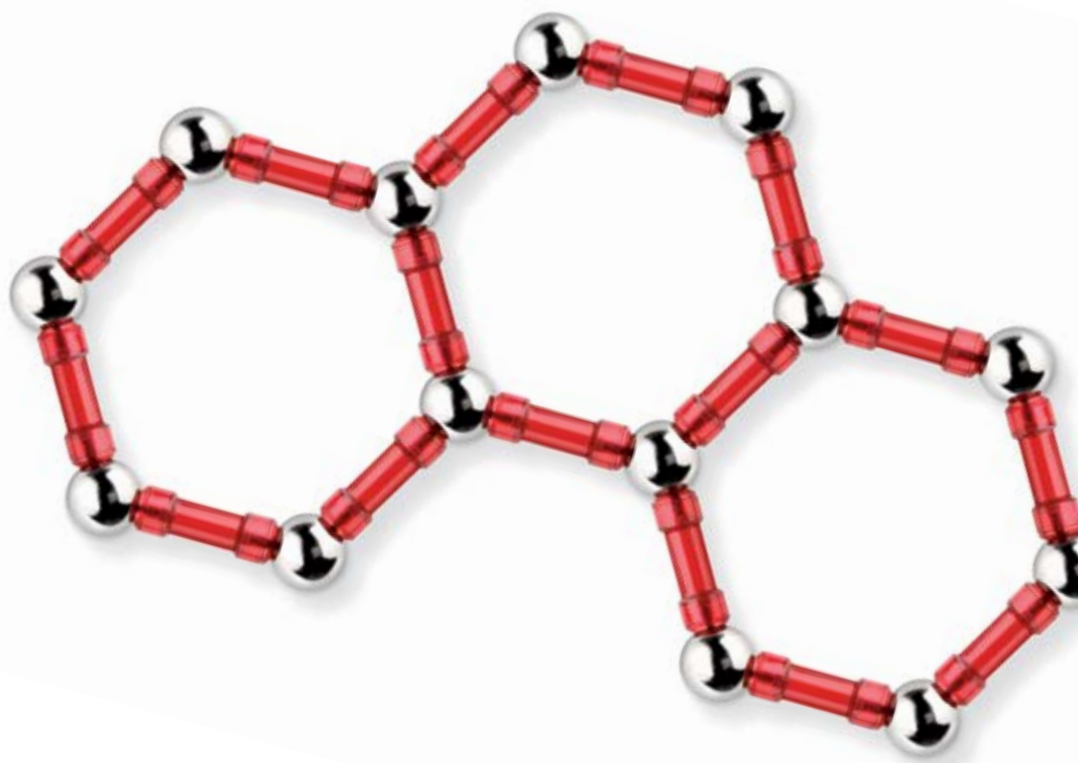
Gesture and voice control are excellent technologies, but are only useful when in the appropriate context. Voice recognition to control functionality, such as calling a single number from a list of hundreds, works well in cars because drivers' hands are firmly attached to the wheel or gear shift. But on the couch at home viewers' hands are typically free and the standard remote control does the job just fine.





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# 4K kicks off

Deloitte predicts that in 2013 the television industry will commence the roll-out of the next generation of high definition (HD) TV, known as 4K, which will offer four times higher resolution than the current highest standard HD<sup>92</sup>. It may be 18-36 months before 4K is technically and commercially broadcast-ready, but 2013 should see several significant landmarks in preparations:

- about 20 4K TV set models from more than ten vendors should be available by year-end<sup>93</sup>;
- the first consumers should take delivery of 4K TV sets;
- a range of 4K content will become available, initially blockbuster movies;
- a growing range of professional and semi-professional 4K cameras should become available;
- new supporting standards should be agreed, including a new high definition multimedia interface (HDMI) standard to service 4K data rates; and
- multiple test broadcasts are likely, with commercial services expected 2014/2015<sup>94</sup>.

The roll-out of any new broadcast standard is a major step, so the expected landmarks for 2013 should be considered significant.

That said, many commentators are likely to question the need for a new version of HD<sup>95</sup>. After all standard definition (SD) TV remains the most popular resolution globally – even for satellite TV customers, who have access to most bandwidth<sup>96</sup>.

Demand for 4K will likely grow over the medium-term, fuelled by rising expectations of higher resolutions across all screens, as well as larger TV sets and next generation games consoles. A growing range of smartphones, tablets and computers offer sufficient resolution for individual pixels not to be discernible<sup>97</sup>. With a 40 inch 4K television, pixels would be hard to see close up, and disappear from about a meter.

The average size of TV sets will likely become steadily larger. As this happens, the need for more dots to fill larger screens will grow. 'Standard' HD on an 80 inch screen viewed from about three meters away would present a pixelated image.

Advances in video games could also drive demand for 4K. In 2013, powerful PCs with sufficiently fast Graphics Processing Units (GPUs) should be able to work with 4K TV sets. In subsequent years, new generations of games consoles might ship with 4K support<sup>98</sup>.

While 4K TVs may be a medium-term purchase for mainstream consumers, wealthy early adopters should be able to satisfy their 4K needs in 2013. The commercial range of 4K TV sets should grow from a handful in 2012 to about 20 models by end-2013<sup>99</sup>. At least half of these sets may be available for under \$10,000<sup>100</sup>. Over subsequent years, the price of 4K TV sets is likely to drop steadily and significantly. With every price decline the accessible market should increase<sup>101</sup>. Within five years if not before, smaller (about 50 inch) 4K TV sets might be available for under \$1,000. The cost of manufacturing 50 inch 4K TV sets is expected to be about a third of the price of making 80 inch sets<sup>102</sup>.

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4K TV set owners will need to rely on pre-recorded or streamed content in 2013: no broadcast services are planned. But there should be a good range of movies available to watch. Many blockbusters launched in 2012<sup>103</sup> and 2011 were digitally captured in 4K. About fifty films have been screened in 4K and films shot in 35mm can be scaled to 4K. Most major films since the early 1980s were shot in 35mm.

In 2013, commercially available eight-layer Blu-ray discs, with 200 gigabyte (GB) capacity (sufficient for a compressed 4K film) may become available. The first eight-layer prototype was announced almost ten years ago. Multi-layered discs are needed because a single Blu-ray disc, with 25 GB of memory, would be too small to store an entire movie<sup>104</sup>.

Streaming 4K content may also be challenging: with uncompressed files a user would require a half gigabit per second (Gbit/s) connection. Downloading an uncompressed 4K movie would take days over a standard broadband connection<sup>105</sup>. But few consumers would ever download an uncompressed file. A one hour compressed 4K film is about 160GB and would take seven and a half hours to download on a 50 Mbit/s broadband connection.



In 2013 the first connectors supporting 4K data rates should be available, based on the HDMI 2.0 standard<sup>106</sup>. Over the past decade, the HDMI standard has been regularly enhanced<sup>107</sup>. Prior to the introduction of an upgraded connector, cable connecting a source to a 4K TV will require four parallel high definition media interface (HDMI) connections, which may be considered inelegant in a domestic setting<sup>108</sup>.

A key landmark for 4K in 2013 should be test broadcasts, following initial trials in 2012<sup>109</sup>. The broadcasts should prove useful for optimizing considerations such as frame rate (the number of still images shown per second to create video effect) by genre. Broadcasters will need to balance minimization of bandwidth requirements while maximizing viewer experience. For sports, the frame rate may need to be 120Hz to provide a fluid picture with no blurring: with higher resolutions image blurring is more visible, making 60Hz transmission less viable. Sport is likely to be one of the genres most likely to be captured in 4K given its strong commercial appeal, but it may require a higher bit rate<sup>110</sup>.

A relatively small set of broadcasters may experiment with 4K. But, as costs fall involvement and interest should steadily rise, reflecting what has happened in HD<sup>111</sup>. In 2013, a growing range of dedicated 4K cameras may become available, adding to the existing range of 4K cameras, which include digital SLRs<sup>112</sup>. As the supply of cameras rises, prices should fall, making 4K more appealing to a higher number of broadcasters<sup>113</sup>.

### Bottom line

The upgrade to 4K entails significant capital expenditure for broadcasters, producers, television manufacturers, infrastructure owners and consumers. It is not a move to be taken lightly.

The cost for broadcasters of creating a 4K channel, factoring in upgrades to existing equipment and infrastructure, could be \$10 million to \$15 million. In future years the costs will decline. Currently an HD channel costs about \$2 million; a decade ago it would have cost about \$10 million.

The top estimate of \$15 million for 4K may seem high, but broadcasters should remember television's commercial success is predicated on its ability to distribute high production costs across a large audience, resulting in a reasonable cost per viewer. A major television event costing \$10 million to stage and watched by a billion people costs one cent per viewer.

Broadcasters evaluating 4K should also note that 4K subscribers would need a new set top box to support the new High Efficiency Video Coding (HEVC) compression standard<sup>14</sup>. These would need to include larger hard drives to cope with bigger file sizes. Set top boxes might need about four terabytes (TBs) of storage, though by 2015 hard disk storage prices may have fallen to about \$15 per TB. Initial customers for 4K services are most likely to be relatively price insensitive to service costs; service providers should be predisposed to upgrading these clients' customer premise equipment (CPE) for no or little cost.

One of the major bottlenecks to offering 4K services will be bandwidth. Broadcasters should consider how much they are likely to need, and must have a handle on likely improvements in 4K compression. In 2013 4K could require up to 40 Mbit/s; by end 2014 it should require as little as 20 Mbit/s, equivalent to the bandwidth requirements for the first standard HD transmissions in 2005, and the first 3D TV transmissions in 2010<sup>15</sup>.

Satellite-based broadcasters should be in a good position to offer 4K. Satellite capacity is growing steadily<sup>16</sup>. 4K test transmissions via satellite links are expected in 2013<sup>17</sup>. Terrestrial broadcasters may have less bandwidth at their disposal. They should consider whether they need to request more spectrum to enable 4K broadcast. They are likely to face strong competition for available spectrum. Companies offering IPTV services should consider 4K's impact on the case for rolling out fiber to the home (FTTH).

Program makers need to balance the investment required against potential returns. One consideration is viewing figures. According to one analysis the higher the resolution of the program being watched the less likely the viewer is to change channel<sup>18</sup>.

For TV manufacturers, one attraction of 4K is that it could provide a motivation to upgrade existing sets<sup>19</sup>. Some commentators may question, however, whether 4K provides sufficient incentive to buy a new set. 4K's unique selling point – the intensity of its resolution – loses its uniqueness once the viewer is a certain distance from the TV set. In other words, the visual quality of 4K is most evident when in close proximity to the TV set. Yet few watch television in very close proximity.

The first owners of 4K TVs in 2013-2015, shortly after purchasing their set, might hold "pixel parties" at which friends and family are encouraged to view some 4K footage from close proximity – about a meter away. They may be asked to try and spot an individual pixel. This experience – should individual pixels prove impressively elusive – is likely to provoke admiration and envy, and possibly catalyze further sales<sup>20</sup>. Thereafter the set will be watched from normal distance, but the memory of the quality of that close encounter will likely linger. This ritual is likely to resemble when new owners of high resolution tablet computers and smartphones take ownership of their new devices<sup>21</sup>.

TV manufacturers will need to determine what the optimal size of 4K TV sets should be. 4K's impact may be more evident on larger TV sets, but the larger the set the higher the cost of manufacture, limiting the market for such TVs.

Manufacturers should also consider other markets for large, high resolution sets, particularly the commercial market. Initial sales of larger 4K sets are likely to be sold to large companies for boardrooms and meeting rooms. The visual quality of a presentation delivered on large, high resolution sets may be higher than that for an overhead projector, and may in some cases be cheaper, when factoring in the cost of a high quality projection screen.

# Dual video screening readies for prime time

Deloitte predicts that in 2013, about ten percent of households in developed countries, and about three percent of households in developing countries, will dual video screen their television consumption on a monthly basis. That is, they will have two (or more) screens, most likely of different sizes, showing television programs at the same time and in the same room. These television images may be separate programs or alternate streams of footage for the same event, such as different matches in the same golf tournament.

By the end of 2013, time spent dual video screening could exceed the time spent consuming the combination of a television program and its dedicated program app or website.

The key driver for dual video screening is simple: just one television stream may be insufficient for the person or people in the room. There are likely to be two main reasons for that being the case.

First, there is a desire among household members to spend time together. Watching television is in many homes a principal family activity. However, it is sometimes difficult to agree on what to watch. One solution is to watch two separate programs and that is most easily achieved on two screens.

In 2013, most dual video screening will be based on a combination of traditional TV set and a connected device, most frequently a laptop, but also possibly a tablet (among the minority of individuals who own one) and occasionally a smartphone. One person or more will watch and listen to the main TV, while the other (or others) will watch on the smaller devices and use headphones.

Deloitte's prediction is that the smaller screen will often be used to watch sport – reflecting who has real control of the remote in the household. Dual video screening enables families to spend time together, without compromising on what to watch – even if those on the smaller screen may not be entirely happy.

Dual video screening in this manner realizes a latent demand that has existed for decades<sup>122</sup>. Television manufacturers have long offered the ability to watch two television images, through installing two tuners in a TV set and placing a smaller picture in the main image (picture-in-picture).

However this presentation of images has had little take-up, as the smaller image has been unsatisfactorily small and the larger image unsatisfactorily compromised by the former, leaving both sets of viewers dissatisfied<sup>123</sup>. Dual video screening also replicates the work place environment for millions of workers around the world who work with two or more screens on a regular basis.

The growing availability of 'over-the-top' (OTT) program and movie demand services has per the law of unintended benefits enabled the ambition of picture-in-picture to be realized, but through the offer of picture-and-picture. Over-the-top is access to premium content via the Internet on any connected device, marketed as enabling subscribers to consume anywhere (known as TV Anywhere or TV Everywhere). As take-up accelerates it is likely to be used to consume content in the same room as the main set-top box. Free-to-air TV broadcasters' OTT offerings would also facilitate simultaneous consumption of two or more video streams in the same room.

Another reason for dual video screening is to satisfy viewers' desire to consume more of a particular piece of content. This is likely to be particularly prevalent with sport, in which multiple simultaneous events might have a bearing on the outcome of the principal video stream. A motorsport race, for example, is an edited highlight of as many as dozens of cameras. Traditionally, viewers have only been able to view one image at a time, often the contest for the lead or a leading position. TV coverage of tennis tournaments typically only shows the match the producer believes the majority of viewers want to watch. Yet a motorsports fan may also want to watch the progress of a favored driver and a tennis fan a preferred player.

For major events, viewers may be able to choose between a range of cameras, but selecting which camera to watch may be a little slow and labored. Dual (or multiple) video screening enables the viewer to flick quickly – far faster than would be possible through physically changing channels – from one set of events to another. Deloitte predicts that during major sports events for which multiple streams are available, up to ten percent of households will be using multiple screens in the same room in 2013, with the second (or additional) screen being a connected device or a second television set; for example one brought in from the kitchen.

Multiple video screening of the same content does not mean viewers will necessarily watch more television, although it is likely they may watch the same event for longer. Multi-screening viewers may watch more attentively, in the same way that chatter about a program on social and other networks ratchets up the intensity and buzz associated with consuming a program.

Deloitte expects that dual video screening of the same content in the first half of 2013 will be dominated by combinations of TV sets and smaller connected devices, with the latter often positioned on the viewer's lap. Thereafter, second TV sets and larger computer monitors may start to predominate and are likely to be positioned adjacent to the main TV set. A key reason for this will be ease of use: it is easier to view two video images by moving the eyes from side to side than to move the head, and changing focus, from nearby on a small screen to a larger screen several meters away.

Looking to the longer term, Deloitte's prediction is that by 2020 between five to ten percent of homes in developed countries will have a second large TV set in their living rooms, primarily to facilitate secondary video viewing. The second set is unlikely to be used for every program – or indeed even for the majority of programs – but for major sports events, and for when families want to spend time together, and agree to disagree over what to watch. Second TV sets are also likely to be used with households with games consoles to enable multiple-player games play.

A second large TV screen is likely to be better value for money than splitting a very large screen into two side-by-side images: even today the cost of a 42 inch TV screen is less than \$400, which is less than ten percent the cost of an 80 inch screen, and about a third of the price of a typical 60 inch screen<sup>124</sup>. It is worth noting that a 42 inch screen is also cheaper than many ten inch tablet computers, and with 21 times the screen area: per square inch as well as per hour of consumption, television is likely to remain excellent value in 2013 and in the long term. Further, the weight of two 42 inch television sets can be a quarter that of a single 80 inch television set and would be distributed over a larger area with more mounting points. Two screens are also much less likely to require strengthening of the supporting wall.

Over the past decade consumption of TV has risen steadily in many markets, with some currently averaging five hours' viewing per day, equivalent to more than a quarter of waking hours. The TV set has also become an ever-larger physical presence in the home.

Still, a decade from now some readers may well look back nostalgically on an era when they just had one TV set on the wall; much as some workers, particularly those working with data, may remember a time when they had only a single monitor to analyze.

### Bottom line

Broadcasters, who are likely to remain unsure of how best to monetize any form of dual screening, may want to consider video streams, which do not necessarily require the creation of additional content. Existing distribution architectures can also readily cope. Licensing arrangements permitting the viewing of content on any device – agreed for the launch of over-the-top services – have long been in place. The falling cost of principal and ancillary cameras means there will be even more footage to select from. The marginal cost of hiring an additional producer to curate secondary video feeds may be lower than the cost of building an app or website for a program – and is also closer to the average broadcaster's core skill set.

Dual video screening's prospects should not be equated with picture-in-picture's disappointing take-up. Both approaches attempt to serve the same need, but the user experience for picture-and-picture, using current technologies, is far superior to the fundamental compromise of picture-in-picture.

For those who think that having multiple screens in a room is too intrusive, tolerance of TV's physical impact in the home is remarkably high and is growing; we accommodate what we find valuable<sup>125</sup>. In Hong Kong, a market characterized by relatively small homes, the fervor for TV-based karaoke systems pre-dated the arrival of flat screens. Karaoke fans were proud of karaoke systems based on large cathode ray tube (CRT) sets that were as deep as screens were wide.

Advertising-funded broadcasters and media agencies should consider the impact that dual or multiple video screening will have on the measurement and impact of advertising.

# Connected TV: hits and misses

In 2013, Deloitte predicts that tens of millions of connected TV sets will sell globally, and the installed base of TV sets with integrated connectivity should exceed 100 million<sup>126</sup>. By the end of the decade, the vast majority of new TV sets sold in developed countries will likely incorporate two-way connectivity<sup>127</sup>. However, this may be because it will have become nigh impossible to purchase an un-connected TV set, much as it is the case that in developed countries it is very hard to purchase a brand new cathode ray tube (CRT) TV set.

But despite the forecast boom in sales, only a modest proportion of connected TV sets sold in 2013 and beyond – 15 percent at most – are likely to be purchased solely or primarily for their integrated two-way connectivity<sup>128</sup>. In the vast majority of cases price, size, thinness or bezel width are likely to be the primary reasons for purchase.

Most customers purchasing connected TVs are likely to regard two-way connectivity as a welcome bonus. Some might be indifferent<sup>129</sup>. Some may struggle to access the functionality. A few might feel put out at having to pay for functionality which they have no intention of using, or to which they already have access.

A key reason why connectivity per se is unlikely to be a key selling point for new TVs in 2013 is because hundreds of millions of households around the world already have one or more ways of connecting their TV sets. In at least ten countries around the world, over 30 percent of households already have connected TV – even if in some cases they may not realize it<sup>130</sup>. In a few markets – those with high broadband and PC penetration – the effective connected TV base may be double this, at 60 percent of households<sup>131</sup>.

The effective base of connected TV households is so high because there are multiple ways by which a TV set can be connected. TVs can be connected via a wide range of peripheral devices, many tens of millions of which around the world are likely to already be permanently connected to the TV. Current generation games consoles, set-top boxes and Blu-Ray players typically have two-way connectivity built in and, in most homes, they are permanently connected to TV sets. These peripherals often offer dedicated menus and apps to access movie and TV on demand services. The principal usage of connected TV tends to be to access more content. So households whose TV set is attached to a peripheral with two-way connectivity would not need to purchase a connected TV to access video content on-demand.

Other devices that may not be constantly connected to a TV set can also make a TV “connected”. Laptops, tablets and high-end smartphones can all be connected to a TV set, via a wire or wirelessly. The installed base of these devices numbers over three billion globally. Modern laptops often incorporate high definition multimedia interface (HDMI) ports that provide simple-to-use, high-definition (HD) connections to TV sets; tablets can connect via wires or via a Wi-Fi connection; phones can connect via mini HDMI or wirelessly. In short – there are already myriad ways and billions of existing, owned devices that can enable a TV to become connected.

It should, in practice, be easier to use on-demand TV and movie services on a TV set with built-in two-way connectivity. After all, laptops, tablets and smartphones may be out of the house at the time when someone wants to watch connected TV. But the greater ease-of-use would only be a significant differentiator if viewers were to use connected TV services frequently. In practice, connected TV sets are likely only to be used occasionally to play online games, browse the Internet, download apps, or even video conference; the principal usage of a TV set is likely to remain to watch TV programmes and movies. Usage of TV-on-demand is rising but is likely to remain a small proportion of overall TV viewing. The majority of programs and films that people watch in 2013 will likely be available and consumed via broadcast terrestrial, satellite or cable.

In the majority of cases, broadcast quality and broadcast programs recorded to a DVR should be better than that which is available online. The Internet's rivalrous nature should never be overlooked: it is a shared resource. Your neighbor's use of the Internet may affect the quality of service in your home. If bandwidth is scarce in your neighborhood, this may compromise your ability to watch TV-on-demand, particularly when the pictures are being shown on a large TV screen, rather than a medium-sized laptop screen, or a small smartphone screen. Broadcast, by contrast, is a non-rivalrous service, and everyone in your street or block can be consuming TV pictures with no impact on your quality.

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**In the majority of cases, broadcast quality and broadcast programs recorded to a DVR should be better than that which is available online.**

In summary, the base of households supporting two-way connectivity is already vast; the usage of that connectivity has remained sparse. Connected TVs will sell, but most likely primarily for the thinness of their bezels, the sharpness of their screen or their value for money.

#### **Bottom line**

In 2013, because of the volumes of connected TV sets sold around the world, the implications of connected TV – chief among which is the ability to disintermediate traditional broadcasters, or even traditional TV content – will likely be the subject of intense, and occasionally under-informed, debate at conferences focused on the TV sector<sup>132</sup>.

But the bottom line is that unless must-see content at a competitive price point is made exclusive to connected TVs, for example via a channel or portal that is only available via connected TVs, the need for connectivity in televisions is likely to remain marginal.

TV manufacturers do need to consider ways of differentiating their products. They do need ways in which to boost the often tight margins that characterize the industry. But they should also determine precisely which functionality and features customers are most likely to value.

Broadcasters, in considering which services they should offer, should keep track of the installed base of devices on which their content could be received and consumed. And they should also monitor carefully the extent to which new forms of consumption grow in popularity.



# Over-the-top may lift legacy broadcasters and distributors more than pure plays

Deloitte predicts that in 2013, in markets where services are available, two of the top three over-the-top (OTT) TV program and movie services are likely to be provided by existing broadcasters and distributors.

OTT services use the Internet to distribute TV and movie content to homes. Any company can provide OTT TV and movie services and many do so, including TV broadcasters, device manufacturers and fast food vendors<sup>133</sup>. Pure play OTT providers and OTT divisions of larger companies not in the TV industry are likely to enjoy growing market share and take up, but in most markets their active paying subscriber base will probably account for less than ten percent of households. The market is shaping up to be dominated by existing players.

Combined OTT revenues for existing broadcasters and pure plays are likely to be less than two percent of earnings (from subscriptions and advertising). Free-to-air TV broadcasters are likely to offer OTT for free, while pay TV companies are likely to include OTT access as part of subscription packages. Total global revenues from TV advertising and subscriptions are likely to reach about \$400 billion in 2013<sup>134</sup>.

The two factors underlying the popular appeal of legacy broadcasters' OTT services are brand and content. Most viewers are likely to remain faithful to the broadcasters and programs they have watched in previous years, so long as those broadcasters continue to provide the type, quality and quantity of programs that viewers like. Viewers will likely remain averse to new sources of content in 2013, due to the opportunity cost of taking time to watch a program they may not enjoy.

Viewers will mostly use broadcasters' OTT services to catch-up on programs they were unable to watch or were unaware of when first broadcast. Viewers will generally watch programs via OTT very shortly after first transmission: hours for sports and news, up to a day for reality, soap operas and dramas and about a week for documentaries<sup>135</sup>. The freshness of content is likely to be key to popularity: although some portion of OTT viewing will be 'long tail' (shows that are more than a week old). Deloitte estimates that more than 75 percent of programs will be watched within a week of initial broadcast<sup>136</sup>.

Another factor expected to drive demand for broadcasters' OTT services is awareness: the majority of viewers will have been exposed to the broadcasters' brand for decades: the OTT service is a natural and seamless extension of that brand. Broadcasters are also likely to promote their own OTT brands regularly over the typical 3-5 hours viewing of broadcast or pre-recorded TV that the average citizen with access to television watches daily. Over the course of a week a viewer would likely see dozens of promotions for broadcasters' OTT services. Pay TV providers and subscription channels are likely to continue to promote their OTT services to improve perceptions of value for their services.

OTT pure plays and divisions of larger companies start from a much smaller audience base than broadcasters. In some cases their brands may be entirely new to the market, niche or in an adjacent or even unrelated space<sup>137</sup>. OTT pure plays, as recent entrants to the market and with limited access to current programming, may have to rely primarily on archive content. They may lack the call-to-action appeal of broadcasters' OTT services.

Some customers will willingly subscribe to OTT services based mostly on archive content. For some the ability to access box sets of TV series at a price point that is typically much lower than pay TV may be exactly what and how they want to consume TV programs. For others, watching every episode of a series sequentially may be akin to consuming dozens of breakfasts in a row.

The consumption of programs and movies via OTT distribution is likely to remain small in proportion to total consumption<sup>138</sup>. The vast majority of viewers in 2013, and in subsequent years, are likely to continue to default to broadcast and the TV schedule, before checking what is stored on their Digital Video Recorder (DVR) before finally accessing OTT services.

Deloitte's expectation is that even in markets with extensive broadband roll-out, on-demand TV and movies will largely represent only a few percentage points of total viewing, whether this is via broadcasters' pay-TV companies or pure-play OTT provider sites. Further, official on-demand TV and movies sites are likely to represent only a few percentage points of total online video.

**Bottom line**

The reality of OTT for the majority of households is likely to be as part of the ecosystem of television services provided by either pay-TV companies or free-to-air broadcasters. OTT access has now become a standard and occasional means of accessing TV content. In markets where it is available OTT has become a fundamental TV technology, similar to digital video recorders (DVRs) or electronic program guides (EPGs.) OTT's principal role is likely to be to enable catch-up, rather than to create a bespoke 'channel' of TV content.

OTT is important, but not core. If OTT services were to be suspended for a week, people would still watch television. What is core is content, and whichever entity has access to the most popular content is likely to have the most popular OTT site.

The OTT service itself is likely to remain a sub-brand, and not a separate brand of free-to-air or pay-TV providers. It is more likely to succeed as a sub-brand, rather than a new identity which viewers are unfamiliar with.

Deloitte expects that in 2013 all OTT players are likely to continue to grow, at least in usage terms, but there is likely to be significant press coverage of the progress of pure play OTT companies and OTT divisions of larger companies that are not broadcasters or content producers. Broadcasters and pay TV companies should analyze and contextualize these headlines and react commensurately.

OTT providers should note that the quality of a consumer's broadband service will have a key impact on quality of service. OTT pure plays and divisions of larger companies need to balance whether to invest or use services that offer guaranteed quality of service, e.g. sufficient, protected bandwidth into a home to ensure uninterrupted viewing. But in some markets local regulations may prohibit certain types of traffic to be prioritized in this way. If traffic cannot be prioritized adequately, OTT services could suffer interruption. When this happens, broadcasters and pay TV companies must have fall backs – such as standard broadcast and DVRs. OTT pure plays would not be able to offer that service.

In the medium term, as televisions become larger and have higher resolutions, HD transmission may be required to ensure sufficient picture quality. In some markets bandwidth may be insufficient to support HD. And in the longer term, as 4K transmissions – which offer four times the resolution of current HD – become mainstream, faster broadband networks will be required.

Another medium term consideration is the convergence of DVRs and on-demand. As hard disk storage becomes steadily cheaper, DVRs can become de facto content storage nodes. Initially a multi-terabyte DVR with multiple tuners may record the five main channels' prime-time broadcasts. If someone in the household misses a program, playback could be from the DVR, rather than via the Internet. In this scenario, pure-play OTT providers may face additional barriers to entry into the mainstream television ecosystem.

# The reality of “cord cutting” in North America

Deloitte predicts that in 2013 almost all North American households that pay for TV through multichannel video programming distributors (MVPD)<sup>139</sup> will continue to subscribe. Less than one percent of subscribers will discontinue their pay TV subscription (also known as ‘cord cutting’). That small number of cord cutters will likely be driven by a mix of: macroeconomic conditions, a perceived lack of value of pay TV, growth in over-the-top (OTT) video services and changing TV consumption habits.

This reality is likely to contrast starkly with various apocalyptic headlines suggesting imminent, significant cord cutting. These headlines will often be based on online surveys whose responses – however honest when given – do not always equate to outcomes. In one 2012 survey, 31 percent of respondents said they were either planning to or seriously considering cancelling their subscriptions, primarily because of the availability of OTT services<sup>140</sup>.

However survey data can be wrong: reported subscriber numbers from the various MVPD providers show a net rise in subscribers in the last two years.

OTT Internet TV services and pay TV are often characterized as mutually exclusive competitors; the reality is that they are often complements<sup>141</sup>. US MVPD subscriptions were up 135,000 in the four quarters ending the third quarter of 2012, an increase of 0.1 percent<sup>142</sup>. Canadian broadcast distribution undertaking (BDU – the equivalent of MVPD in the United States) subscriptions increased by about 136,000, or 1.2 percent, in the same period<sup>143</sup>.

However, the pay TV market contains many moving parts which vary: over time, by geography and by delivery technology. Individual cable, telecommunications or satellite providers gain and lose subscribers to each other every quarter. Individual subscribers may cancel a service, then rejoin only a few months later, either with their original provider, or another pay TV player. The focus of this Prediction is on total net subscriber numbers for all forms of pay TV.

It is important to stress that in 2013 and most likely for several years to come the North American pay TV market will be substantially different from other TV markets. What happens or fails to happen in the North American market may or may not provide lessons for other markets.

Outside of North America, over-the-air (OTA) TV viewing hours are lower<sup>144</sup> and there may be national TV license fees<sup>145</sup>. Most importantly, rates of pay TV penetration vary widely around the world: in the United States and Canada about 90 percent of homes pay for TV, whereas in EU countries the proportion is 35 to 60 percent. In South Korea the rate almost 100 percent and in Brazil is less than 30 percent<sup>146</sup>. But if there is no evidence of cord cutting in 2012, is there any reason to think that it could happen in 2013 or beyond? And if so, how large could it be?

Predicting pay TV subscriptions in North America is complex. Key variables include economic growth and consumer confidence<sup>147</sup>, the rate of household formation<sup>148</sup>, content deals for the forthcoming season, the propensity of some consumers to have more than one kind of pay TV service at the same time, and competition/substitution from other formats, such as OTT pure plays.

Extrapolating a view on cord cutters from this complex mix is challenging. However, based on the most recent quarterly data from the United States and Canada, and assuming the variables have been more-or-less constant, the rate of subscriber additions has been slowing. Growth in US subscriptions was running at more than 1 percent year-over-year in 2009 and 2010, but fell to 0.1-0.2 percent in 2012<sup>149</sup>. In Canada, growth was about one percent for most of 2010 and 2011, but has fallen to 0.3-0.4 percent in the most recent quarters<sup>150</sup>.

Based on the trend lines, and if there is no dramatic increase in household formation, it seems probable that the number of total pay TV subscribers could be flat, or even fall in North America in 2013. Further, some have speculated that a proportion of young people creating new households are doing so without traditional pay TV: not cord cutters, but possibly ‘cord nevers’<sup>151</sup>. The size of this group is unknown, but if significant could lead to a fall in the percentage of homes paying for TV, even if the absolute number of homes is more-or-less flat.

Still, subscribers who do not renew their subscriptions are likely to be drawn from a very narrow pool. In North America the categories of live spectator sports, news, reality TV, first run drama and comedy constitute the ‘four pillars’ of pay TV and are generally not available through third-party OTT alternatives. The proportion of households in North America with at least one family member willing to pay for TV sports is estimated to be more than 80 percent<sup>152</sup>.

Further, those who don’t watch a lot of sports tend to watch a lot of reality, news and first-run comedy and drama. Few households watch none of the categories.

In 2013, given the exclusive content ownership by MVPD and BDU distributors of the four pillars, a maximum of ten percent of North American households would contemplate cancelling pay TV, and still be able to watch the shows they really want to watch<sup>153</sup>. That is not zero, but neither is it as large a pool of potential cord cutters as most articles speculate.

#### **Bottom line**

MVPD and BDU providers should note that the loss of a small number of subscribers may not necessarily lead to a fall in revenues or profitability: pay TV providers might be able to increase average revenue per subscriber faster than they lose (usually less profitable) cord cutters. While cord cutting surveys may generate headlines, pay TV operators should probably be more focused on the 99 percent of their customers who are likely to stay, and look to increase average spend and design packages to please them, rather than attempting to appease the small but vocal group of subscribers who threaten to cancel – at least when answering surveys.

Further, MVPDs and BDUs have significant power to minimize cord cutting itself and to mitigate the impact of cord cutting: they are often the Internet Service Provider (ISP) that the cancelling subscriber requires in order to access to the services of the OTT provider.

They can price a bundle of pay TV services and Internet access such that there is negligible financial incentive to cord cut, even without factoring in additional data usage due to increased streaming. One analysis across multiple operators and in certain regions found that cancelling pay TV offered savings of just \$5 per month, relative to an average \$90 pay TV bill<sup>154</sup>. In some cases, cord cutting could end up costing \$20 more<sup>155</sup>. Aggressive pricing of bundles could help minimize cord cutting.

Second, many pay TV/ISPs expect cord cutters to increase their data consumption such that they require a bigger, more expensive data plan with faster speeds and/or more data. If cord cutters resemble the overall TV-watching population, and have two people in a household watching 35 hours per week OTT, that would amount to in the region of 700 GB of data per month<sup>156</sup>. This increment would require most households to pay more for data and/or speed<sup>157</sup>. In this way cord cutting may be revenue neutral – and possibly even net positive – to bottom lines. Broadband services in North America tend to be higher margin since they do not have the pass through content costs of pay TV.

On the other hand, not all North Americans watch the same amount of TV: the lightest quintile watches about a fifth as much TV as the average viewer (and 90 percent less than the heaviest quintile<sup>158</sup>). In such a household, and assuming again that they move all their TV viewing to OTT solutions, they would consume only an additional 150GB per month, an amount that in many regions may not require them to pay more for data under the most common plans.

Finally, the growth in OTT providers has benefitted content creators: OTT has been a new bidder for content rights, enhancing the value of that content. Given the very small numbers of cord cutters and cord nevers who are substituting OTT for pay TV, it seems likely that the vast majority of money made from selling content will come from the traditional broadcasters and distributors. OTT is a delightful incremental source of revenue, but unlikely to be in the same league.

# Telecommunications

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# A strong year for LTE adoption

More than 200 operators in 75 countries will have launched a Long Term Evolution (LTE) network by the end of 2013, Deloitte predicts<sup>159</sup>. By year-end LTE subscriptions should exceed 200 million, a 17-fold increase in just two years<sup>160</sup>. About 300 LTE devices (smartphones, tablets and dongles) should be available by year-end, including a range of sub-\$100 smartphones. However, it will be a year of momentum for LTE, rather than completion: at the end of 2013 the vast majority of 1.9 billion smartphone customers are likely still to use 3G and 2.5G devices.

LTE was launched in Sweden in 2009<sup>161</sup>. Growth has since been steady but slow, with the exception of the United States, Canada, Japan and South Korea, which have seen faster take up<sup>162</sup>. In most countries where LTE has launched, 3G and its variants, such as HSPA, have remained the dominant networks. As of January 2012, there were just 12 million LTE customers, compared to more than a billion 3G subscribers<sup>163</sup>. By mid-2012, over half of LTE devices had been sold in just one market – the United States<sup>164</sup>. By January 2013, the number of LTE subscribers might have risen to more than 60 million and by year end subscriber numbers may surpass 200 million<sup>165</sup>.

Device availability should increase rapidly. At the end of 2011, only 27 LTE-enabled smartphones and 11 tablets were available<sup>166</sup>. One year later, over 150 models of smartphones and 50 tablets were on the market<sup>167</sup>. By the end of 2013, an additional 150 smartphones and tablets may have been launched. These will include a small but growing range of LTE handsets aimed at the pre-pay market, and priced at under \$100: as of January 2013, fewer than ten sub-\$100 LTE handsets models will be available. By year end, that number is likely to triple. The range of sub-\$100 handsets is significant as it makes LTE accessible to a significant target audience.

Through 2013, there are likely to be tens of millions of LTE device owners not on an LTE tariff, as well as numerous individuals on an LTE tariff who do not have an LTE phone. In 2013, at least fifty million LTE devices are likely to be sold to individuals whose carrier does not have an LTE service, or whose available LTE frequencies are not supported on that device, or to subscribers who do not want to subscribe to LTE<sup>168</sup>. These fifty million will augment the existing base of tens of millions of LTE-ready devices that may never be used on an LTE network.

The cost of LTE chipsets, which has a significant impact on the retail price of LTE devices, should continue to fall in 2013. The incremental cost of adding LTE to one of the first LTE-enabled smartphones was estimated to be about \$40<sup>169</sup>. At year-end 2012, the incremental cost of adding LTE to a chipset is likely to be in the region of \$10 and in the range of \$5 – \$10 range by mid-2014<sup>170</sup>.

Realized (as opposed to advertised) LTE speeds should remain significantly faster (three times faster or more) than equivalent 3G networks. However, as LTE networks attract more users, speeds may decline from 20-30 Mbit/s to about 10 Mbit/s or less<sup>171</sup>. Carriers are likely to balance their networks so that LTE performance remains differentiated from 3G speeds. For some carriers, up to half of data traffic is expected to be carried over LTE networks by the end of 2013<sup>172</sup>. In some markets HSPA speeds may exceed LTE speeds, but in many cases this will be temporary: in the medium term, LTE should be faster than HSPA, because providing equivalent speeds on HSPA requires two to three times more spectrum. At the beginning of 2012, actual average LTE speeds recorded in the United States were three to seven times faster than 3G<sup>173</sup>.

Usage of complementary networks (principally Wi-Fi) may be little affected by LTE. While LTE is faster and lower cost per gigabyte (GB) than 3G, it is likely to remain more expensive in countries with mature fixed network infrastructures. In home and office contexts, it will be slower than fixed broadband networks accessed through Wi-Fi routers<sup>174</sup>. Deployment of LTE small cells improves indoor coverage, but there is not always a business case for this<sup>175</sup>. In most cases users may gravitate to the fastest, most reliable and best-priced wireless network available: they are unlikely to debate the technical merits of LTE picocells versus Wi-Fi. They will leave such discussions to engineers, and those debates are likely to persist through 2013 and beyond<sup>176</sup>.

In most markets, LTE network coverage is likely to focus on cities, where the majority of calls are made, traffic generated and revenues earned. In some markets, operators may be required to build out rural LTE coverage as a condition of obtaining a license<sup>177</sup>.

The migration of speed-seeking data users to 4G may be accompanied by a rise in the volume of voice calls on legacy 2G and 3G networks. As data traffic migrates to LTE from 3G networks, the latter's capacity is likely to get freed up, enabling higher call quality, with a lower likelihood of calls dropping. Although technology permits voice calls to be carried over the LTE network (VoLTE), they are likely to be offered in only a handful of markets, supported by at most a few dozen handsets<sup>178</sup>.

In the long term, data usage by LTE customers should remain higher than by 3G customers. In 2012, networks reported LTE customer data usage was between 50 percent and 900 percent higher than 3G customer usage<sup>179</sup>. Again some of this was likely to have been due to 3G customers moving their relatively high data usage to LTE networks, and some caused by increased data usage triggered by the availability of higher speeds and larger data caps<sup>180</sup>.

LTE customers are likely to generate significantly higher average revenue per user (ARPU) than 3G customers. That is because of selection effect, where an operator's higher spending customers migrate or are migrated to LTE tariffs, and consumers being willing to pay a premium for higher speeds<sup>181</sup>.

By the end of 2013 or 2014, revenues from subscribers on LTE tariff plans may have reached about 10 percent of global mobile service revenues, with three to four percent of the total subscriber base<sup>182</sup>. However this does not necessarily mean that LTE networks will generate a tenth of all revenues. To illustrate, the majority of voice calls made over LTE handsets in 2013 are likely to be carried over 2G or 3G networks; LTE handsets on LTE tariffs will still use 3G and 2G if LTE networks are not available.

While LTE networks will be fast enough to support video downloads, in most markets LTE will be used only occasionally for video download, due principally to the cost of serving that capacity and/or data costs to the end-user. LTE is more efficient in carrying data than 3G networks over a given amount of radio spectrum, meaning that the cost to the operator of carrying a gigabyte (GB) of data on an LTE network should be several factors lower than for 3G.

Despite LTE's superior spectral efficiency, it is still likely to cost about \$5 to \$10 for a mobile operator to carry 1GB of data, sufficient for about one to two hours of high definition (HD) video streaming or two to four hours of standard definition video<sup>183</sup>.

Some carriers may price LTE at under \$5 per gigabyte in 2013, but this will tend to be to encourage usage. As they fill up, mature LTE networks are likely to see significantly higher pricing. As of Q4 2012, research found a range of \$0.66 to \$5.50 per GB<sup>184</sup>. The former carrier at the lower end of the range had five percent of its customer base on LTE, while the latter had about 16 percent of its customer base on LTE<sup>185</sup>.

While LTE is unlikely to be able to deliver live, uninterrupted TV to a bus or train full of commuters on their way to work at an affordable price<sup>186</sup> this does not mean that LTE is inadequate; it is just not suited to this type of application.



At the end of the day, LTE isn't the reinvention of cellular. It is not the transformational shift that was seen in the move from essentially voice-only 2G technology to voice and data 3G technology. It does not require the effort and cost in educating the customer base what 3G entailed. It delivers more data, faster and often cheaper – characteristics which many are likely to find appealing and it is likely to encourage them to use mobile for more data applications, and more often, than was the case with 3G. Browsing a website should be faster and more pleasurable. Photos captured on a device may be shared at a higher resolution than with 3G, simply because the upload for a larger file takes less time. For business users, e-mail is still likely to remain a key application, but sending and receiving e-mails with bulky attachments should be an easier experience, and as such is likely to be attempted (and accomplished) more often.

#### **Bottom line**

A key question for operators across the globe remains how to encourage demand for LTE, both initially and over time. Two of the key levers are pricing and marketing.

Carriers need to price LTE services, initially and over time, to encourage customers to take advantage of the newly built network while ensuring a return on their investment. One approach is likely to be shared data plans. The two dominant US carriers offer multi-device shared data plans. Subscribers pay a fixed monthly fee for LTE access to a bucket of data which is shared across LTE-enabled devices, principally smartphones, tablets and laptops. This appears to be successful in driving rapid LTE adoption<sup>187</sup>. If successful, some consumers may even consider dropping their fixed broadband subscription<sup>188</sup>.

As the LTE base grows, carriers need to have a plan for pre-pay. In many markets pre-pay dominates in terms of subscriber numbers, so offering LTE handsets at prices applicable to the market likely to be a significant driver of adoption makes sense. In pre-pay markets such as India and Russia, where LTE is currently available, sub-\$100 LTE handsets could encourage faster adoption. When LTE services become available in China – the world's largest smartphone market – sub-\$100 handsets could be a critical factor in uptake<sup>189</sup>.

In terms of marketing, a key question is how best to differentiate 3G and 4G. Operators need to strike a balance between underwhelming and over-selling, as there may not be any single new killer app in 4G which 3G cannot deliver. What will differ markedly, however, is user experience, and as a result duration and intensity of usage.

Content companies are likely to be excited about the possibilities for distributing via faster LTE networks. However they should be realistic as to what is possible. LTE will be faster than 3G, but network access may be too expensive for bandwidth hungry applications, and bandwidth is finite. Sending video over LTE is technically possible but may not be the best use of LTE, particularly when alternatives such as Wi-Fi are available.



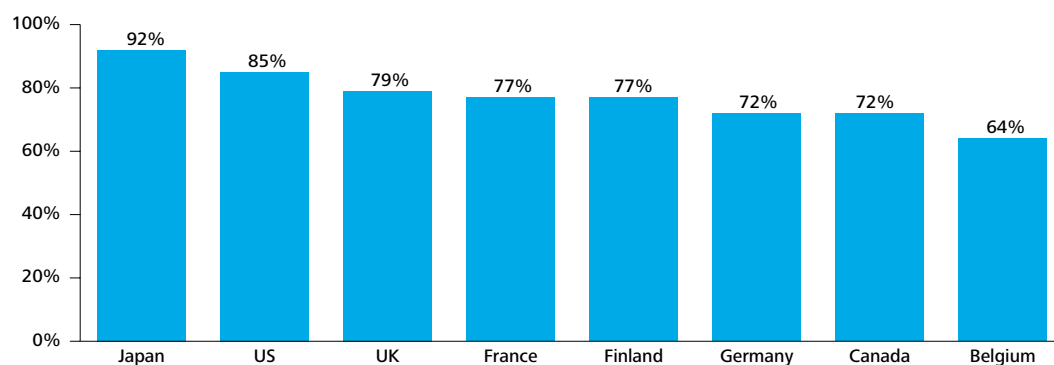
# Smartphones ship a billion but usage becomes simpler

In 2013, Deloitte predicts that global shipments of smartphones, defined as any device perceived by consumers as being a smartphone, will likely exceed one billion units for the first time<sup>190</sup>. The installed base of all smartphones, per this definition, is likely to be close to two billion devices by year-end<sup>191</sup>.

As the base grows, usage is likely to stratify further<sup>192</sup>. The absolute number of those exploiting the full breadth of a smartphone's capability is likely to increase, but the proportion and absolute number of those using only the basic functionality of a smartphone – voice, text and photos – is also likely to rise.

One significant example of the diversity in usage of smartphones relates to data. In 2013, one in every five smartphone owners may never or rarely (less than once a week) connect to the Internet through cellular or Wi-Fi in 2013. Throughout the year, there are likely to be hundreds of millions of smartphone owners who are not on a data package. Deloitte's research in multiple countries indicated that among those owning or with access to a smartphone more than one in five did not use their device to connect to the Internet (see Figure 2 and 3)<sup>193</sup>. The 400 million smartphones that never or rarely connect to the Internet in 2013 will not be idle, but their usage will resemble that of a feature phone.

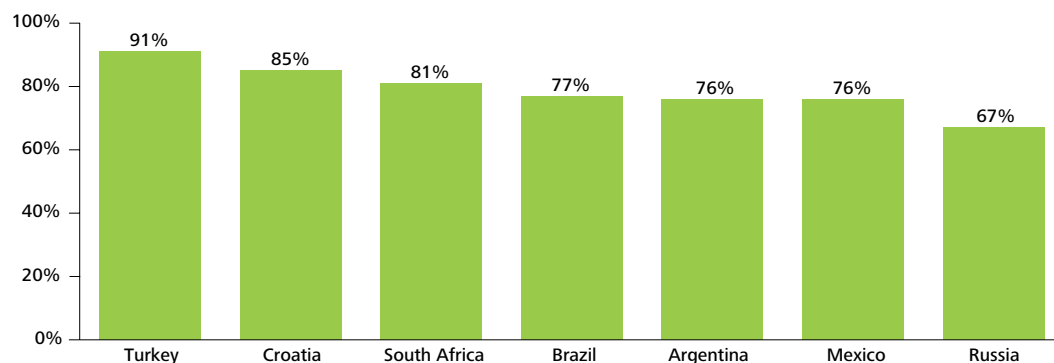
**Figure 2. Proportion of smartphones that are Internet-connected in developed markets among respondents who own a smartphone**



Note: The sample for developed markets is nationally representative.

Source: Deloitte Global Mobile Consumer Survey, May-June 2012<sup>194</sup>. Sample: Respondents who own a smartphone (Belgium 249, Canada 933, Finland 405, France 791, Germany 846, Japan 598, UK 1063, US 836)

**Figure 3. Proportion of smartphones that are Internet-connected in developing markets among urban professionals who own a smartphone**



Note: The sample for emerging markets is representative of the online population.

Source: Deloitte Global Mobile Consumer Survey, May-June 2012<sup>195</sup>. Sample: Respondents who own a smartphone (Argentina: 474, Brazil: 779, Croatia: 445, Mexico: 659, Russia: 591, South Africa: 1588, Turkey: 410)

The reasons for using these phones in such a basic way are multiple and often overlapping: the limited capability of new entry-level smartphones and older hand-me-down high-end smartphones; the lack of interest or ability among a proportion of smartphone owners to use their device's smart capabilities; the lack of understanding or affordability of data tariffs, including understanding of metered charging; the lack of the required cellular and/or Wi-Fi infrastructure that would enable a user to exploit the full set of a phone's smart functionality and multiple ownership of smartphones by individuals.

There is a significant variance in the technical capability in the smartphone base. While the capability of all smartphones at all price points is constantly rising, there is a massive difference in the specification of smartphones. A low-end smartphone can wholesale for as little as \$50, particularly for soon-to-be-replaced models<sup>196</sup>. A high-end smartphone can retail for over \$700 before tax. As Deloitte highlighted in the 2012 Predictions for the Telecommunications sector, as of the start of 2013, we estimate that half a billion of the global smartphone base will have retailed (prior to subsidy) for \$100 or less<sup>197</sup>.

Further, in 2013, the installed base of hand-me-down smartphones is likely to continue to rise. Smartphones that are over two years old may struggle to deliver the applications that a high-end smartphone, costing up to \$1,000 after tax, can.

Some games' graphics may render flawlessly on a high-end device, but appear pixelated and jerky on a low-end or relatively old smartphone. Some applications may simply not open on a low-end phone due to insufficient processing power or memory, while some low-powered devices may simply be poor at rendering even mobile specific sites. Entry level devices may only have 2.5G networks which may prove annoying slow at downloading data. In some markets 3G networks are not yet available<sup>198</sup>.

Owners of entry-level or older smartphones may download and try out apps, or browse some sites soon after acquiring their devices, but if the experience is poor, they may never try it again<sup>199</sup>. According to Deloitte's research conducted in 15 countries, 16 percent of smartphone owners have never downloaded a single app. In the developed markets surveyed, 21 percent of smartphone owners and 13 percent of urban professional smartphone owners in emerging markets have never downloaded an app<sup>200</sup>. It may be that the only apps this category of owners will ever use are those that come pre-loaded onto the device.

A second reason for basic usage is simply because the phones' owner is uninterested in using a smartphone for anything more than making calls and sending messages – even if the phone is capable of it<sup>201</sup>.

In a growing number of markets it is becoming ever harder to purchase feature phones, meaning that someone wanting to replace their feature phone may struggle to find an equivalent model to replace it with, and may settle for a smartphone through lack of alternatives<sup>202</sup>. That person may be reluctant or simply disinterested in using a smartphone's breadth of functionality. The growing inability to find a feature to purchase is likely to lead to a growing gulf between smartphone and 3G/4G penetration across all markets. For example, in Vietnam as of Q1 2012 smartphone penetration was around 30 percent but only 11 percent of subscribers had a 3G subscription<sup>203</sup>.

The shrinking availability of feature phones is mostly due to the fact that manufacturers, especially those with smaller scale, may not find it viable to develop their own proprietary operating system (OS) and prefer to use the available open source OSs. Some smaller manufacturers may simply find it unviable to manufacture 2G feature phones and focus on entry level 3G smartphones instead: a third party OS could be used, and margins may be higher.

Some users – for examples those that inherit smartphones from others – may be grateful to receive the phone, but may not want to use the data services, often for reasons of affordability. Teenagers receiving these devices may not be able to afford the data costs. Some of these donated smartphones may end up being used principally as portable games consoles or as music players and occasionally connect to Wi-Fi. Older recipients may find the data tariffs difficult to interpret, or be put off by articles in the press about bill shock<sup>204</sup>. In some households, there may only be sufficient budget for one or two data plans, but not for the entire family to be on a data plan. So while the penetration of smartphones may rise in a household, the number of data plans may stay constant. To provide context, in the US, average household spend on cell phones was \$1,226 in 2011 versus \$1,110 in 2007<sup>205</sup>. In that time, household spend for all items increased by \$67: in other words, families reduced spend in other areas to accommodate rising spend on mobile telephony. The ability to afford a greater number of data plans per household may be limited.

In a few cases individuals may spend hundreds of dollars on a new high-end smartphone and just use it to make calls and send messages. This is similar to the way in which luxury kitchens may typically only be used to make toast or a sports car with a racing heritage may be used predominantly for the school run. Owners of high-end smartphones – as with owners of any high-end product – may purchase these devices because of their build quality, or because of the cachet that comes with ownership, rather than because they necessarily want to exploit the range of their functionality.

A further reason for smartphones under-utilization is because the owner's underlying cellular network may have poor mobile data quality and coverage. While cities have ever improving 3G and LTE coverage, mobile broadband penetration in rural areas remains inconsistent. In emerging countries, fixed broadband infrastructure may be patchy and public Wi-Fi hotspots scarce.

A final reason for low or no usage of a smartphone's data capability is multiple ownership – a growing proportion of individuals own several smartphones. Among 15 countries surveyed in a recent study, between eight to 52 percent of respondents own or have access to a smartphone<sup>206</sup>. Some owners that are provided a smartphone by their employer prefer to buy a personal device too. In some cases this is to separate work and private lives; in other cases it is because an individual wants to use different models of phone for different functions, e.g. a qwerty keyboard phone for e-mail, and a touch screen for browsing. In these cases one smartphone may be used predominantly for data, but the other little used.

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### **Bottom line**

Smartphones have been a phenomenal success and are likely to remain so in 2013. However while smartphones' shipments and installed base should continue to grow, they are likely to be used in different ways by different users. Smartphone owners should not be considered homogenous. Even across the same model, usage is likely to vary considerably.

A key recommendation for operators is to encourage those currently refusing or reluctant to use data services to try them out. In some cases it may mean sponsoring the creation of content designed for lower-end phones that would provide an incentive to try out data. For others it may mean the creation of tariff schemes that are easier for the mobile data 'refuseniks' to understand – for example the offer of an all-you-can-eat per application tariff (For more information, see 2013 Prediction: All-you-can-app) For those that have inherited smartphones and do not take as intuitively to mobile data usage as the phone's first owner, in-store walk-throughs of how to browse or how to download apps may be useful.

Mobile operators should also note that failure to convince someone to use a smartphone's data capability isn't necessarily a failure. In one respect low data usage can be a good thing: metered voice usage remains a relatively high margin business in most markets, and they are much more likely to receive text messages through higher margin SMS tariffs than lower margin data messaging apps.

Understanding the diversity of smartphones and smartphone owners is critical to any company attempting a "mobile centric" strategy. This strategy needs to respect the diversity of the smartphone user base and also acknowledge the reluctance or financial inability of a large number of smartphone owners to use a smartphone for data<sup>207</sup>.

App developers should determine where they should best focus their development resources. Developing for all platforms and phones is unlikely to be feasible. Developers should note that owners of entry-level and older smartphones are unlikely to have significant personal budgets set aside for purchasing apps. This may cause a negative spiral: as owners of older phones have a declining range of apps compatible with their generation of smartphone, their appetite for accessing app stores will diminish.

Retailers and content companies should determine how their addressable market may vary by phone model or operating system<sup>208</sup>. Just because someone owns a smartphone does not necessarily mean that they will often or ever access a mobile website. Further, someone willing to purchase an app, such as a game, may not want do their weekly shop via their smartphone<sup>209</sup>. Similarly they should be careful to separate tablet users from smartphone users: while tablets and smartphones share an operating system, usage of a ten inch tablet may vary significantly from that of a four inch smartphone.

Smartphone vendors should determine how best to differentiate their products with target clients who are unlikely to use data services. One approach would be to preload a range of apps, such as games that can be played offline. For apps that require Internet connectivity, it may be that in order to gain app usage outside existing customer bases, content companies or businesses need to subsidize Wi-Fi or cellular connectivity costs<sup>210</sup>.

Also carriers should continue to build out data ready networks in the developing world: there may be hundreds of millions of data capable smartphones just looking for a signal – at the right tariff.

# “Mobile” advertising is dead. Long live tablet and smartphone advertising

Deloitte predicts that in 2013, what is currently described as “mobile” advertising will get split into two categories representing two similar but distinct devices – tablets and smartphones<sup>211</sup>. The smartphone sector may generate about \$4.9 billion in revenues in 2013, while advertising on tablets may be worth about \$3.4 billion<sup>212a</sup>.

In 2013, ad revenue is likely to reach \$2.50 per smartphone, and \$12.60 per tablet<sup>212b</sup>. The differences by type of advertising reveal a wider gulf. Display revenues, which include in-app ads<sup>213</sup>, are forecast at about \$7 per tablet, considerably higher than a forecast \$0.60 per smartphone. Differences between search revenue per device are less marked but still significant – at about \$1.70 per smartphone and about \$5.60 per tablet<sup>214</sup>.

In 2014, growth in both categories should be strong, with smartphone advertising rising by between 30 to 35 percent to about \$6.5 billion, and tablet advertising by 50 to 55 percent for tablets to about \$5.2 billion. Revenues will be generated from a forecast base of some 2.3 billion smartphones in 2014 (approximately a 20 percent increase from 2013) and 370 million tablets, a 40 percent rise from 2013<sup>215</sup>. Advertising revenues per smartphone in 2014 are forecast at about \$2.80 and about \$13.90 per tablet<sup>216</sup>.

Advertising effectiveness is measured by a range of metrics standard across most advertising formats, such as cost per thousand impressions (CPM) and, for online advertising, click through rates (CTRs). All these metrics should remain higher for tablets than for smartphones in 2013, and in some cases in the medium term. As of Q2 2012, CPMs for tablet computers averaged \$3.95; for smartphones they were up to \$2.85<sup>217</sup>. One analysis found that tablet CPMs are 33 percent to 55 percent higher than for phones<sup>218</sup>. Among smartphones, there are significant variations in usage by operating system and price bracket, with CPMs as of Q2 2012 ranging between \$0.20 and \$2.85<sup>219</sup>. One agency found that conversion rates were more than four times higher on tablets than on smartphones<sup>220</sup>.

Mobile advertising has traditionally grouped tablets and smartphones together because of their many similarities. Both devices share operating systems (OS). The processors, graphics, radios, Wi-Fi chips, cameras and satellite navigation chipsets used in smartphones are often the same as in tablets. Flash memory sizes are similar. The screen technology used on full-screen smartphones and tablets is virtually identical. Even price ranges are broadly similar<sup>221</sup>. Feature phones’ ad revenues are often bundled with smartphones’ as they also have some similarities, such as their usage of text-message based ads.

Yet in one critical respect, the devices differ: screen size. This drives fundamental differences in usage and monetization. Smartphones are five to seven square inches, and have little space in which to place high-impact display ads. The largest smartphones are 11 square inches, about a quarter of the space offered by 9.7 inch tablets, which boast a 40 square inch display area. Even seven inch tablet computers have almost twice as much viewable area, at 21 square inches, than the biggest smartphones.

The usability of a screen ratchets up with size. Ten inch tablet screens have four to eight times more surface area than smartphones, but usability, usage and advertising effectiveness may be multiples of that. Smartphones and tablets both use virtual keyboards. On the former the keys are small, but use clever algorithms to guess what the user is trying to input. On a ten inch tablet, the keys are likely to be similar to those on a laptop computer, i.e. close to the size of a typical fingertip. Error rates are likely to be lower. ‘Fat fingers’ – that is clicking on the wrong link when browsing or selecting the wrong letter or number when typing, are not about the user’s fingers being over-sized but rather due to tiny screens increasing the incidence of imprecise typing<sup>222</sup>. The higher the error rate when typing a search query or clicking on a hyperlink, the lower the likelihood the user will return.

It is important to note another critical trend among smartphones, which is stratification in usage. As mentioned, 1.9 billion smartphones are forecast to be in use by the end of 2013. But these devices will be used in increasingly different ways. For example, about 400 million devices will never, or rarely (less than once a week), be used to connect to the Internet. In other words, almost a quarter of smartphone users will rarely or never browse the Internet (and therefore will not be exposed to advertising on websites) or effect a search from their phones.

In the medium term, the number of smartphones users who rarely or never connect to the Internet – because all they want to do is to make calls and send messages – may grow, driven for example by a lack of standard feature phones to purchase. The growing base of smartphone owners who use their devices as feature phones may drag down ad revenues per device in the medium term. Messaging- based advertising would remain the only form of advertising on these devices.

An individual's pattern of smartphone usage is likely to be influenced by ownership of other devices, particularly tablets (and especially smaller, more portable tablets). Individuals who own both a tablet and a smartphone are likely to tend to use tablets for any activity that works better on a larger screen, including browsing, e-commerce, video games, gaming and some social network usage<sup>223</sup>. All these activities offer opportunities for serving ads or encouraging search.

A degree of tablet usage is likely to be a straight transfer from a PC: owners of larger tablets are likely to migrate, or to have migrated, a significant share of their browsing (including search), e-commerce, video games and communications activity to tablets. Again, browsing and communications support ad serving and stimulate search.

Tablet adoption is still in its relative infancy – globally by the end of 2013 there will be less than 300 million tablets in use and in most markets tablet penetration will be lower than 30 percent<sup>224</sup>. In fact, in the majority of markets ownership percentages will likely still be in the single figures. That means the tablet's full advertising potential is some way from being realized.

The use of search on smartphones and tablets when the user is out and about is likely to be affected by network availability. Search relies on bandwidth – either from cellular mobile or Wi-Fi. With inadequate bandwidth, it may be challenging for users to both run a search and then click on the results, impacting negatively on click through rates. Rising availability of Wi-Fi, as well as more extensive and faster 3G/LTE networks, should make the ability to complete a search cycle more likely and search should become more valuable as a result.

Use of search when out and about – regardless of network connectivity – will be driven by need. The need to search (for a place to eat, a shop or a hotel) is for the majority likely to be occasional rather than habitual. And when a search is required, there are multiple alternative options available, from polling friends and family, to speaking with a shop assistant or simply stumbling across a hidden treasure.

Smartphones and tablets can use location to increase advertising effectiveness. This could enable targeted advertising, perhaps blended with coupons. In markets with a broad base of smartphones enabled for near field communications (NFC) and NFC readers, smartphones could be used to find and then pay. However, while the NFC phone base is likely to be in the hundreds of millions in 2013, the availability of NFC readers may remain variable.

Smartphones and tablets are powerful advertising media, each with its strengths and constraints. While similar, they are distinct, and their distinctiveness may deepen over time.

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**Smartphones and tablets are powerful advertising media, each with its strengths and constraints. While similar, they are distinct, and their distinctiveness may deepen over time.**

### Bottom line

Usage of smartphones and tablets is sufficiently distinct to merit them being regarded as separate categories in multiple respects, including advertising. Splitting the device categories should make it easier for the industry to realize value from the advertising opportunities offered by billions of smartphones and tablets. The increasing variety of smartphones may also merit further delineation, for example by screen size, operating system or device age<sup>225</sup>.

Both forms of advertising are in relative infancy. In 2013 the modern tablet form factor will be a mere three years old and modern smartphones just a few years older. There is much experimentation and innovation ahead. For example, one area of opportunity is second screening, which is the use, while watching television, of a second (and in some cases third) connected screen-based device, such as a tablet, smartphone or laptop. Advertising shown on the television set could be replicated on the second screen, or the content of the TV program being watched could trigger certain websites to open on the second screen. Another opportunity lies with games. There are an estimated 200 million online gamers globally, who play for an average 13 hours per week<sup>226</sup>. The coming year is likely to see much continued experimentation with these opportunities.

The progression of smartphone and tablet advertising is likely to be linked to their ability to generate e-commerce revenues. While both devices are in their relative infancy, there is a significant gap in the range of content accessible via each. Most internet content is formatted for viewing on PCs. This reflects the PC's 80 percent share of browsing time across PCs, tablets and smartphones. Content formatted for PCs – including e-commerce sites – is generally also viewable on larger tablets. Smartphone advertising revenues are likely to be a function of the quantity of smartphone optimized e-commerce sites are created. Website owners need to determine how best to allocate development resources for PC-oriented and smartphone-optimized sites<sup>227</sup>.

Companies should also consider how smartphone and tablet advertising is likely to connect to other forms of advertising, and alternative forms of interaction. It may be that the smartphone drives discovery, the tablet offers further information and the PC or shop is where the transaction takes place<sup>228</sup>.

Advertisers should consider new forms of advertising specific to the physical characteristics and typical usage of smartphones. If the banner advertising used on PCs and tablets cannot readily fit a smartphone screen, then new formats should be tried which aim to harness its positive aspects (such as location information) and which work within its limitations. For example, rich media advertising such as interactive videos or game functionality might be more appropriate for small screens.

Any form of advertising may be subject to fraudulent activity. The smartphone and tablet ad categories are unlikely to be immune. The industry should consider how best to minimize fraudulent clicks<sup>229</sup> and exaggerated claims<sup>230</sup>.

Some users may be worried about fraudulent ads on smartphones and tablets which lead to malware being downloaded<sup>231</sup>. The industry should consider how best to indicate to users that ads are authentic.

# All-you-can-app

Deloitte predicts that in 2013 between 50 and 100 mobile operators will offer all-you-can-eat services with unlimited access to specific applications. All-you-can-app (AYCA) will, for a fixed monthly subscription, offer unrestricted use of each service's content, with connectivity charges bundled in. Over the course of the year the portfolio of AYCA services available should grow. Pricing is likely to range from zero to tens of dollars per month, with the price indicative of the content's value and data volumes. AYCA services will complement existing data tariffs.

In 2013 AYCA services will be aimed primarily at customers interested in, but hesitant about, mobile data usage, due to worries about running up large data charges. These will mostly be the hundreds of millions of users currently migrating or recently migrated to smartphones. Further, AYCA may be popular in countries with low income levels, where they will aim to stimulate usage of mobile data services.

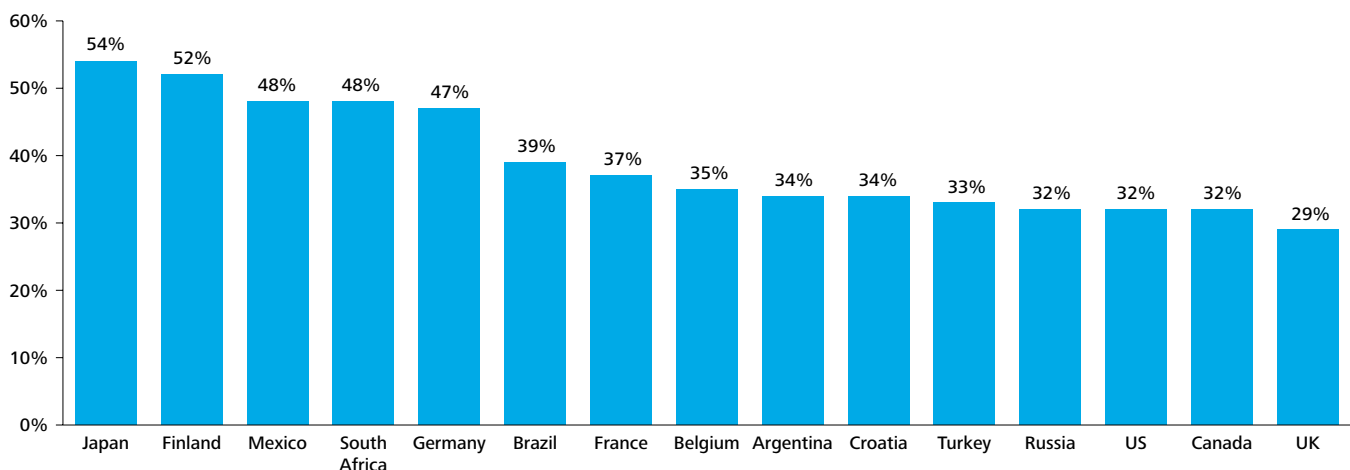
AYCA is a middle ground between unrestricted all-you-can-eat tariffs and metered data charging. All-you-can-eat is attractive to consumers but unpredictable, and occasionally rampant usage has made the offer uneconomic for some operators<sup>232</sup>. Metered usage enables carriers to charge according to network impact, but inadvertent usage can land subscribers with unexpectedly high data bills<sup>233</sup>.

A fundamental challenge of metered billing is that it requires subscribers to know the file sizes of digital content they want to download. However, the size of a digital file is not always obvious. Consumers are familiar with CDs and DVDs: they look the same, are of similar size and a CD album plays about half the time of a DVD movie. However consumers may not realize there is a thousand-fold difference in the size of a compressed MP3 track, which is typically a few megabytes (MBs) and an hour of high-definition video, which can be many gigabytes (GBs)<sup>234</sup>.

Operators are likely to be eager to introduce AYCA tariffs to encourage more of their subscriber base to use mobile data services. Data revenues are needed to counterbalance declines in mobile voice, SMS and roaming revenues. But a large proportion of smartphone owners do not appear to use data services. By year-end 2013 about 400 million of the 1.9 billion smartphone installed base may never or only rarely (less than once a week) be used to connect to the Internet. In 2013, and over the medium term, a large proportion of the four billion mobile users still using feature phones may upgrade to a smartphone<sup>235</sup>. This large group needs a mobile data pricing model appropriate to later adopters. This needs to be perceived as low risk.

AYCA may fit the bill. Among 15 countries surveyed in a Deloitte study, between 29 percent and 54 percent of smartphone owners would like to have unlimited access to services they use most (see Figure 4)<sup>236</sup>.

**Figure 4. Smartphone owners that would prefer to subscribe to a package which would give them unlimited access to services they use most, by country**

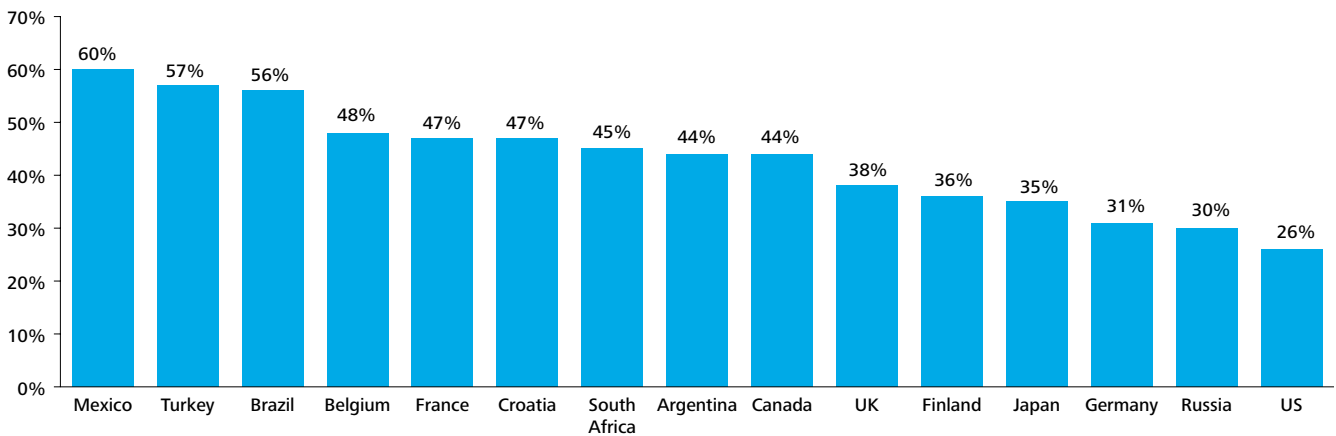


Source: Deloitte Global Mobile Consumer Survey, May-June 2012<sup>237</sup>. Sample: Respondents who own a smartphone and use the mobile network to connect to the Internet (all countries, 5,398 respondents)



The same study also found that between 26 and 60 percent of users had a higher-than-expected bill in the past 12 months (see Figure 5). Over half wanted to cap their monthly mobile spend and would be prepared to set a limit in excess of their current average spend<sup>238</sup>.

**Figure 5. Respondents who have had a higher-than-expected bill in the past 12 months**



Source: Deloitte Global Mobile Consumer Survey, May-June 2012<sup>239</sup>. Sample: Respondents who have a mobile phone contract (all countries, 11,090 respondents)

There are proven parallels to the AYCA model. The pay TV sector has for decades offered unlimited access to specific services or genres, such as sports, movies, music or kids content. Customers can readily increase or reduce their content bundles – and the monthly spend is predictable.

Deloitte’s research indicates that the most popular AYCA services would likely be for social networks, email, video and Instant Messaging (IM) services. Facebook was ranked the number one most desired service in 12 of the 14 countries surveyed – with Russia and Japan the only exceptions<sup>240</sup>. YouTube was second most popular, being ranked number one in Japan and number two in five countries. WhatsApp (an instant messaging service) and BlackBerry Messenger were also among the most popular services. The range of AYCA services offered is likely to steadily become more diverse over 2013 and beyond.

Operators are likely to partner with existing third party companies to jointly offer AYCA services, as well as create their own. For example in India, Reliance offers unlimited access to WhatsApp and Facebook for Rs16 (\$0.30) per month<sup>241</sup>. Some operators offer unlimited access to apps when roaming. Hong Kong firm 3 offers unlimited access to WhatsApp for around \$6 per month while roaming<sup>242</sup>. Telkomsel Indonesia offers optimized access to third party voice over Internet Protocol (VoIP) services<sup>243</sup>.

Operators are also likely to offer AYCA music and TV services, which are more data intensive. In Thailand, Malaysia and Singapore, online music service Deezer Premium + is available for a fixed fee with connectivity charges included<sup>244</sup>. In Germany, Deutsche Telekom has teamed up with Spotify to offer a €10 (\$12.88) service that bundles unlimited access to music with inclusive access charges<sup>245</sup>. As for TV, Vodafone in Spain and Greece is offering unlimited access to a range of TV channels for €1.77 (\$2.28) and €2.46 (\$3.20) respectively per week<sup>246</sup>.

Some operators and operator groups may offer AYCA services for free for a limited period to stimulate usage. In Q4 2012, Telefónica offered free usage and subscription to Joyn, a messaging application<sup>247</sup>. Some AYCA services may be offered for free to encourage usage of an indirectly monetized service. For example, Google has launched a service in partnership with Globe Telecom, in the Philippines, offering free access to Google products such as search, Gmail and Google+<sup>248</sup>. Users are able to access websites that show up in Google's search results for free. Accessing a site outside those results prompts an invitation to subscribe to a mobile data plan.



#### Bottom line

Confusion over data pricing benefits none of operators, consumers or content creators. While initial data users may have had a reasonable understanding of file sizes, mainstream users are more likely to get bill shock through inadvertent downloads of large files via cellular networks.

It is a good time to introduce AYCA: the majority of mobile customers have yet to move to smartphones, and predictability in pricing should provide sufficient reassurance to try out mobile data services. Further, the technological tools needed to deploy AYCA are increasingly economically viable – for example the cost of deep packet inspection (DPI) technology falls every year, due to Moore's Law<sup>249</sup>.

AYCA will not suit every customer or every carrier. Heavy users may prefer unrestricted all-you-can-eat packages, where available, and figure out for themselves which services to use each month. Business users may prefer metered packages. Carriers should offer the range of data tariffs most suited to their customer bases. In a few markets, AYCA may not be the right approach: rather offering differing tiers of unlimited usage but at different access speeds may be considered the best approach.

AYCA need not be limited to offers from carriers. Content companies and aggregators could offer products and services with bundled mobile connectivity charges<sup>250</sup>. Consumers would not have to pay twice: once for the content and again for data used in the download.

Carriers should also note that other connectivity providers are likely to offer AYCA-type services. For example, Google has entered into a partnership with a Wi-Fi provider in India which offers users unlimited access to Google+ and 10 minutes of free access to YouTube each week<sup>251</sup>.

Some handset vendors may want to proactively partner with content owners and pre-agree potential AYCA deals. This could make the vendors' handsets more attractive to operators when determining which handsets to support.

# The looming spectrum shortage: worse before it gets better

Deloitte predicts that although additional spectrum will continue to be made available in 2013 in many global markets, spectrum exhaustion will continue to exacerbate in many countries, especially in dense urban areas. End users will continue to see performance impacts as a result, primarily in the form of lower speeds, but also through inability to access networks and dropped calls or sessions. The reason is simple demand for spectrum will exceed supply. Demand for wireless bandwidth continues to grow in leaps and bounds, but supply is relatively constrained. By 2014 the US alone may suffer a 275 MHz spectral “deficit”<sup>252</sup>.

To be clear, a spectrum shortage is highly analogous to a crowded highway: it doesn’t just “stop working” like an electrical grid that goes down in a storm with no power to anyone across wide areas, sometimes lasting for days. Instead, the likely outcome of the predicted shortage will be most intense in cities, on certain networks (those with the most subscribers) and in peak wireless hours. Users can expect wireless ‘rush hours’ to be characterized by two to three times as many failed attempts to connect, three to four times as many dropped calls or frozen web browsing, and both 3G and 4G speeds 50-90 percent lower than expected. In the worst situations, download speeds may be under 1Mbit/s for lengthy periods of time, making video streaming impossible and even web browsing difficult.

The cellular device market sends and receives in the portion of the electromagnetic spectrum ranging from 600 MHz to 3600 MHz. These bands are strictly regulated by national governments and allocated for specific purposes. Spectrum is like land: no more can be made, it is difficult to share and not all spectrum bands are created equal. 900 MHz is the spectral equivalent of beachfront property: transmissions on that frequency band go further, penetrate buildings better and have good capacity. On the other hand, 3500 MHz is a bit like desert scrubland: radio waves in this band have shorter range, poor in building performance, and are even vulnerable to bad weather.

The demand for additional spectrum is tied directly to the seemingly insatiable consumption of wireless broadband communications. Wireless traffic has more than doubled each year since 2009 and the increasing penetration of smartphones and tablets only serves to exacerbate the problem<sup>253</sup>.

Today, the average smartphone drives 35 times more traffic than a typical cellphone. It is expected that by 2016 wireless traffic will have increased 50 fold from 2012.

So why can governments not just increase the “supply” of spectrum? The supply of radio spectrum can be improved by only two methods.

The first is accomplished through the allocation or reallocation of frequency bands to operators. As the distribution of spectrum can have major economic implications for competition and accessibility, many governments put significant effort into developing and governing the models used for assigning spectrum. For the last decade, the auction approach has become most prevalent, both as a source of government revenue and a relatively transparent method of allocating scarce and valuable resources. However, these auctions often incorporate additional rules to encourage new entrants, provide coverage of rural and lower income areas, provide support to aging public safety communication networks, and mandate that a certain percentage of the population be covered. While auctions allow additional capacity to be made available, such as the repurposing of analogue TV bands occurring in many countries, they do not occur rapidly, and are lagging behind surging demand.

The second method is to make more efficient use of limited spectrum. Fourth generation (4G) technologies such as LTE have substantially improved spectral efficiency. LTE is almost 16 times better than 3G at moving a bit of data over a Hertz of spectrum. However in the seven years it has taken to develop and widely deploy this new technology, wireless traffic increased 30-fold. Telecommunication equipment vendors simply can’t invent new technologies fast enough to meet growing demand. The emerging LTE-Advance standard expects to further double<sup>254</sup> spectral efficiency over LTE. This is wonderful, but results in adding less than a year of additional capacity at current growth rates.

Emerging technologies, such as Heterogeneous Networks or HetNets, have the potential to address some of these concerns. HetNets consist of a series of wireless access layers, protocols, and equipment allowing mobile devices to seamlessly move between wireless networks of various types. Voice calls and data sessions can be maintained without interruption as devices move between macrocells (covering dozens of km), microcells (covering kms), picocells (100s of meters) and femtocells (tens of meters) and back. Emerging technologies and standards can extend HetNets across Wi-Fi, Mesh and Ad-Hoc wireless networks as well.

As little as two years ago, this lack of portability was not a significant issue for most end users. Mobile devices connected to the cellular network were typically used in such a way that virtually all traffic was managed by a traditional macrocell, usually located on a tower. The problem is that moving between these networks is sometimes not transparent to either the end user or the network provider. Users may need to: manually identify and select a different network (either microcell or Wi-Fi); provide necessary credentials to authenticate onto the new network; and re-establish a session with the application.

HetNet is based around more intelligent devices and networks that can monitor the current wireless environment for available networks and single quality and, when appropriate, automatically select, authenticate and hand over current sessions without user intervention.

At this time, some of the technologies needed to deliver HetNet services have yet to be widely deployed. Further, HetNets require changes to the end user device, access points and the network core making adoption more complex and expensive.

Internet Protocol Version 6 (IPv6) is the successor to the widely used IPv4, which has "only" 4.2 billion unique addresses. Almost all of those are in use, requiring addresses to be re-used. While that helps mitigate the shortage of addresses under IPv4, it means that new addresses must often be dynamically assigned, making it difficult to maintain existing session information and to determine exactly where devices are located. IPv6 has  $10^{38}$  addresses (or enough to give every star in the known universe a trillion IP addresses) and will be able to give each device a unique identifier, and simplify the handover processes.

VoLTE (Voice over LTE) is another set of technologies and standards that will enable HetNet by allowing voice traffic to be carried over 4G networks. Today, most 4G networks use LTE for data and fall back to 2G and 3G networks for voice. This increases the complexity of moving calls between networks as there may be multiple voice and data sessions than need to be managed using very different methods and technologies. VoLTE handles voice calls as another data session (containing audio information) allowing much easier movement between networks.

The standards behind HetNet have been under development for several years (the IEEE 802.21 working group was established in 2004). However, since HetNets span networks defined by multiple standards bodies (including IEEE, 3GPP, 3GPP2, ITU-T and IETF) a number divergent attempts at standardizing network interoperability have occurred delaying widespread adoption. Although current initiatives have begun to show progress (such as 802.11u) there is still much activity. The Wi-Fi Alliance's Hotspot 2.0 program<sup>255</sup> began administering the Passpoint™ certification process in June 2012, which covers mobile devices and hotspots that automatically select and authenticate access to Wi-Fi networks using a devices SIM card. At present, only a limited number of certified devices are available. In parallel, the Wireless Broadband Alliance, as part of its own Next Generation Hotspot initiative<sup>256</sup>, is working closely with the Wi-Fi Alliance to validate certified devices in real world conditions. Phase two trials with several global carriers began in Q4 of 2012<sup>257</sup>. It is expected that many carriers are waiting on the outcome of these trials before making significant investments in HetNet related infrastructure.

While strong progress is being made towards making HetNet services a reality, it may take most of 2013 to resolve these challenges. Foundational technologies will continue to be rolled out, standards compliant equipment will become widely available and business concerns will be ironed out. Some markets will see the introduction of limited HetNet capabilities and limited pilots. Additional acquisitions in the Wi-Fi service provider and equipment market are likely as lagging carriers and manufacturers look to quickly build their footprint or expand their product offerings.

There is another approach, called cognitive radio, where the device detects all parts of the wireless spectrum and dynamically alters its transmission or reception parameters according to which bits are currently not being used.

This allows much more data to be sent over a given spectrum band at a given point in time<sup>258</sup>. Also known as dynamic spectrum management, it does work in labs today. But it is likely years to decades away from adoption.

### Bottom line

While progress is being made towards making additional spectrum available, and considerable effort is being made to improve spectral efficiency, demand for wireless bandwidth will likely attempt to outstrip these improvements in supply for at least several years. Major metropolitan areas in some geographies should expect to see continued deterioration in end user experience. The other alternative is that carriers may want to increase what they charge for data and speeds: if spectrum truly is a scarce resource, then using price to signal its value is likely to reduce demand to the point where service standards do not fall.

Regulators may wish to accelerate and streamline their spectrum allocation process. Although auctions are an equitable and transparent process that also raises money for the treasury, the process around them can take years or even decades. Further, they can look at allocating larger spectrum blocks (the blocks have tended to be somewhat fragmented) and encouraging solutions that promote spectrum sharing, particularly at the higher frequency bands.

Carriers will likely want to do even more with Wi-Fi, as well as find picocell and femtocell business models that lead to more rapid adoption. One possible strategy is that instead of having consumers pay for the small cells (which they have been loath to do) carriers can respond to complaints of poor coverage by paying for the femtocells themselves, and thinking of it as a customer retention tool and associated cost. Any coverage of adjacent areas and cellular offload is just gravy.

Spectrum isn't just needed for smartphones and tablets: as 4K TV rolls out, TV broadcasters may want to get back some of the spectrum that they gave away in the transition from analogue. Although compression is likely to improve the amount of bandwidth that 4K broadcast signals will require, it is unlikely to provide a true 4K signal in the current spectrum allocated for HD digital.

Ironically, in the short term, some customers may experience improved voice performance as delays in implementing VoLTE (Voice over LTE) will allow data traffic to migrate to 4G networks, while freeing up 3G networks to more effectively carry voice traffic.

There are some cities where macro-cell sizes are as small as they can usefully be: rooftop antennas and towers cannot be spaced any more closely. But that is not the case in all areas – sometimes the local resistance to new antennas is such that it can take years to erect a new tower<sup>259</sup>. Streamlining the cell site approval process – while continuing to allow for citizen input, of course – would help reduce some of the impact of spectrum scarcity.

Finally, along with cognitive radio, smart antenna technology with variable gain can correct for certain inefficiencies by directing signals toward devices generating or consuming traffic. In effect this shrinks the cell site by only occupying the spectrum in the direct line of sight between the tower and device. As other devices consume traffic, they can share that same spectrum by also taking advantage of the directionally focused antenna<sup>260</sup>.



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- 100 For a list of 4K TV sets announced: Source: Faster 4Kx2K, Slower AMOLED TV?, DisplaySearch Blog, 13 September 2012. See: <http://www.displaysearchblog.com/2012/09/faster-4kx2k-slower-amoled-tv/>
- 101 Price declines could be about 30 percent year-on-year in the short term. The actual price declines depend on demand. If demand for 4K demand is strong price decline will be faster.
- 102 TV set manufacturing assumes a certain number of bad pixels per square inch, with a certain acceptable level of errors. If a manufacturing process delivers a good 50 inch glass 90 percent of the time and assuming the error rate is not affected by screen size, you would get 76 percent good (90 percent ^ 2.5) glass on an 80 inch line of TV sets (an 80 inch set has two and half times the surface area of a 50 inch set). However factoring in other issues, yields for 80 inch sets are likely to be much lower. This means the cost of making 80 inch sets is markedly higher than 50 inch sets. In terms of market share, one analyst has forecast that 4K screens will account for over 20 percent of the 50 inch and larger TV market. For a discussion on demand drivers for 4K screens: Source: Faster 4Kx2K, Slower AMOLED TV?, DisplaySearch Blog, 13 September 2012. See: <http://www.displaysearchblog.com/2012/09/faster-4kx2k-slower-amoled-tv/>
- 103 About 50 films have been screened in 4K, but Hollywood plans to convert existing films to 4K. Laurence of Arabia is one title that has undergone conversion: Source: 4K channels could launch in 2014, 3D Focus, 29 November 2012. See: <http://www.3dfocus.co.uk/3d-news-2/ultra-hd/4k-channels-could-launch-in-2014/11300>
- 104 Some commentators have noted that an uncompressed 4K movie (4 terabytes in size) would require about 200 standard 25 GB Blu-ray disks for storage. Changing disc every few minutes might disrupt the viewing experience. However movies are compressed prior to being launched to the public. A compressed 4K movie could fit on a few standard Blu-ray discs or a single eight-layer disc. Source: Why Ultra HD isn't ready to replace HD, TechRadar, 23 February 2012. See: <http://www.techradar.com/news/television/tv/why-ultra-hd-isnt-ready-to-replace-hd-1065703>
- 105 This assumes a NTB file and an average throughput of about 7.5 Mbit/s
- 106 For more information on support for 4K standards: Source: Ivy Bridge Gets 4K Display Support in October, AnandTech, 9 November 2012. See: <http://www.anandtech.com/show/6270/ivy-bridge-gets-4k-display-support-in-october> . HDMI 2 is expected to support 4K.
- 107 For a table showing iterations of the HDMI standard: Source: HDMI, Wikipedia. See: [http://en.wikipedia.org/wiki/HDMI#Version\\_2.0](http://en.wikipedia.org/wiki/HDMI#Version_2.0)
- 108 Source: Why Ultra HD isn't ready to replace HD, TechRadar, 23 February 2012. See: <http://www.techradar.com/news/television/tv/why-ultra-hd-isnt-ready-to-replace-hd-1065703>
- 109 BSkyB in the UK and SKY Perfect JSAT have been trialling capture of football in 4K. Source: Sky tests 4K at The Emirates, Broadcast, 11 October 2012. See: <http://www.broadcastnow.co.uk/techfacils/sky-tests-4k-at-the-emirates/5047650.article>; Source: SKY Perfect JSAT airs soccer game at 4K, BroadcastEngineering, 2 November 2012. See: <http://broadcastengineering.com/satellite/sky-perfect-jsat-airs-soccer-game-4k>
- 110 Source: The opportunities for 4K video technology, Futuresource Consulting, November 2012. See: <http://www.futuresource-consulting.com/press.html>
- 111 Readers may be interested in the progress of 8K ultra high definition (UHD). While the first broadcasts of 8K are not expected till the 2020s, the practicality of shooting in 8K is improving rapidly. One major improvement is in terms of weight. The first super high vision 8K cameras weighed more than the average adult at 80kg. As of end 2012, the weight of 8K cameras had fallen to 4 kg.
- 112 For example: Source: Canon has unveiled the 4K EOS-1D C, Canon, April 2012. See: [http://cpn.canon-europe.com/content/news/canon\\_unveils\\_4k\\_eos\\_1d\\_c.do](http://cpn.canon-europe.com/content/news/canon_unveils_4k_eos_1d_c.do)
- 113 Source: Resellers snap up 4K Sony cameras, Broadcast, 19 November 2012. See: <http://www.broadcastnow.co.uk/techfacils/resellers-snap-up-4k-sony-cameras/5049124.article> (requires subscription to read the full article); Source: Red 4K Cinema Player, Red. See: <http://www.red.com/products/redray>
- 114 HEVC, also known as H.265, is the successor to H.264. It breaks video frames into blocks of 64x64 pixels versus 16x16 for H.264. For more information: Source: HEVC, a new weapon in codec wars, to appear in September, CNET, 22 August 2012. See: [http://news.cnet.com/8301-1023\\_3-57498163-93/hevc-a-new-weapon-in-codec-wars-to-appear-in-september/](http://news.cnet.com/8301-1023_3-57498163-93/hevc-a-new-weapon-in-codec-wars-to-appear-in-september/); Source: High Efficiency Video Coding (HEVC), Fraunhofer. See: <http://hevc.hhi.fraunhofer.de/>
- 115 As of H2 2012, 4K transmission was possible within a 50 Mbit/s link. In 2013, 4K trial broadcasts are expected to start in Korea, at between 30 and 40 Mbit/s. Source: First 4K Ultra High Definition Transmission via ASTRA 3B, Enhanced Online News, 7 September, 2012. See: <http://eon.businesswire.com/news/eon/20120907005241/en> ; Source: Get Ready For 4K and 8K Broadcasts (if you live in Korea or Japan), definitionmagazine, 8 November 2012. See: <http://www.definitionmagazine.com/journal/2012/11/8/get-ready-for-4k-and-8k-broadcasts-if-you-live-in-korea-or-j.html>

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- 117 Source: Astra plans 4K and iPad for HD+, Broadband TV News, 29 November, 2012. See: <http://www.broadbandtvnews.com/2012/11/29/astra-plans-4k-and-ipad-for-hd/>
- 118 According to research, higher picture quality discourages channel hopping. Source: Get Ready For 4K and 8K Broadcasts (if you live in Korea or Japan), definitionmagazine, 8 November, 2012. See: <http://www.definitionmagazine.com/journal/2012/11/8/get-ready-for-4k-and-8k-broadcasts-if-you-live-in-korea-or-j.html>
- 119 The need for a reason to upgrade is particularly pressing given recent declines in sales volumes of TV sets. Source: LCD TV shipments decline for first time ever, CNN Money, 21 June, 2012. See: <http://money.cnn.com/2012/06/21/technology/TV-shipments-LCD/index.htm>
- 120 For a discussion on the impact of high resolution screens in phones, tablets and computers: Source: Why does a retina display matter?, TechRadar, 2 June, 2012. See: <http://www.techradar.com/news/mobile-computing/tablets/why-does-a-retina-display-matter-1082433>
- 121 For a discussion on pixel density: Source: Will Apple Keep Upgrading Display Resolution?, DisplaySearch Blog, 8 November, 2012. See: <http://www.displaysearchblog.com/2012/11/will-apple-keep-upgrading-display-resolution/>
- 122 For an analysis of how the multiple streams of TV and Web content were consumed in the UK during the Olympic Games, the BBC has provided in-depth commentary on demands for content for each category content and each device. Deloitte's view is that much of the consumption of content in peak time would have been based on multiple devices, that is combining TV broadcast (one or more streams), online video and online text. Source: The story of the digital Olympics: streams, browsers, most watched, four screens, BBC, 13 August 2012. See: [http://www.bbc.co.uk/blogs/bbcinternet/2012/08/digital\\_olympics\\_reach\\_stream\\_stats.html](http://www.bbc.co.uk/blogs/bbcinternet/2012/08/digital_olympics_reach_stream_stats.html)
- 123 There have also been attempts to provide a single screen solution by using 3D technology. 3D TV signals work by sending alternative left and right eye images. 3D glasses have distinct left and right lens characteristics, which enable the creation of a 3D image in the viewer's brain. One other use of 3D is to broadcast alternate programs on each frame, with one program shown on one frame, and the other on the subsequent one. One viewer is given a set of glasses with the equivalent of two left lenses; the other gets two right lenses. This enables each viewer to see one program, but not the other. That is the theory; the practice is that the viewer is still able to see a small, but sufficiently distracting, amount of two programs, which means this approach is not yet fully viable.
- 124 Prices obtained from popular e-commerce sites in a range of countries in December 2012.
- 125 For data on the rising size of television screens, see: Percentage of TV sets sold, by screen size, Ofcom, 2012: <http://stakeholders.ofcom.org.uk/market-data-research/market-data/communications-market-reports/cmr12/tv-audio-visual/uk-2.12>
- 126 According to analysts, connected TV sales should be in the high tens of millions in 2013; the installed base should reach into the hundreds of millions. Note that these are number for TVs with integrated connectivity. Hundreds of millions more households can readily connect their TV sets via peripherals. Sources: Smart TV Growth For 2012 Pegged At 15%, But North Americans Still Slow To Adopt, TechCrunch, 17 October 2012. See: <http://techcrunch.com/2012/10/17/smart-tv-growth-for-2012-pegged-at-15-but-north-americans-still-slow-to-adopt/>; A fifth of TV sets connected to the Internet by 2016, Digital TV Research, 2 November 2011. See: <http://www.digitaltvresearch.com/ugc/press/22.pdf>
- 127 As of Q1 2012, smart TVs, which incorporate connectivity, had 20 percent market share in the UK, up from five per cent share two years previously. Source: The Communications Market 2012, Figure 2.16, Ofcom, July 2012. See: [http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/UK\\_2.pdf](http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/UK_2.pdf)
- 128 One survey found that about half of connected TV sets had actually been connected. Source: Half of Internet TVs Aren't Connected, TechNewsDaily, 17 February 2012. See: <http://www.technewsdaily.com/3827-exclusive-internet-tvs-connected.html>. Research undertaken by Ofcom in the UK found that 60 percent of those that purchased a smart TV (which incorporates connectivity) did so because "I needed a new TV and decided to buy one with the latest technology". By contrast one fifth did so because "I liked the range of internet connected services available" and 27 percent noted that "It was nothing to do with the internet functionality of the TV". Source: The Communications Market 2012, Ofcom, July 2012, Figure 2.17. See: [http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/UK\\_2.pdf](http://stakeholders.ofcom.org.uk/binaries/research/cmr/cmr12/UK_2.pdf). These findings are echoed by others who note that purchasers of connected TV sets in the US buy a connected set because the best TVs come with connectivity, not because connectivity necessarily defines the best TVs. Source: Sure, People Will Buy 'Connected TVs,' But Will Anyone Actually Use Them?, paidContent, 30 August 2010. See: <http://paidcontent.org/2010/08/30/419-sure-people-will-buy-connected-tvs-but-will-anyone-actually-use-them/>
- 129 According to one survey in the UK, about half of those with a connected TV set had connected it. Source: The year of connected TV, Page 7, Harris Interactive, June 2012. See: [http://www.harrisinteractive.com/vault/HI\\_UK\\_TMTE\\_Reports\\_ConnectedTV.pdf](http://www.harrisinteractive.com/vault/HI_UK_TMTE_Reports_ConnectedTV.pdf)
- 130 Research undertaken in the UK published in June 2012 found that 13.5 percent of households claimed to have a connected TV set. Source: No rise in take-up of connected TVs, Broadcast, 15 June 2012. See: <http://www.broadcastnow.co.uk/news/multiplatform/no-rise-in-take-up-of-connected-tvs/5043288.article> (requires subscription to read the full article); Research conducted by Deloitte LLP on the UK market (4,000 respondents, nationally representative) at that time found that 43 percent of households have a games console capable of accessing TV content via dedicated broadcaster channels apps. For more information, see: TV: Why? Perspectives on the UK television sector 2012, Deloitte LLP, August 2012: [www.deloitte.co.uk/television](http://www.deloitte.co.uk/television)
- 131 As of 2010, according to OECD data, in 27 countries around the world, household broadband penetration had surpassed 60 percent. In these countries broadband penetration rates would likely have risen, to at least 65 percent, by January 2013. In at least half of these countries, broadband speeds should be sufficient to enable TV or movies-on-demand to connected TV sets. For more data on broadband penetration; Source: OECD Broadband Portal, The Organisation for Economic Co-operation and Development (OECD), December 2011. See: <http://www.oecd.org/internet/broadbandandtelecom/oecd broadbandportal.htm>
- 132 For a collection of discussions on connected TV, see: Connected TV, Guardian: <http://www.guardian.co.uk/media-network/connected-tv>
- 133 For example, in the UK one of the companies offering an OTT service is a leading pizza delivery company. Source: Pizza chain launches VOD service in U.K., Variety Insight, 30 October 2012. See: <http://www.variety.com/article/VR1118061416>
- 134 Deloitte LLP estimate based on Ofcom number for 2011 of \$370 billion. Source: Global TV revenue climbs, C21 Media, 14 December 2011. See: <http://www.c21media.net/archives/74097>

- 135 Usage of digital video recorders (DVRs) and on demand services are often similar. Deloitte LLP has undertaken research on the time period in which programs recorded to DVRs are watched. In the UK about 70 percent of pre-recorded reality TV, sports, news and current affairs and soap operas are watched within a day of first broadcast; between 82 percent and 88 percent of these programs are watched within two days of first broadcast; between 95 percent and 100 percent are watched within a week. Source: Deloitte LLP and GfK, June 2012.
- 136 The most-watched programs on the BBC's iPlayer are recently broadcast programs. Source: Monthly Performance Pack, Page 13, BBC, October 2012. See: <http://downloads.bbc.co.uk/mediacentre/iplayer/iplayer-performance-oct12.pdf>
- 137 For example in the UK, one on demand service called SeeSaw was launched by a national TV infrastructure company. While this company provides services to much of the country, it is not a consumer brand, and hence had to create a new brand for its business to consumers. Source: SeeSaw chief executive looks forward to launch, The Telegraph, 14 February 2010. See: <http://www.telegraph.co.uk/technology/news/7223006/SeeSaw-chief-executive-looks-forward-to-launch.html>
- 138 The BBC's iPlayer service had 165 million requests for TV programs in October 2012 – a record, and a 23 percent increase on the 134 million requests in the previous October. This represents less than three programs per month for every potential user of the service. Source: Monthly Performance Pack, Page 4, BBC, October 2012. See: <http://downloads.bbc.co.uk/mediacentre/iplayer/iplayer-performance-oct12.pdf>
- 139 A multichannel video programming distributor (MVPD) is a service provider delivering video programming services, usually for a subscription fee (pay TV). These operators include cable television (CATV) systems, direct-broadcast satellite (DBS) providers, and wireline video providers such as competitive local exchange carriers (CLECs) using IPTV. In Canada these same players are called Broadcast Distribution Undertakings (BDUs). There are just under 100 million pay TV subscriptions in the United States, and 11.5 million in Canada.
- 140 One survey found that that 31 percent of current mobile/connected TV viewers were either planning to cancel their pay TV service in the next year or seriously considering cancelling. Of those, 81 percent saying online over-the-top video options are the primary reason. Source: Tremor Video Study Finds Increased Mobile Video Consumption In The Home, Business Wire, 30 May 2012. See: <http://www.businesswire.com/news/home/20120530005878/en/Tremor-Video-Study-Finds-Increased-Mobile-Video>
- 141 Source: OVER-THE-TOP SERVICES ARE FAR MORE LIKELY TO APPEAL AS COMPLEMENTARY, RATHER THAN PRIMARY, PAY-TV SERVICES, Analysys Mason, 21 July 2011. See: [http://www.analysismason.com/About-Us/News/Insight/Insight\\_payTV\\_Europe\\_Jul2011/](http://www.analysismason.com/About-Us/News/Insight/Insight_payTV_Europe_Jul2011/)
- 142 It is important to use a four quarter number: there is pronounced seasonality in pay TV additions and cancellations, with Q1 and Q4 being positive, and Q2 and Q3 being negative. Source: Cord-Keeping: Pay TV Shrinks for the Quarter, Stays Steady for the Year, All Things D, 7 November 2012. See: <http://allthingsd.com/20121107/cord-keeping-pay-tv-shrinks-for-the-quarter-stays-steady-for-the-year/>
- 143 BMO Capital Markets proprietary research, November 2012.
- 144 Less than 15 percent of North Americans get any TV from terrestrial broadcasts.
- 145 For example in Germany there is license fee of about €18 [\$47] per month, in the UK there is a license fee of £145 [\$190] per year. Source: German TV licence fee to remain stable, Rapid TV News, 18 January 2012. See: <http://www.rapidtvnews.com/index.php/2012011818885/german-tv-licence-fee-to-remain-stable.html>; Source: TV Licence types and costs, TV Licensing. See: <http://www.tvlicensing.co.uk/check-if-you-need-one/topics/tv-licence-types-and-costs-top2/>; Source: Television licence, Wikipedia. See: [http://en.wikipedia.org/wiki/Television\\_licence](http://en.wikipedia.org/wiki/Television_licence)
- 146 Source: Connected-TV and pay-TV operator partnerships: Harnessing market disruption for mutual gain, informa telecoms & media. See: <http://www.informatandm.com/wp-content/uploads/2012/02/ITM-CES-Connected-TV-White-Paper.pdf>
- 147 In North America, pay TV rates have tended to drop when the economy is weak and rise when it recovers. Globally, the relationship is less clear: even during recent European economic weakness, pay TV penetration has been increasing.
- 148 Source: New households growing in the U.S., 7 November 2012, Business First. See: [http://www.bizjournals.com/louisville/blog/morning\\_call/2012/11/new-households-growing-in-the-us.html](http://www.bizjournals.com/louisville/blog/morning_call/2012/11/new-households-growing-in-the-us.html); New household formation is a complex topic. In between national censuses, it is an estimate based on smaller samples, and subject to frequent revision. Since 2008, levels of household formation have been much lower than historical rates, but seem to be accelerating in late 2012 to over 1.15 million households year-over-year, more than 70 percent higher than the average following the recession.
- 149 Source: Cord-Keeping: Pay TV Shrinks for the Quarter, Stays Steady for the Year, All Things D, 7 November 2012. See: <http://allthingsd.com/20121107/cord-keeping-pay-tv-shrinks-for-the-quarter-stays-steady-for-the-year/>
- 150 BMO Capital Markets proprietary research, November 2012.
- 151 Source: Time Warner CEO: Cord cutters not an issue, "cord nevers" might be, paidContent, 16 November 2012. See: <http://paidcontent.org/2012/11/16/time-warner-ceo-cord-cutters-not-an-issue-cord-nevers-might-be/>
- 152 Based on interviews with multiple North American broadcasters and distributors.
- 153 Based on interviews with multiple North American broadcasters and distributors.
- 154 Source: The NPD Group: Average Monthly Pay – TV Subscription Bills May Top \$200 by 2020, The NPD Group, 10 April 2012. See: [https://www.npd.com/wps/portal/npd/us/news/press-releases/pr\\_120410/](https://www.npd.com/wps/portal/npd/us/news/press-releases/pr_120410/); Average US pay TV bill was \$86 in 2011, and assumed to grow at six percent, so over \$90 in 2012.
- 155 Source: Cord-Cutting: Cable's Offer You Can't Refuse, The Wall Street Journal, 13 November 2012. See: <http://online.wsj.com/article/SB10001424127887324073504578109513660989132.html>
- 156 The exact amount would depend on the bit rate and the amount of shared watching. Different ISPs have different data caps, speeds, and pricing plans. Potential cord cutters may not be the "average" North American TV watcher, and therefore need or not need to pay more for data.
- 157 Assuming 2.5GB per hour and two people per household, requiring 1.2 Mbit/s downstream. Bandwidth requirements vary by provider. Some services have variable rate throughput, with bandwidth dynamically variable according to the speed of the broadband connection and/or the device on which video is being used.
- 158 Source: The Cross-Platform Report, Nielsen, 15 June 2011. See: <http://www.slideshare.net/genarobardy/nielsen-crossplatform-report-q1-2011>
- 159 The GSA forecasts that 209 LTE commercial networks will be available by the end of 2013. Up to 10 operators may have launched the next iteration of LTE Release 8, also known as LTE advanced. LTE Release 8 can support up to 300Mbit/s in a 20MHz channel with 4x4 MIMO or by using 2 carriers of 20MHz, i.e. 40MHz of spectrum, but using a 2x2 MIMO. LTE Advanced Release 10 can support over 1Gbit/s with at least four aggregated carriers of 20MHz each (and up to 100MHz of spectrum) using a 4x4 MIMO. Sources: Evolution to LTE Report, Global Mobile Suppliers Association, 2 November 2012. See: [http://www.gsacom.com/downloads/pdf/GSA\\_Evolution\\_to\\_LTE\\_report\\_011112.php4](http://www.gsacom.com/downloads/pdf/GSA_Evolution_to_LTE_report_011112.php4) (requires subscription to read the full article); Russia Gets LTE-Advanced, Telecom Weekly, 24 October 2012. See: [http://www.lightreading.com/document.asp?doc\\_id=226310](http://www.lightreading.com/document.asp?doc_id=226310)

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- 163 Sources: LTE subscriber base reaches 12 million at the end of 2011, Fierce Wireless, 13 March 2012, see: <http://www.fiercewireless.com/press-releases/lte-subscriber-base-reaches-12-million-end-2011>; Global 3G connections reach 1B, says industry group, Telecom Asia, 27 January 2012, see: <http://www.telecomasia.net/content/global-3g-connections-reach-1b-says-industry-group>
- 164 According to Canalis, as of the end of Q2 2012, there were almost 17 million LTE-enabled smartphones shipped in United States, which account for almost 60 percent of all LTE-enabled smartphones shipped worldwide.
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- 166 Source: Status of the LTE Ecosystem, Global Mobile Suppliers Association, 28 October 2011. See : [http://www.gsacom.com/downloads/pdf/GSA\\_197\\_LTE\\_devices\\_Form\\_Factors.php4](http://www.gsacom.com/downloads/pdf/GSA_197_LTE_devices_Form_Factors.php4) (requires subscription to read the full article)
- 167 Source: Status of the LTE Ecosystem, Global Mobile Suppliers Association, 23 November 2012. See: [http://www.gsacom.com/downloads/pdf/gsa\\_lte\\_ecosystem\\_report\\_231112.php4](http://www.gsacom.com/downloads/pdf/gsa_lte_ecosystem_report_231112.php4) (requires subscription to read the full article)
- 168 The vast majority of LTE chipsets support only four to five of the eight main bands on which LTE networks are run globally: in North America, 700/800 and 1700/1900 MHz are used; 2500 MHz in South America; 800, 900, 1800, 2600 MHz in Europe; 1800 and 2600 MHz in Asia; and 1800 MHz in Australia. In some cases LTE support may come included as part of an integrated chipset that combines various capabilities including LTE. However the LTE capability may only be effective if combined with other hardware parts such as signal amplifier and filter. Upgrading the radio hardware on a smartphone is very unusual so such devices, while supporting LTE, are very unlikely to be ever used on an LTE network due to the upgrade cost. Source: Nexus 4 Features Hidden LTE Chip, International Business Times, 26 November 2012. See: <http://www.ibtimes.com/nexus-4-features-hidden-lte-chip-footage-explains-how-activate-4g-lgs-new-handset-videos-900174>. For more information on LTE frequency bands Source: LTE (telecommunication), Wikipedia, 29 November 2012. See: [http://en.wikipedia.org/wiki/LTE\\_\(telecommunication\)#Frequency\\_bands](http://en.wikipedia.org/wiki/LTE_(telecommunication)#Frequency_bands)
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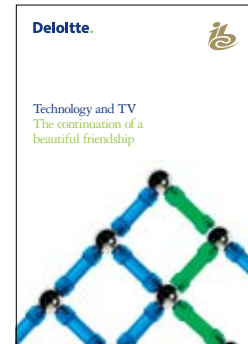
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