



**ADOPTION OF INFORMATION
& COMMUNICATIONS TECHNOLOGIES
IN THE UNITED STATES:**

NARROWING GAPS, NEW CHALLENGES

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Introduction

New technology in information and communications has changed the character of the digital divide—and the meaning of digital equity in this deeply connected age. Today home Internet access is common, but low-income households, older Americans and people who have high school degrees or less lag behind other demographic groups.

The widespread use of smartphones is narrowing the gap for some of these groups, but that alone is not a solution for overcoming the digital divide.

These factors, along with the growing importance of the Internet to the economy and society at large, are shifting discourse on digital equity. Since 2009, the Federal Communications Commission has focused the debate around broadband access, which it characterized as a “foundation for a better life” in developing a National Broadband Plan to connect more households by 2020. In fact many key institutions in business, education, health care and government deliver services today in ways that assume that people have Internet access.

This evolving landscape requires a multifaceted approach to policy debates and investments, a new challenge for social organizations and others concerned with narrowing the divide and promoting digital equity. Upgrades in networks and growth in technical capacity must be complemented by investments in digital skills and literacy, and assessing their effectiveness.

The payoff has tremendous potential, leading to powerful new ways to deliver services, but also connecting more people and helping them engage more effectively with their communities.

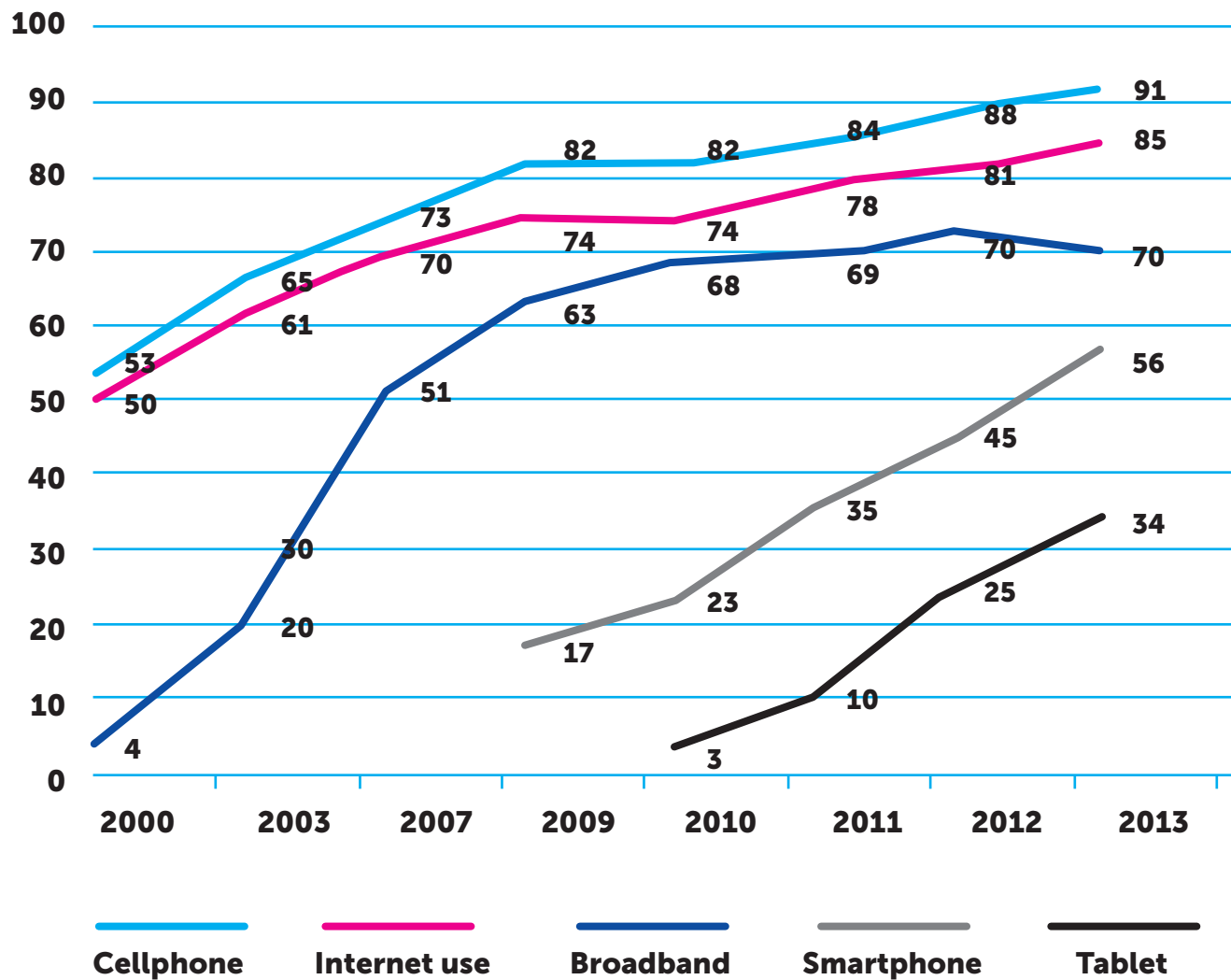
A. Broadband adoption trends

How has the digital divide—the existence of systemic gaps in adoption of information and communications technologies—changed since 2000?

Americans have more and better information and communications technologies today than a dozen years ago. In 2000, half of households had personal computers (51.5 percent) and 41.5 percent had Internet access. Home online access was mainly on dial-up Internet connections; just 4.4 percent of American households used “always-on” high-speed connections, at a time when access speeds were much slower than today. Today, devices have decreased in size and increased in computing power. Wireline and wireless networks have become faster and more available, and online access and use is prevalent in the United States.

Figure 1: Adoption of information and communications technologies, 2000-2013

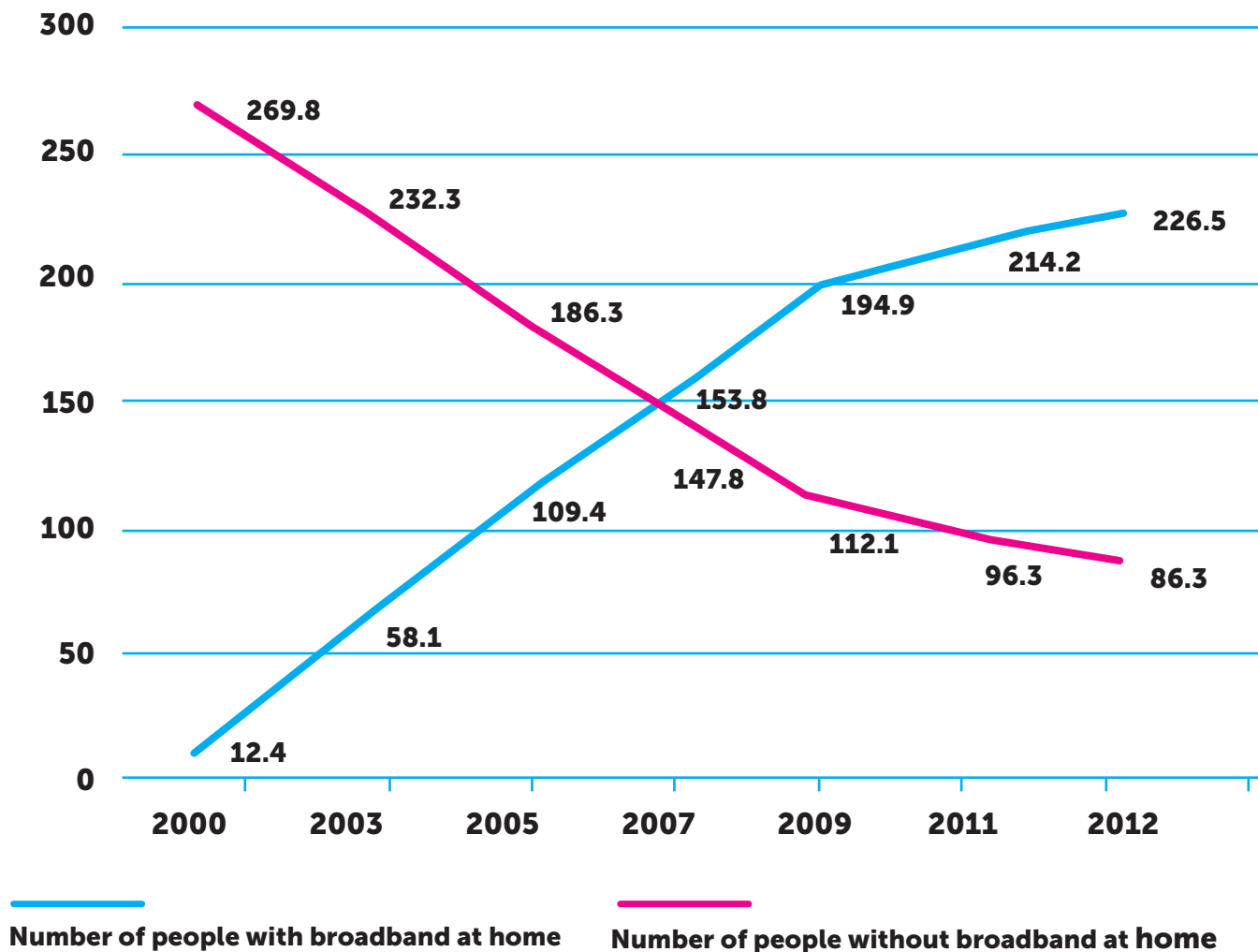
(Percent of American adults with each device or service)



Today, 70 percent of Americans have home broadband access. This is up from 51 percent in 2007. Eighty-five percent of Americans use the Internet from somewhere (home, work, a library, a friend's house or a community center). Home access is common. Some 90 percent of those who use the Internet have access from home; of those home users, 92 percent use broadband to go online and 4 percent use dial-up (the remainder do not identify their means of access). Mobile access is widespread as well; some 63 percent of Americans have used the Internet on a mobile device such as a smartphone, tablet or other handheld device. Some 35 percent of Americans (older than age 16) have used the Internet for free outside their home (such as at work or school), and 26 percent have used the Internet at the library. In both cases African-Americans register above the average.

As the following figure shows, those numbers grew substantially in just six years; in 2007 more than half the people in the United States had broadband at home.

Figure 2: Millions of Americans with and without broadband at home (figures in millions)



To put Internet access trends in historical context, it took 20 years (from 1920 to 1940) for electricity to go from 35 percent adoption in homes to 79 percent. It took the telephone 40 years (from 1920 to 1960) to reach 78 percent penetration. Adoption of the Internet in homes has reached the same levels much quicker.

What population segments have below-average home broadband adoption rates?

Income, education and age are the largest predictors of whether a household has broadband. Race and geography (i.e., whether one lives in a rural area) also matter, though to a lesser extent.

The following figures show the share in each group that has broadband at home, compared with an average of 69 percent (from 2011, the most recent data from the National Telecommunications & Information Administration that provides detailed demographic breakouts):

- **Low-income Americans:** 43 percent of households with annual incomes of \$25,000 or less (25 percent of the general population) have broadband.
- **Older Americans:** 49 percent of people age 65 and over (25 percent of the general population) have broadband.
- **Less educated Americans:** 51 percent of Americans with a high school degree or less (42 percent of the population) have broadband.
- **African-Americans:** 55 percent of African-Americans (12.6 percent of the population) have broadband.
- **Hispanics:** 56 percent of Hispanics (16.4 percent of the population) have broadband.
- **Rural Americans:** 58 percent of rural Americans (19.3 percent of the population) have broadband.

How does the United States compare to other countries in broadband?

For broadband adoption, the Organization for Economic Cooperation and Development (OECD) ranks the United States at No. 15 (out of 34 OECD countries) in the number of fixed wireline broadband subscriptions per 100 inhabitants. The United States had 28.8 fixed broadband subscriptions per 100 inhabitants at the end of 2012. Switzerland ranks first with 43.4 subscriptions per 100 inhabitants; France ranks fifth with 36.4; the United Kingdom ranks eighth with 34.3; and Germany ranks ninth with 34.1.

For wireless broadband, the picture is better for the United States, which ranks sixth among OECD countries with 89.8 mobile broadband subscriptions per 100 people. Finland, Sweden, Australia and Korea top the rankings, each with more than 100 mobile broadband subscriptions per 100 inhabitants. The strong showing of the United States is driven by mobile broadband subscriptions on devices such as smartphones and tablets.

The United States ranks No. 9 in the world on average network connection speed and No. 11 for peak network speeds, according to the "First Quarter, 2013 State of the Internet" report by Akamai Technologies. The United States ranks poorly in the share of homes with fiber optic broadband connections; 7.4 percent of homes have such connections, according to the Organization for Economic Cooperation and Development, which ranks the United States at 21st among OECD countries.

Overall, home broadband adoption and wireline network speeds in the United States fall in the middle when compared to other countries. The United States ranks better in international comparisons for wireless broadband.

With all the changes in access technology, how has the notion of the digital divide changed in discourse among policymakers and other stakeholders?

Since 2009, when the Federal Communications Commission began development of the National Broadband Plan, the digital divide debate has been about broadband. In characterizing broadband access as a “foundation for a better life,” the National Broadband Plan set a goal of having 100 million households connected to broadband by 2020. By comparison, some 74 million households had broadband in 2010. For context, there were 117 million households in the United States in 2012. Assuming the number of households increases at roughly the rate of projected population growth, the United States would have approximately 124 million households by 2020. This means the plan’s 2020 goal is for 81 percent adoption of household broadband at speeds of 100 megabits per second.

As of 2012, 72.4 percent—84 million homes—have broadband, according to 2012 data from the National Telecommunications & Information Administration; this means about 33 million households lack broadband. Given multiple people may be in a household, the latest data estimates that about 83 million Americans do not have broadband at home.

Although this report will discuss other modes of online access (e.g., wireless on smartphones), broadband adoption at home should be thought of as an anchor to people’s access. Whether it is a smartphone plan with a data cap or a tablet computer, a great deal of wireless use occurs on Wi-Fi networks at home—and that requires a home broadband access plan. As people use more data on smartphones, many carriers encourage the use of home Wi-Fi to lessen congestion on wireless networks.

B. Smartphone and mobile Internet trends

Smartphones may be a game-changer when it comes to online access. What do adoption patterns look like for smartphones?

Smartphones refer to handheld devices that run on operating systems (such as Apple’s iOS, Android, Windows or Blackberry) that permit the user to access the Internet. For the purposes of this report, the assumption is that people with smartphones have access to the Internet; research indicates that the vast majority of people with smartphones use them to go online.

Smartphone adoption in the United States has been remarkably fast (in comparison to the adoption of other information and communications technologies, such as personal computers and video cassette recorders), and it has been more evenly distributed across demographic categories than broadband. Most striking, whereas white Americans lead the way in broadband adoption, communities of color outperform the average in smartphone

adoption. According to the Pew Internet & American Life Project's May 2013 data, compared to the 56 percent average for adults:

- 64 percent of African-Americans have a smartphone;
- 60 percent of Hispanics have a smartphone;
- 53 percent of whites have a smartphone.

Additionally:

- 39 percent of low-income Americans (household incomes less than \$20,000 per year) have smartphones;
- 44 percent of those with high school degrees or less have smartphones.

However, older Americans trail significantly in smartphone adoption; just 18 percent have them.

a. Why do these population segments adopt smartphones at such high rates?

"Cord-cutting" or the rise of "cell-only" households has a lot to do with this. The share of households that do not have traditional landline telephone service, but rather cellphones as their only form of telephone access, has risen from 3 percent in 2003 to 35.8 percent in the first quarter of 2012. Hispanic households are significantly above average in the "cell-only" category (at 46.5 percent), as are poor households (51 percent). African-Americans also exceed the average with 37.7 percent of African-American homes being cell-only. As cellphone carriers offer upgrades from traditional devices to smartphones, many in these population categories have taken advantage of these offers.

Have smartphones closed the digital divide, given that smartphone adoption has taken hold in several of the population segments that lag in broadband?

Smartphones have narrowed the digital divide, but not completely. To understand why, it is important to examine where smartphones fit into online access patterns for the entire population and for specific population segments. Then, the question is the quality of access: Are smartphones indistinguishable from other modes of access (in terms of online usage patterns) or not?

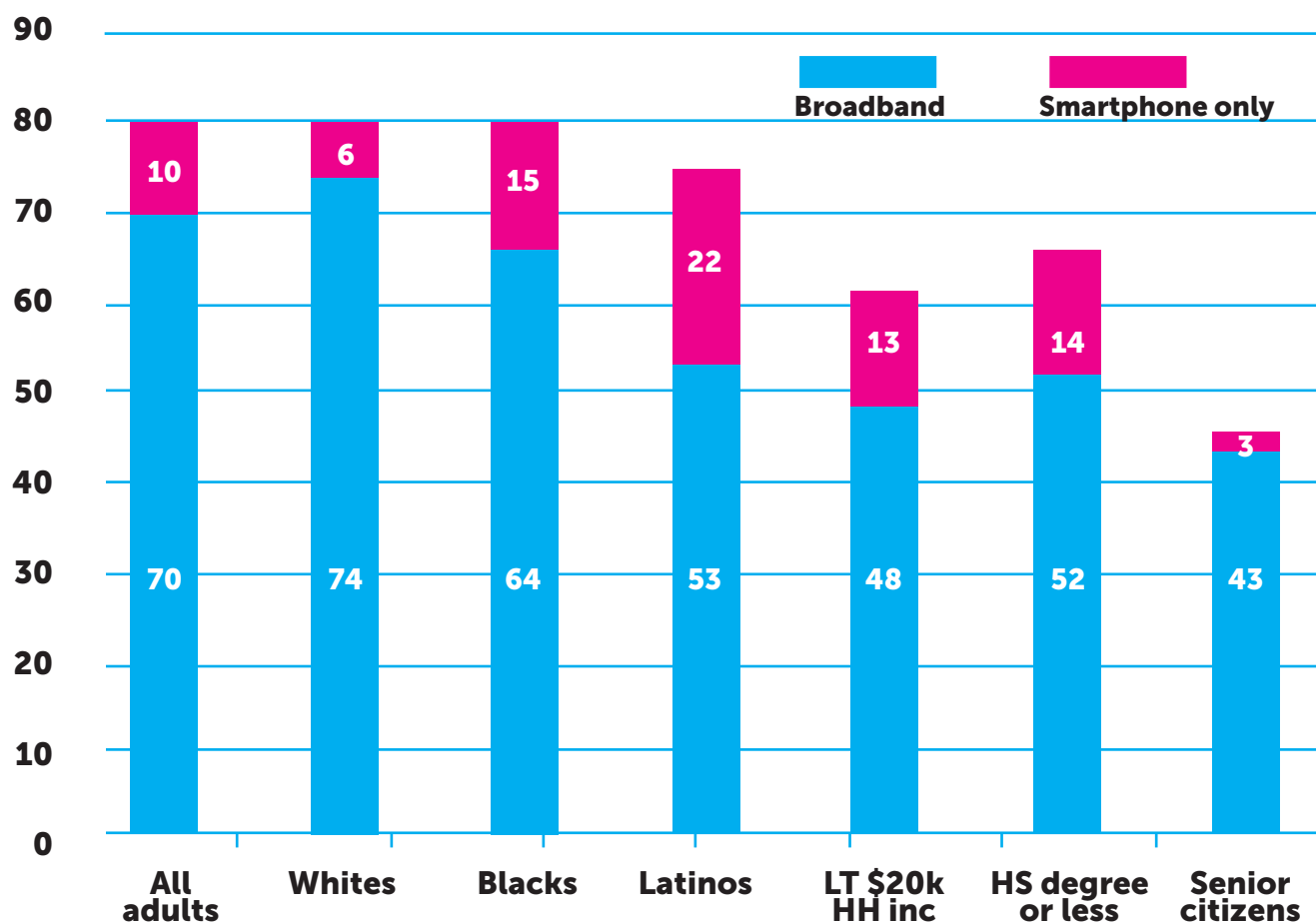
At a high level, smartphones tend to supplement people's assets for online access, not substitute for other means, such as home broadband. Some 83 percent of people with a smartphone also have broadband at home. That figure for African-Americans is 77 percent. It is 63 percent for Hispanics.

Yet, Smartphones are a sole-access device for some Americans. In 2013, according to Pew, 10 percent of Americans had smartphones as their online access means without having a

home broadband connection. Given the functionality of smartphones for online access (not just via browsers but also using “apps”), it makes sense to treat smartphones as a meaningful pathway to the Internet when one has no other alternative.

Between smartphone and home broadband adoption—which together can be termed “advanced Internet access”—80 percent of Americans have use of at least one of those two access means. Within specific population subgroups, as Figure 3 shows, the smartphone is a significant access device for households without broadband service, representing 10 percent of U.S. households.

Figure 3: Advanced Internet access for specific population segments



Smartphones largely close access gaps along lines of race and ethnicity, and narrow gaps for low-income and less-educated Americans. Smartphones do not figure into access for seniors in a substantial way.

And now to the caveats on the quality of smartphone access, that is, whether smartphones result in the same kind of online engagement as those with broadband connections at home.

Research clearly points to lower levels of online engagement among smartphone-only users as compared to people with home broadband subscriptions. A 2012 study for the state of Illinois found that smartphone-only users perform 16 percent fewer online activities on average than home broadband users and 22 percent fewer activities than those with broadband at home and smartphones. A study focusing on Chicago also finds that smartphone-only access is linked to lower levels of online activity. Analysis of 2013 Pew Research Center data for this report confirms the correlation between lower levels of online engagement for smartphone-only users compared to home broadband users.

Several issues are likely the cause of lower levels of online activity for smartphone-only users. First, the smaller screen is less conducive to rich online use than larger screens on desktops or laptops. Second, even with 4G wireless networks, access speeds for smartphones are typically slower than wireline broadband, and fast wireless speeds depend on signal strength, which varies with the location of user. Finally, many smartphone plans have data caps for users; this may constrain the willingness of people to use them for a robust range of online activities.

In sum, smartphones narrow, but do not close the digital divide. Smartphones represent progress in equalizing online access rates across population groups; however, they should not be seen as the solution for the digital divide.

C. Connectivity and the challenges that remain

Policymakers continue to focus on broadband access at home.

Why don't those without broadband have service?

What has been done to address adoption gaps?

Since 2009, research has probed the reasons why people do not have broadband at home. They sort into three buckets:

- **Cost:** the monthly fee for service, the cost of a computer or the cost of installation.
- **Digital literacy:** lack of comfort with using computers or worries about possible hazards online.
- **Relevance:** the perception that there is nothing online that makes having service worthwhile.

According to May 2013 Pew data, non-broadband adopters are older (a third are senior citizens), have lower incomes (60 percent have annual household incomes less than \$50,000) and are less educated (two-thirds have only a high school degree or less).

The research on non-adoption also underscores that non-broadband adopters typically

have more than one reason for not having service at home. That suggests that approaches to non-adoption must address multiple concerns. That is, low-cost access plans must be tethered to digital skills training, not just discounted service. Since 2009 the major initiatives to address non-adoption have targeted the barriers identified in research:

- **The Broadband Technology Opportunities Program**, which has devoted \$450 million to sustainable broadband adoption and public computing centers as ways to increase broadband access. Earlier this year, the program released the “Broadband Adoption Toolkit,” which underscores the importance of digital skills and literacy in drawing people to broadband use and highlights successful strategies to increase broadband adoption.
- **The Internet Essentials program**, which is an initiative of Comcast. Creation of the program was a condition the Federal Communications Commission placed on Comcast as part of the approval of the Comcast/NBC Universal merger. Aimed at families of school-age children who are eligible for free or reduced-priced school lunches, the program offers a cut-rate monthly Internet plan, an option to purchase a \$150 computer and access to free digital literacy training.
- **The Connect2Compete program**, which is a nonprofit launched by former Federal Communication Commission Chairman Julius Genachowski. It has focused on a public relations campaign to increase awareness among non-broadband adopters of the relevance of using the Internet. C2C has also partnered with cable providers to provide low-cost broadband packages to eligible households. Working with Freedom Pop, C2C offered a prepaid wireless broadband plan aimed at non-adopters who may not want to enter into a monthly service arrangement with providers or who may not have wireline broadband options where they live.

Price of service to consumers is a metric to which stakeholders understandably pay a great deal of attention. Non-broadband households with school-age children are among the most price sensitive non-adopters, and both Internet Essentials and Connect2Compete target this segment. In the broadband market, service plans vary by attributes such as speed or bundles, and thus prices do too. From publicly available data, however, pricing trends have not been favorable for lower-priced packages. According to Telogical Systems (the report is available here) from early 2010 to the end of 2012:

- **Prices for “economy” broadband plans (5 megabits per second or less)** increased by 13 percent from \$29.44 per month to \$33.26.
- **Prices for “mid-range” speeds (between 12 Mbps and 18 Mbps)** fell by nearly 10 percent from \$56.10 to \$50.10.

- **Prices for “high-end” speeds (over 60 Mbps)** fell by 5 percent from expensive levels—\$199.95 to \$189.18 per month.

Before 2010, there is little publicly available data on home broadband prices. Existing information comes from surveys where users self-report their monthly broadband bill. In the October 2009 survey the Federal Communications Commission conducted for the National Broadband Plan, users placed their monthly bill at \$41; an earlier 2009 survey by Pew showed a monthly price of \$39. In 2008, a Pew survey found that the monthly broadband bill for users was \$34.50. Before 2010, then, broadband prices showed an upward drift.

Even with caveats about smartphones in mind, there has been a lot of progress in the past decade in increasing Internet adoption rates. How much progress has been made, and what are the sizes of the remaining gaps?

Four years ago, more than 100 million Americans did not have broadband at home. Today, when including “advanced Internet access” (e.g., smartphones), that number has fallen to 60 million. That group comprises the truly disconnected. This group lacks advanced Internet access of any sort, that is, broadband at home, smartphones or a tablet computer (which adds only a single percentage point to the truly disconnected beyond broadband and smartphone access).

The decline in the gap comes from two sources:

- **Broadband-at-home subscribers:** Roughly 10 million more American households—or about 19 million more adults—have broadband at home today compared to 2009, as adoption rates have grown from 63.5 percent to 72.4 percent. About 111 million Americans lacked broadband at home in 2009; that figure was 87 million in 2012 (the 24 million increase in broadband adoption includes adults and those younger than 18).
- **Mobile access:** Some 19 percent of Americans lack each of the three key online pathways (i.e., broadband, a smartphone and a tablet). Given that, according to 2013 Pew data, 70 percent of Americans have broadband at home, the additional online pathways of smartphones and tablets add 11 percentage points to measures of digital inclusion, or about 34 million people.

Using Pew’s 2013 data, which covers multiple forms of access, and calculating the base as a share of all Americans (313.9 million people), this places the number of truly disconnected Americans at about 60 million people as of the first quarter of 2013.

Remaining adoption challenges of information and communications technologies are smaller than four years ago, but are they harder to solve? How much additional progress can reasonably be expected?

Remaining non-broadband adopters are likely to be the most difficult to attract to broadband. Much of that is linked with socioeconomic status. Two-thirds of those who do not have broadband at home have high school educations or less. Half are age 55 or older, and 60 percent have annual household incomes less than \$50,000. Yet there is heterogeneity among non-broadband users. Analysis for the National Broadband Plan showed that non-adopters can be sorted into four segments:

- **Digitally Distant:** 10 percent of the general population does not see the Internet as relevant to them and lack the digital skills to go online.
- **Digital Hopefuls:** 8 percent of the general population is interested in getting online access at home, but they cannot afford monthly service.
- **Digitally Uncomfortable:** 7 percent of the general population; most in this group have a computer (some have dial-up service), but they do not see the relevance of access and many express concerns about online security.
- **Near Converts:** 10 percent of the general population. People in this group have positive attitudes about computers and online access, but lack the financial means to have home broadband access.

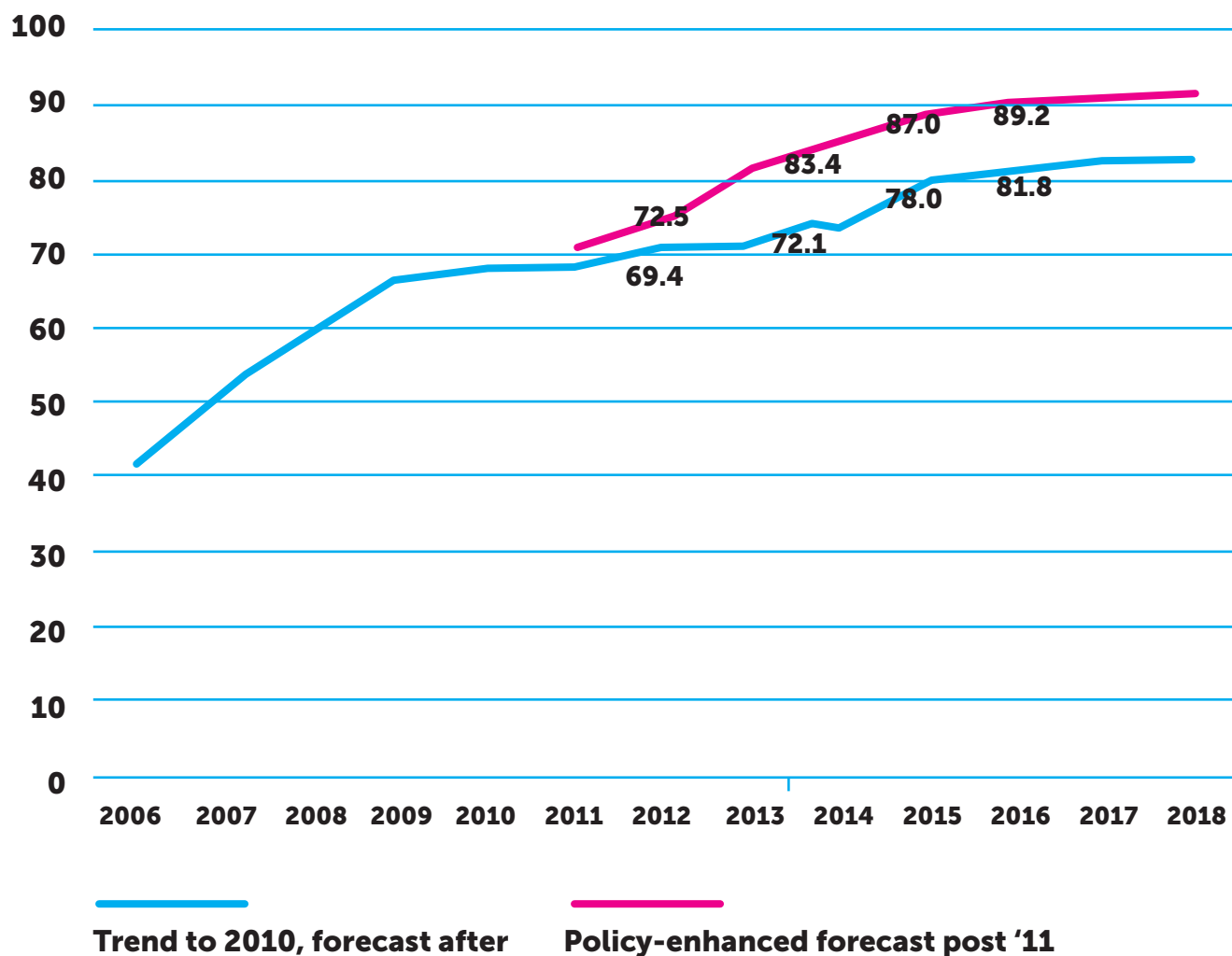
This analysis suggests that two groups (the Digital Hopefuls and Near Converts) are more likely candidates for broadband adoption in the near term than the other two groups. The National Broadband Plan, for internal purposes only, forecasted home broadband adoption to 2015 with a baseline scenario and a “policy-enhanced” scenario. The “policy-enhanced” scenarios were calculated by developing probabilities that non-adopters in each of the four segments might buy service within several years of 2010. Those probabilities were developed based on users’ answers to questions about past online use and their attitudes toward the Internet—with past use and positive attitudes increasing the chances of adoption.

The baseline forecast pegged broadband adoption at 78 percent in 2015 without any policy intervention. With policy aimed at increasing broadband adoption, the forecast projected an 87 percent home broadband adoption rate by 2015 . Figure 4 below includes forecast figures to 2018, a date used in subsequent forecasts for the Federal Communications Commission as it developed Connect2Compete.

The following figure summarizes the analysis. The “potentially convertible by 2015” scenario assumes that broadband adoption was bound to increase from 2009 levels,

given the traditional path of consumer technology adoption. It further assumes that the growth will come from segments most predisposed to getting broadband. The aspirational “reachable with the right programmatic catalysts” scenario assumes faster growth if policy interventions are effective.

Figure 4: Forecasting adoption to 2018 (internal analysis for National Broadband Plan)
 (Percent of broadband adoption among Americans)



With broadband adoption having grown to 72.4 percent by 2012 (above the 69 percent rate forecast), it is likely that the low-hanging fruit among 2009 non-adopters has been harvested—and many of these people are sensitive to cost. This suggests that future efforts to lure non-adopters online, while needing to address cost, will also have to focus on digital skills and relevance in order to reach remaining non-adopters.

In terms of broadband saturation levels, the forecasting exercise suggests that the 90 percent adoption range is the ceiling, with help from policy interventions. For telephones, the 90 percent plateau was reached in the late 1960s and remained at that level until the early 1980s.

Promoting digital skills is clearly important for non-users. Is it relevant to people who are already users of information and communications technologies?

Yes, digital skills are relevant to broadband users and non-users alike; they also are of growing importance. Research shows that there is a great deal of variation in digital skills across the population; those with lower incomes and less education are most likely to exhibit lower levels of online skills. Lower skills translate into less frequent online use and a narrower scope of online activities. Research also shows that people who express concerns about the safety of the online environment are less engaged with the Internet.

Cultivating digital skills is likely to become more critical as the Internet evolves. The next wave of technology innovations holds great potential for individual and social benefits. In many areas (e.g., health care applications, home energy management, delivery of government services, education), the advent of the “Internet of things” will increase the value of connectivity to people as the Internet works its way more deeply into the systems that run our lives. As the Internet becomes more valuable for individuals, it will also become more complicated for many. Getting full value to a wide range of the population will require sufficient levels of digital skills and a great deal of trust among current online users (since many new applications require people to share personal data with service providers).

The growing importance and complexity of the online world is likely to transform the character of what it means to talk about the “haves” and the “have-nots.” So-called “adoption” problems—whether someone has the latest gadget for connectivity—may really become a technology transfer problem, a multi-sided conversation about how to integrate into various behaviors new ways to carry out tasks. These new ways rely not only on deep online connectivity, but also trust, skills, operating across multiple devices and adeptness at minimizing costs of a transition to new systems. The “have/have-not” discussion will migrate to one where the focus is who is ready or not ready to embrace and cope with online-enabled change.

There is a final dimension to the digital skills/literacy issue: service providers’ experimentation with new business models. Fifty-five percent of adults have two or more access pathways (e.g., broadband, tablets or smartphones), and 23 percent have three. This means people have to think about attributes of service plans (e.g., data caps, termination fees) in ways unheard of a decade ago. Research from the Federal Communications Commission in 2010 shows that consumers have a good understanding of the price they pay for services,

but lower levels of understanding of more nuanced parts of service plans (such as data caps). The transition to “all IP” networks (that is, the retirement of copper telephone networks to be replaced by communications networks that run on the Internet protocol) will place additional demands on consumers to understand new business models and service plans.

Does all this mean that the term “digital divide” is outmoded?

The digital divide continues to be a powerful term to motivate a policy discussion on equity as information and communications technologies become more pervasive. To take one example of the term’s adaptability, in recent years it has referred to home adoption of broadband service (do you have a subscription?), network deployment (can you get broadband in your neighborhood?), and network quality (is your broadband service really fast, such as fiber or upgraded cable, or slower DSL or wireless broadband speeds?). For these reasons, the term itself is not likely to vanish from policy discourse in the near future. Additionally, with 60 million Americans falling into the “truly disconnected” category, the size of the offline population will likely warrant policy discussion for some time.

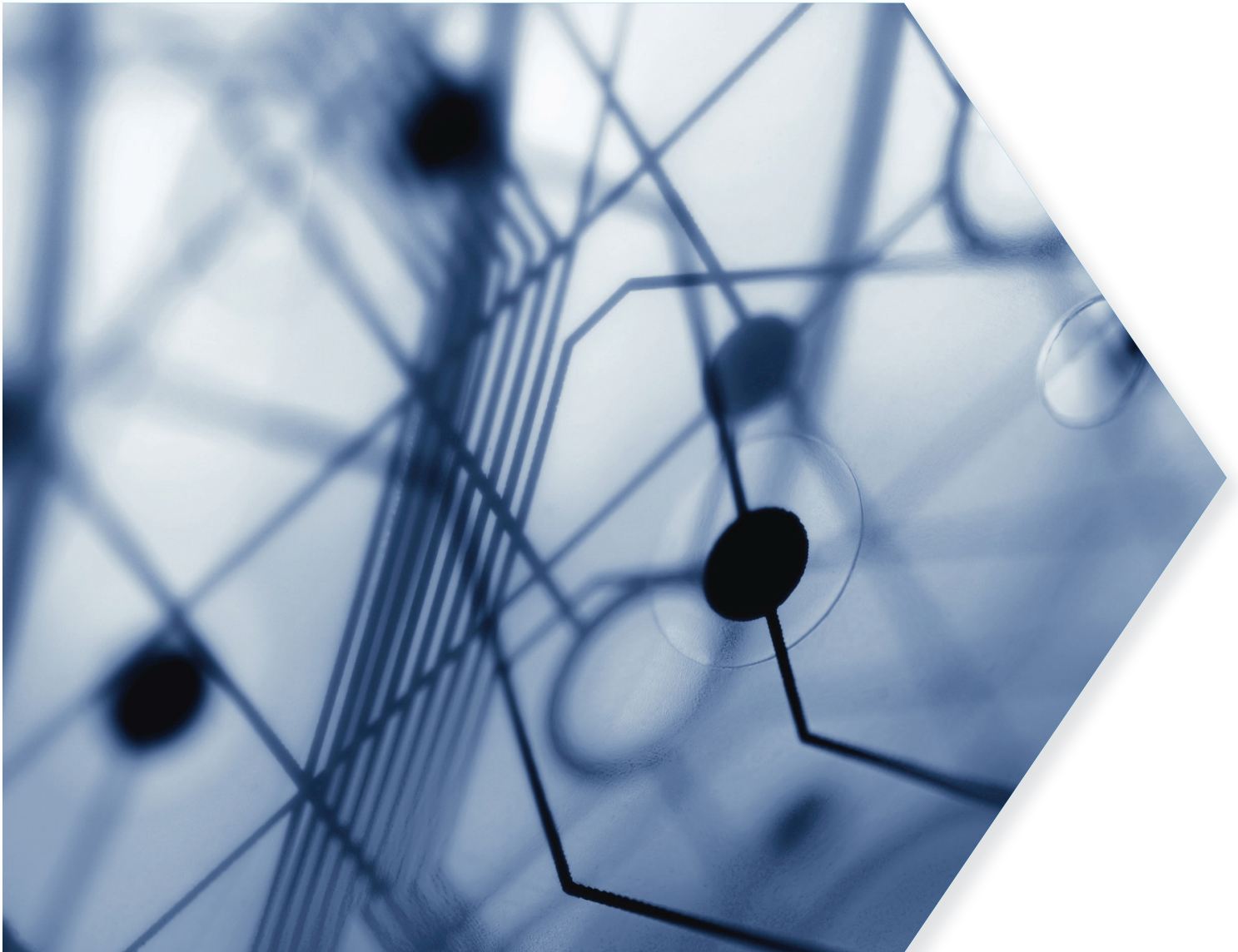
A concern about the term “digital divide” is whether the binary way in which it frames digital equity issues applies in today’s circumstances. This analysis suggests that improving all users’ digital skills is crucial to encouraging full use of information and communications technologies. That is a very different problem than access to gadgets or services. Therefore, an ongoing focus on access alone might obscure attention to digital skills, whose solution requires fresh approaches.

D. Industry developments

How do current developments in industry impact the communications and technology debate?

Industry is in the midst of dealing with different forces that pull in different directions—one toward scarcity and one toward abundance. On the wireless side, the growing appetite of users for mobile data has strained the capacity of wireless networks. Data caps are the consequence, as wireless carriers place monthly limits on data use to manage congested wireless networks. On the wireline side, tepid consumer demand and a settled market structure among incumbents mean that there are no announced plans for significant network upgrades. Congested wireless networks and yesterday’s wireline networks may effectively create a world of scarce bandwidth for consumers.

Efforts to promote fiber optic build-outs to households constitute a force in the other direction—abundance. This makes Google Fiber and Gig.U (the University Community Next Generation Innovation Project) potentially very disruptive, but they are also risky. Fiber-to-the-home will have the capacity for very fast speeds, but it is unclear whether



there is sufficient consumer demand for that capacity. That means the business case for these (and other fiber-to-the-home initiatives) is far from clear. Even when Google Fiber and Gig.U-driven fiber build-outs are complete, they will only serve a fraction of the U.S. population. It's unclear whether these efforts will spark widespread fiber investment from other players, although AT&T did announce a fiber build in Austin after Google announced its fiber network there. On the wireless front, increasing spectrum supply is the priority. The Federal Communications Commission plans to hold incentive auctions next year where broadcasters voluntarily surrender spectrum that is subsequently sold to the private sector. Federal agencies are also searching for ways to share their often underused spectrum assets so that it can be made available to the private sector.

These ambitious plans to address wireline and wireless scarcity will take a long time to bear fruit. The result is that we may be entering an era of digital scarcity in the near term with an uncertain pathway to digital abundance in the long run.

E. Conclusion

This suggests stakeholders may want to shorten the time horizon of scarcity and accelerate the advent of digital abundance. If that is true, how does this happen?

First, the status quo may be suitable to some actors in the information and communications technology industry; some incumbent broadband providers may see a profitable near- or medium-term future that does not require investment in network upgrades that other stakeholders would like to see.

That said, decisions on how to hasten the era of digital abundance have critical uncertainties:

- **Demand:** Notwithstanding investments by Google in its fiber-to-the-home projects in three U.S. cities (Kansas City; Provo, Utah; and Austin), it is not clear, given today's usage patterns, how consumers and businesses will use fiber's very fast connection speeds.
- **Strategies to spur adoption and usage:** Although the past four years have seen investments to increase broadband adoption and usage, little is known about the return on this investment. Even though stakeholders have a good understanding of how to implement broadband adoption programs that increase subscribership, there is little quantification of how dollars invested in the programs change outcomes (and the value of the outcomes).

As adoption and use of information and communications technologies has unfolded in the United States, investments in capacity have generally paid off—eventually. Innovation at the technical level sparks applications development, and enough applications prove worthwhile so that consumers in time exhaust capacity. That will undoubtedly be the case in the future. The question is whether investments to accelerate that process yield societal and economic gains that justify the cost. The answer is unclear.

What does all this mean for stakeholders interested in the digital divide?

The preceding analysis shows a clear narrowing of the digital divide, but also points to how digital skills loom large in a society where the Internet's importance is growing. Just in the past two years, the amount of time people spend online daily has grown by about 30 minutes, with much of that time coming from time spent watching television. Research over a longer period shows that about a third of Americans' leisure time has migrated to the Internet and away from offline leisure activities. And one only needs to follow the news to see that new applications are transforming the delivery of education and health care services. As the Internet finds its way to more corners of our lives, the inability to access or use it becomes more consequential.

The Internet's growing importance to society, along with the industry trends discussed, will likely focus the policy debate on the expensive big ticket items—such as the challenges of scarcity, evolving market structure and the large investments needed to increase network capacity. But this should not consign digital skills to a secondary role in the policy debate. The growth of online access means that most of our key institutions—government, business, education, health care—expect, and often simply assume, that people have access to the Internet. The result is powerful new ways to more effectively deliver services online. However, the success of these tools depends not on access alone, but also a population with the digital skills and literacy to use them.

There is one final point on the potential payoff to upgrading the population's digital skills. Such investments will also serve as a crucial complementary investment that increases the return to expensive upgrades to home high-speed and mobile broadband networks.

How to shape investments in digital skills and literacy constitutes a new challenge for the philanthropic community. To address this challenge, the philanthropic community should consider:

- Developing the knowledge base to:
 - Understand the role of digital skills and literacy in engaging Americans in emerging socially consequential online applications;
 - Track progress in digital skills development;
- Supporting the development of strategies that can help all online users acquire the skills and information to be engaged online users. This includes assessing the returns to programs that promote digital skills and literacy.

Note on sources

An appendix provides tables with detailed data on figures cited here as well as a discussion of sources. Data on trends in broadband and Internet adoption come from the National Telecommunications & Information Administration. Trends on cellphone, smartphone and tablet computer adoption come from the Pew Research Center's Internet & American Life Project, as does data on 2013 adoption.

Appendix A: Data tables

Broadband adoption over time by socioeconomic categories National Telecommunications & Information Administration surveys

	2001	2003	2007	2009	2010	2011
All	9.2%	19.9%	50.8%	63.5%	68.2%	69.0%
Family Income						
Under \$25K	3.1	7.4	27.9	35.8	42.9	43
\$25K to \$50K	7.3	13.9	45.8	61.0	65.8	65
\$50 to \$75K	12.2	24.5	66.0	79.3	80.7	84
\$75K to \$100K	20.8 [^]	32.1	76.8	91.5 [^]	87.8	90
\$100K or more	*	45.9	86.3	*	92.6	93
Education						
Less than HS degree	2.4	5.1	17.6	28.8	33.1	35
High school degree	5.7	14.5	36.8	50.9	56.9	58
Some college	10.3	20.7	56.5	69.5	74.3	75
College +	16.3	32.0	74.1	84.5	87.2	88
Race/Ethnicity						
White, Non-Hispanic	10.2	22.4	54.9	68.0	71.8	74
Black, Non-Hispanic	4.7	12.4	36.4	49.4	55.5	55
Asian, Non-Hispanic	15.1	29.8	69.1	77.3	80.9	81
American Indian or Alaskan Native, Non-Hispanic	7.6	*	29.8	48.3	52.3	*
Hispanic	5.3	11.0	35.2	47.9	56.9	56
Foreign born status						
Citizens (including foreign born)	9.3	*	*	64.4	68.9	*
Non-citizen	7.7	*	*	51.0	58.3	*
Age						
16-44	11.3	22.2	58.8	71.2	76.7	77
45-64	10.1	22.6 ^{**}	57.9 ^{**}	68.2	72.0	73
65+	3.1	15.9 ^{**}	37.5 ^{**}	39.9	45.5	49
Gender						
Male	10.7	20.9	54.4	66.7	71.2	
Female	7.6	19.0	47.0	60.2	65.3	
Location						
Urban (Metropolitan)	n/a	n/a	53.8	66	70	72
Rural (Non-metro)	n/a	n/a	38.8	54	57	58
Household type						
Married couple with children	13.9	25.6	67.0	79.8	78.1~	79~
Single parents (male)	7.2	19.4	47.6	60.1	64.9~	69~
Single parents (female)	5.6	14.8	43.4	56.9	*	*
Family without children	9.1	20.7	53.4	67.7	*	*
Non-family Households	7.0	17.3	39.6	50.8	*	*

[^] -- Denotes income \$75K per year and up

^{**} -- Denotes age breakouts of 45 to 54 and 55 and older

~ -- Denotes households with children versus households without children

* -- Data not reported

SOURCE: NATIONAL TELECOMMUNICATIONS & INFORMATION ADMINISTRATION "DIGITAL NATION" REPORTS.

Detailed breakout of adoption patterns

Pew Research Center's Internet & American Life Project: May 2013 Survey

	Internet user	Accesses Internet on mobile device	Broadband at home	Smart-phone	Smart-phone only (no broadband)	Tablet
All	85%	63%	70%	56%	9%	34%
Gender						
Male	85%	64%	71%	59%	10%	32%
Female	85	62	69	53	9	35
Race/Ethnicity						
White	86	60	74	53	6	33
African-American	85	73	64	64	15	32
Latino	76	66	53	60	22	34
Age						
18-24	99	87	81	79	14	33
25-34	95	85	79	81	14	37
35-44	93	81	80	69	12	49
45-54	91	63	75	55	9	38
55-64	77	43	64	39	7	28
65+	56	26	43	18	3	18
Income						
Under \$20K	70	51	48	39	13	16
\$20K to \$50K	86	60	67	51	11	27
\$50 to \$75K	94	70	84	60	7	38
\$75K to \$100K	96	77	85	73	8	50
Over \$100K	97	85	90	81	6	60
Education						
High school grads or less	74	53	52	44	14	24
Some college/assoc degree	92	67	78	60	9	35
College +	96	76	89	70	4	49

SOURCE: PEW RESEARCH CENTER'S MAY 2013 NATIONAL SURVEY OF 2,252 AMERICANS AGE 18 AND OLDER.

Analysis of respondents with either a smart- phone, broadband at home or a tablet computer

	Has 0 of 3 access paths	Has 1 of 3 access paths	Has 2 of 3 access paths	Has 3 of 3 access paths
All	19%	25%	32%	23%
Gender				
Male	44%	49%	49	48
Female	56	51	51	52
Race/Ethnicity				
White	65	65	62	69
African-American	12	11	12	12
Latino	16	16	14	12
Age				
18-24	3	12	21	14
25-34	5	13	21	20
35-44	6	15	19	25
45-54	14	24	17	22
55-64	24	17	13	11
65+	44	17	7	5
Income				
Under \$20K	33	21	14	5
\$20K to \$50K	29	32	31	18
\$50 to \$75K	6	14	17	14
\$75K to \$100K	2	8	11	15
Over \$100K	3	8	15	34
Education				
High school grads or less	69	49	32	24
Some college/ associate's degree	19	31	37	31
College +	9	19	30	45

SOURCE: PEW RESEARCH CENTER'S MAY 2013 NATIONAL SURVEY OF 2,252 AMERICANS AGE 18 AND OLDER.

Analysis of respondents who lack information or communications technologies (or limited to smartphone only)

	Not an Internet user	Not a home broadband user	Not a smart-phone user (but have a cell)	Not a cellphone user	Smart-phone only (no broadband at home)	Entire sample
All	15%	30%	34%	9%	9%	100%
Gender						
Male	47%	47%	47%	35%	53%	48%
Female	53	53	53	65	47	52
Race/Ethnicity						
White	60	56	68	69	49	66
African-American	11	14	10	8	18	12
Latino	23	22	12	18	33	15
Age						
18-24	1	8	7	4	20	13
25-34	5	11	8	4	23	16
35-44	8	11	13	8	21	17
45-54	11	17	20	17	18	20
55-64	24	19	22	22	17	16
65+	48	31	27	42	5	16
Income						
Under \$20K	35	30	23	28	23	17
\$20K to \$50K	25	30	30	33	33	28
\$50 to \$75K	5	7	13	6	10	13
\$75K to \$100K	2	5	7	2	8	9
Over \$100K	4	5	7	4	9	15
Education						
High school grads or less	72	66	51	58	60	42
Some college/ assoc degree	17	22	28	26	29	31
College +	7	10	19	14	10	27

SOURCE: PEW RESEARCH CENTER'S MAY 2013 NATIONAL SURVEY OF 2,252 AMERICANS AGE 18 AND OLDER.

Appendix B:

Background on data and sources used

This appendix provides additional data, discussion and citations to sources used for claims made in the body of the report.

Reliance only on smartphones for Internet access

Research that shows people who rely on smartphones for Internet access perform a narrow scope of online activities comes from studies in Illinois and one focusing only on Chicago. Two studies are the source for this claim:

- In Chicago, Mossberger et.al. find that “broadband at home remains critically important for digital citizenship, and that the growth in mobile phone use has not erased inequalities in participation online and seems unlikely to do so. Moreover, smartphones are not bridging the gap in disadvantaged communities.” That study found, across a range of 11 online activities, smartphone-only users were less likely to engage in all but one (the exception was job search).
- For Illinois, Horrigan finds that smartphone-only users perform, on average, 22 percent fewer online activities than home broadband users. Smartphone-only users were less likely than home broadband users to engage in five of seven activities probed; for the other two (job search and social networking) smartphone-only users were equally likely as home broadband users to do those things.

Barriers to adoption

Research into barriers to broadband adoption has been undertaken chiefly at the Federal Communications Commission and National Telecommunications & Information Administration (NTIA) at the U.S. Commerce Department. This research has shaped the three main buckets into which barriers to adoption fall:

- **Cost** – the monthly fee for service, the cost of a computer or installation cost.
- **Digital literacy** – lack of comfort with using computers or worries about possible hazards online.
- **Relevance** – the perception that there is nothing online that makes having service worthwhile.

The magnitudes of these barriers differ depending on researchers’ methodological approach. The National Telecommunications & Information Administration’s surveys use a single question that asks respondents to identify the main reason they do not have broadband at home.

When framed that way, the results are:

- **48 percent** – Lack of relevance, saying they don't need broadband or are not interested;
- **28 percent** – Broadband is too expensive;
- **13 percent** – They have no computer or an inadequate one;
- **3 percent** – They use the Internet from someplace other than home;
- **1 percent** – Broadband is not available where they live.

The FCC, in a national survey conducted for the National Broadband Plan, used two questions to understand non-adoption. The first allows respondents to choose multiple reasons for non-adoption from a list, and the second question then asks respondents to identify the main reason. The results were as follows:

- **51 percent** - Monthly cost too expensive
- **44 percent** - Activation/installation too much
- **35 percent** - Worried about bad things online
- **32 percent** - Not comfortable with computer
- **32 percent** - Cannot afford computer
- **25 percent** - Nothing online I want to see
- **24 percent** - Internet is waste of time
- **16 percent** - Not available where I live
- **9 percent** - Uses Internet at work

The typical non-adopter cites three reasons for non-adoption when allowed to cite multiple reasons.

When then asked to identify the main reason they do not have broadband at home, the responses grouped as follows:

- 36 percent cited cost, with 15 percent pointing to the monthly fee, 10 percent the cost of a computer, 9 percent citing the activation or installation cost, and 2 percent a combination of reasons;
- 22 percent cited factors relating to digital literacy, specifically lack of comfort with computers or worried about bad things online;
- 19 percent cited lack of relevance, saying they thought the Internet was a waste of time, that there was nothing online they would want to see, or (for dial-up users) the additional speed was not worth it.



The different approaches to questioning result in different emphases on reasons for non-adoption, with lack of relevance more prominent in the National Telecommunications & Information Administration approach and cost more prominent in the Federal Communications Commission approach. The Federal Communications Commission approach also reveals that non-broadband users usually cite more than one reason for not having broadband at home.

Barriers to use of online applications

Two studies show that digital skills and literacy are associated with lower levels of online engagement—even when controlling for other factors (such as age, income or education) that might also influence level of digital skills. The 2010 Federal Communications Commission study that surveyed 5,005 Americans on broadband adoption and usage patterns explored the issue; it found that 29 percent of broadband users had low levels of digital skills. Those with lower skills were consistently less likely to do any of the 16 activities that the survey probed and, on average, did 30 percent fewer online activities.

Forthcoming work from the Joint Center on Political and Economic Studies, using 2013 survey data, shows that, in the context of job search, people with low levels of digital skills are far less likely than those who rate high on digital skills to use the Internet for job search—by a 49 percent to 29 percent margin.

Americans' growing reliance on the Internet

As more Americans have made it online since 2000, with the proliferation of online access devices, it is not surprising that people have become more reliant on it. This shows up in data in several ways:

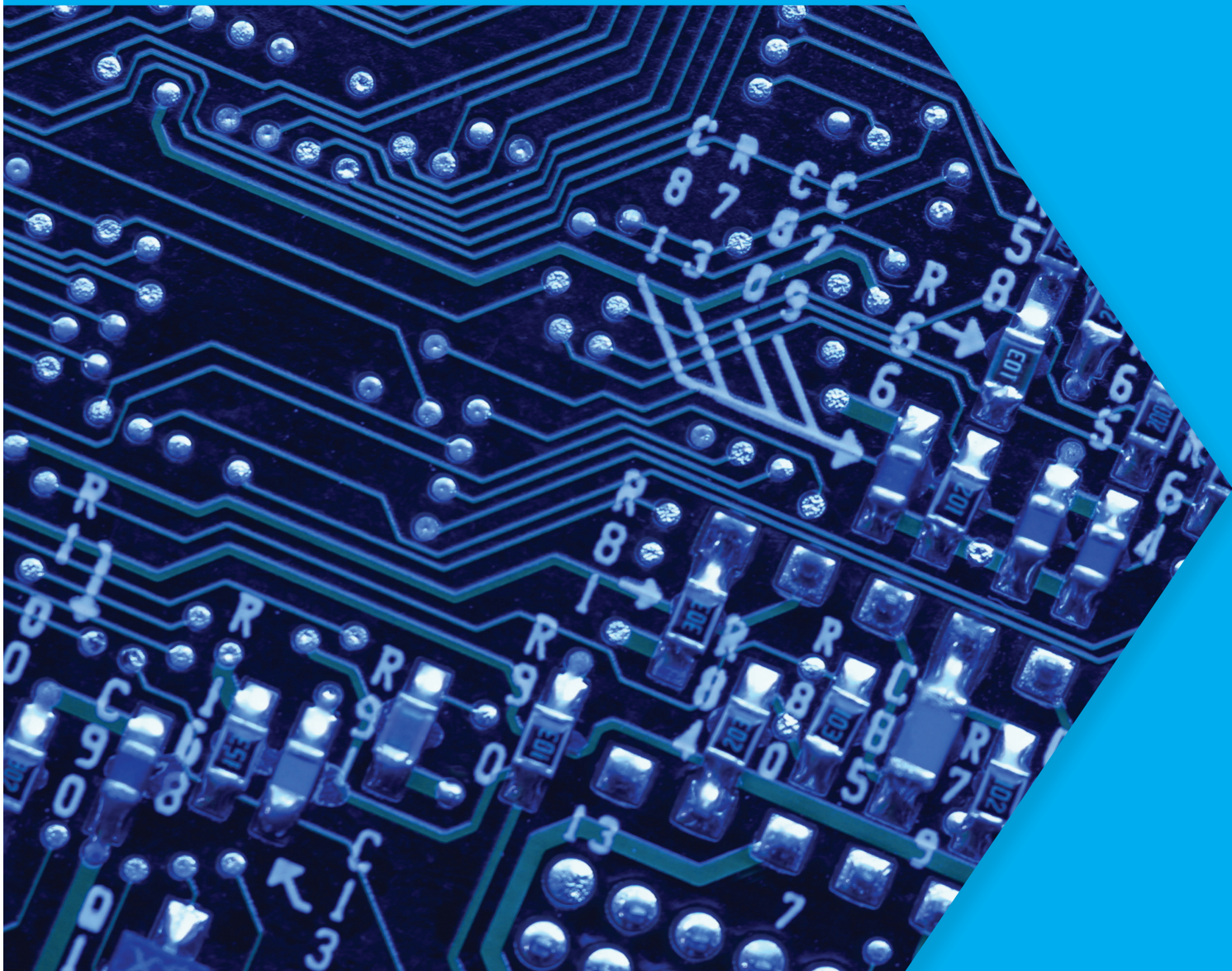
- **Time use:** Analysis of time-use surveys from 2003 to 2011 finds that about one-third of online time comes from other leisure activity. Other measures show an increase in time spent online. Americans' time spent online grew by about 30 minutes per day from 2010 to 2012, from 2 hours and 34 minutes to 3 hours and 7 minutes. Nearly two-thirds of the increase came from time spent watching TV, with smaller decreases in time spent with newspapers, the radio and magazines.
- **Data traffic:** At a global level, mobile data traffic grew by 70 percent between 2011 and 2012. Overall global IP traffic is growing by 23 percent per year, fueled both by mobile and the increase in video to people's homes that is carried over the Internet.

Americans' understanding of their Internet bills

A 2010 Federal Communications Commission study titled "Broadband Decisions: What Drives Consumers to Switch—or Stick With—Their Broadband Internet Provider" asked home Internet users how well they understood various dimensions of their bill for Internet service. Here is what Internet users said when asked about the clarity of their bill:

- 78 percent said it was very clear to them on how to contact the company for questions about their bill.
- 66 percent said it was very clear about how much they were paying for service.
- 31 percent said that any restrictions on their use of service were very clear.
- 25 percent said it was very clear what their home speed was.
- 17 percent said it was very clear about how much they might have to pay in fees to switch to another company.

Consumers, it seems, understand the basics of their service—what they pay, who to contact with questions—but have much lower levels of understanding about more nuanced service attributes.



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