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ARTIFICIAL SCARCITY

HOW DATA CAPS HARM CONSUMERS AND INNOVATION

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EXECUTIVE SUMMARY

In this paper, we examine the growth and impact of usage-based pricing and data caps on wired and mobile broadband services in the United States. We analyze the financial incentive that Internet service providers (ISPs) have to implement these usage limits and discuss research that demonstrates how these policies affect consumer behavior. In particular, we explain how data caps can make it harder for consumers to make informed choices; decrease the adoption and use of existing and new online services; and undermine online security. It is also increasingly clear that data caps have a disproportionate impact on low-income and minority populations as well as groups like telecommuters and students. In the conclusion, we urge the Federal Communications Commission (FCC), particularly as the new Open Internet Order goes into effect, to open up a serious inquiry into whether data caps are an acceptable business practice.

INTRODUCTION

We increasingly rely on the web and Internet-enabled devices for virtually every aspect of our daily lives, from our jobs and leisure activities to the provision of vital social services. As more of these activities move online — in addition to the explosion of new applications and services that could not have existed without the Internet — consumer demand for faster speeds and more data continues to grow. The Internet’s ability to enrich our lives in so many different ways is premised on the notion that the network remains an open platform of abundance, not scarcity.

Several recent consumer victories promise to enhance the protection of the free and open Internet in the United States, including the Federal Communications Commission’s (FCC) historic network neutrality order and the critical review that lead to the eventual collapse of the proposed Comcast-Time Warner Cable merger. Unfortunately, other threats remain — including the proliferation of data caps on home and mobile broadband service, which can lead to an array of consumer harms. Through an examination of the rationale behind data caps, this paper explains that claims of congestion and fairness are largely unsubstantiated, and are actually an effort by major Internet service providers (ISPs) to mask economic incentives and gloss over harms to consumers and innovation.

The transition from dial-up Internet to broadband service in the early 21st century resulted in a widespread increase of flat-rate pricing systems, where users pay a simple monthly fee for unlimited network usage regardless of the amount of time spent online or data consumed. But in the past few years, a number of ISPs have explored and adopted usage-based pricing schemes, where customers typically pay a monthly fee for a limited allotment of data.¹ Generally speaking, “data caps” are limits on how much data an individual subscriber — or a group of subscribers on a shared data plan — can download or upload in a single month or billing period. Initially, some Internet providers implemented “excessive use” policies where an account could be suspended or terminated if a customer exceeded his or her monthly limit. But “soft” data caps are now more common, where a customer who exceeds the limit will be subject to fees for additional chunks of

data. Some mobile data providers implement a variation on a soft data caps known as “throttling,” where if the user exceeds the cap, connection speeds are slowed for the remainder of the billing period.

The economic and competitive concerns about data caps are well documented. Failed trials demonstrate that data caps are not popular with consumers, nor are they an effective tool to manage network congestion, particularly on wired networks.² In 2012, New America’s Open Technology Institute (OTI) published a study on the emergence of data caps and other usage-based pricing schemes on both wired and mobile Internet connections in the United States.³ It found that data caps, especially on wireline networks, are hardly a necessity, and instead appear to be primarily motivated by a desire to further increase revenues from existing subscribers and protect legacy services (such as cable television) from competing Internet services. There is little technical rationale for data caps, especially since congestion occurs in moments of peak demand, while data caps discourage usage at all times, even during off hours, when the network has plenty of capacity.

At the beginning of 2013, OTI noticed a change in rhetoric among ISPs, particularly within the cable industry. Attempting to win over a skeptical public, they shifted their rationale for data caps away from congestion management and focused instead on a narrative about promoting “fairness.”⁴ But those arguments also proved to be flimsy, especially in the absence of evidence about how an increase in data caps would actually help light users save money.⁵ Even the CEO of Time Warner Cable has admitted that data caps and discounted offerings for light users were generally quite unpopular.⁶

Two years later, the “fairness” rhetoric touted by the cable companies and other ISPs remains unsubstantiated. American consumers continue to pay high prices for Internet service,⁷ and the arguments that usage-based pricing might mean some customers would pay “less for less” appear to be empty.⁸ For example, while Comcast and Time Warner Cable offer discounts for “light” data users, customers of both companies get just a few dollars back on their monthly bill for a significant

reduction in use, and may face stiff penalties if they go over the reduced threshold in a given month. Time Warner Cable gives customers \$5 off for using less than 30 gigabytes (GB) and \$8 off for using under 5 GB,⁹ while Comcast’s “Flexible Data” option provides a \$5 credit for using 5 GB or less of data, but then charges \$1 for each additional gigabyte above that threshold.¹⁰ These onerous terms help explain why such plans are unpopular with consumers. As the Government Accountability Office (GAO) summed up in a November 2014 report on usage-based pricing: “The extent to which mobile and fixed Internet customers have benefitted from low-cost low-data plans is unclear at this time.”¹¹ The problem is exacerbated by the lack of consumer choice among broadband providers — if customers are not happy with their ISP’s usage-based pricing scheme, they often lack alternative providers.¹² These usage restrictions are a manifestation of the concentrated market power of ISPs in the broadband age.

Despite a variety of arguments against them, data caps and others forms of experimental usage-based pricing continue to be implemented on both home and mobile broadband service. Comcast, for example, has re-introduced and expanded its data usage trials, limiting customers in certain geographic areas to 300 GB per month and charging \$10 for each additional 50 GB that they use.¹³ Other providers have also followed suit, as described in Figure 4.¹⁴ And on the mobile side, we have witnessed the introduction of a variety of new usage-

based pricing schemes, including a shift from individual plans to “shared” family data plans, where the activity of several users counts against a single monthly bundle of data.

According to the GAO’s November 2014 report, all four of the mobile providers surveyed and seven out of the 13 home broadband providers implement some form of data caps. The report further asserts that “the number of providers that utilize UBP and, therefore, the number of Internet customers that are affected by it, could grow in the future.”¹⁵

The ongoing proliferation of data caps signals a need to address the issue before it results in sustained consumer harm. While some researchers argue that usage-based pricing may be necessary to manage congestion¹⁶ and deal with the coming data flood,¹⁷ most analysts, including those at the GAO, are increasingly skeptical of this rationale.¹⁸ In this paper, we examine both the quantitative data and discuss the research that demonstrates the behavioral impact of these policies. In the conclusion, we explain the current and potential consumer harms stemming from the spread of data caps and urge the FCC — particularly in light of its recent net neutrality order — to open up a serious inquiry into whether data caps are an acceptable business practice.

TABLE 1: DOES “LESS FOR LESS” REALLY WORK?

In theory, data caps and usage-based pricing allow ISPs to offer consumers low-cost, low-bandwidth subscriptions. But in practice, the discounts available are not good value. According to Sandvine, the average monthly bandwidth consumption for a North American household in 2014 was 54 GB. A household that signed up for Time Warner Cable’s “Essentials Internet” discount on a standard broadband package and limited its total usage to 5GB would save \$8 a month on its bill. But the price discount is hardly proportional to the bandwidth reduction. For a 23 percent discount on the monthly bill, an average household would have to reduce its data consumption by 91 percent, and if an Essentials Internet user consumed the average amount of bandwidth one month, he or she would face \$25 in overage fees.

TIME WARNER CABLE DISCOUNT

Data Consumption	Plan Type	Cost
Unlimited	Standard Internet	\$34.99
5 GB	Essentials Internet	\$26.99
54 GB*	Essentials Internet with overage fees	\$51.99

* Average monthly

THE DATA ON DATA CAPS

“If you try to use monthly volumes as a way of managing congestion, you never do a very good job of it.”

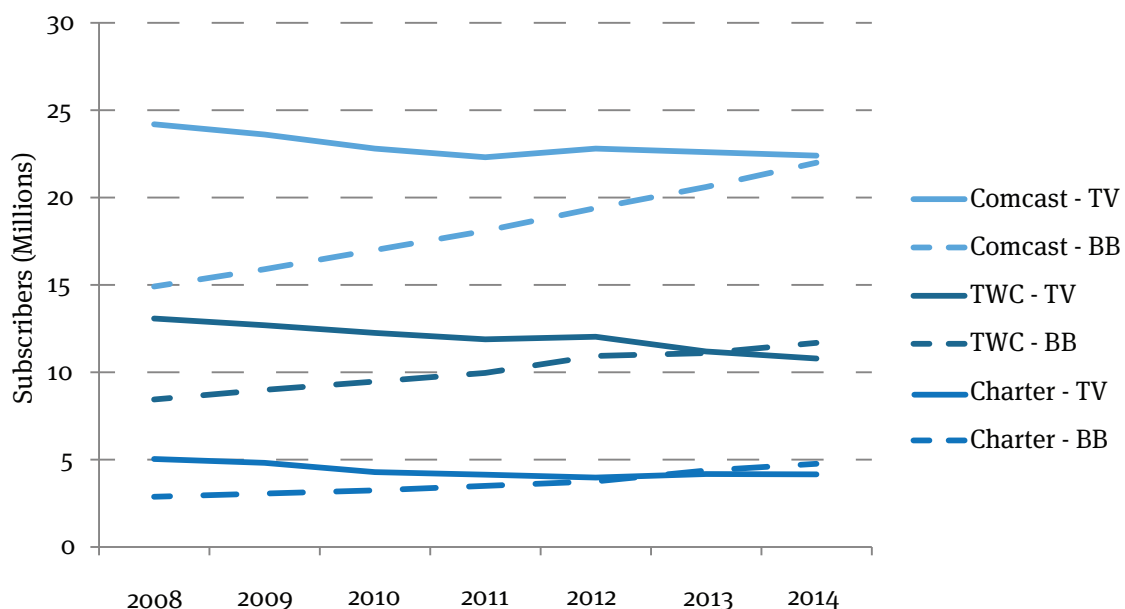
- Don Bowman, Sandvine cofounder and CTO¹⁹

Data caps on broadband service gained national prominence in 2008 when Comcast updated its terms of service to include a hard data cap of 250 GB on residential broadband users. Other ISPs have since experimented with or permanently instituted various forms of data caps, including Cox, Charter, and Time Warner Cable. Major mobile operators have also imposed caps that limit Internet data traffic for smartphone and mobile broadband users. (See Figures 3 and 4 for complete details on the current state of data caps implemented by major U.S. broadband providers.)

The way these data caps are implemented suggests that ISPs use them primarily to extract additional revenue from consumers, rather than for any technical rationale.²⁰

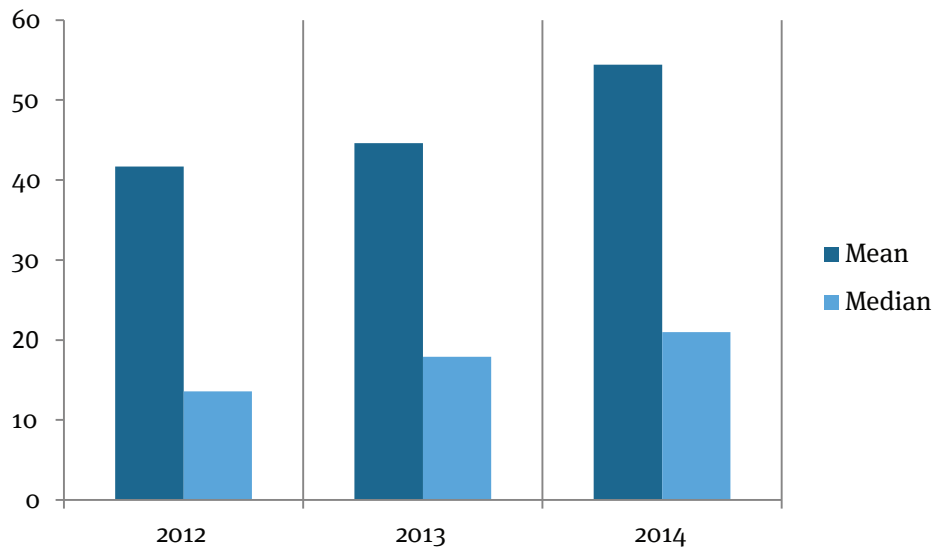
On the wireline side, it is increasingly clear that ISPs — particularly the largest cable providers, which have more broadband customers than subscription TV customers — need new ways to monetize broadband service as their legacy TV business shrinks. The subscription television market continues to erode in the face of higher programming costs, competition from over-the-top providers like Netflix and Hulu, and changing consumer preferences.²¹ Comcast became the most recent company to announce that it had more broadband than cable subscribers, although the transition from television to broadband provider has been clear for some time.²² And with Internet data consumption increasing, data caps will continue to be a financial boon for these companies even as their legacy TV services fall off.

FIGURE 1: THE EVOLUTION OF CABLE COMPANY SUBSCRIBERS FROM TV TO BROADBAND



Source: Company 10-K reports

FIGURE 2: AVERAGE MONTHLY BANDWIDTH USAGE FOR NORTH AMERICAN HOUSEHOLDS



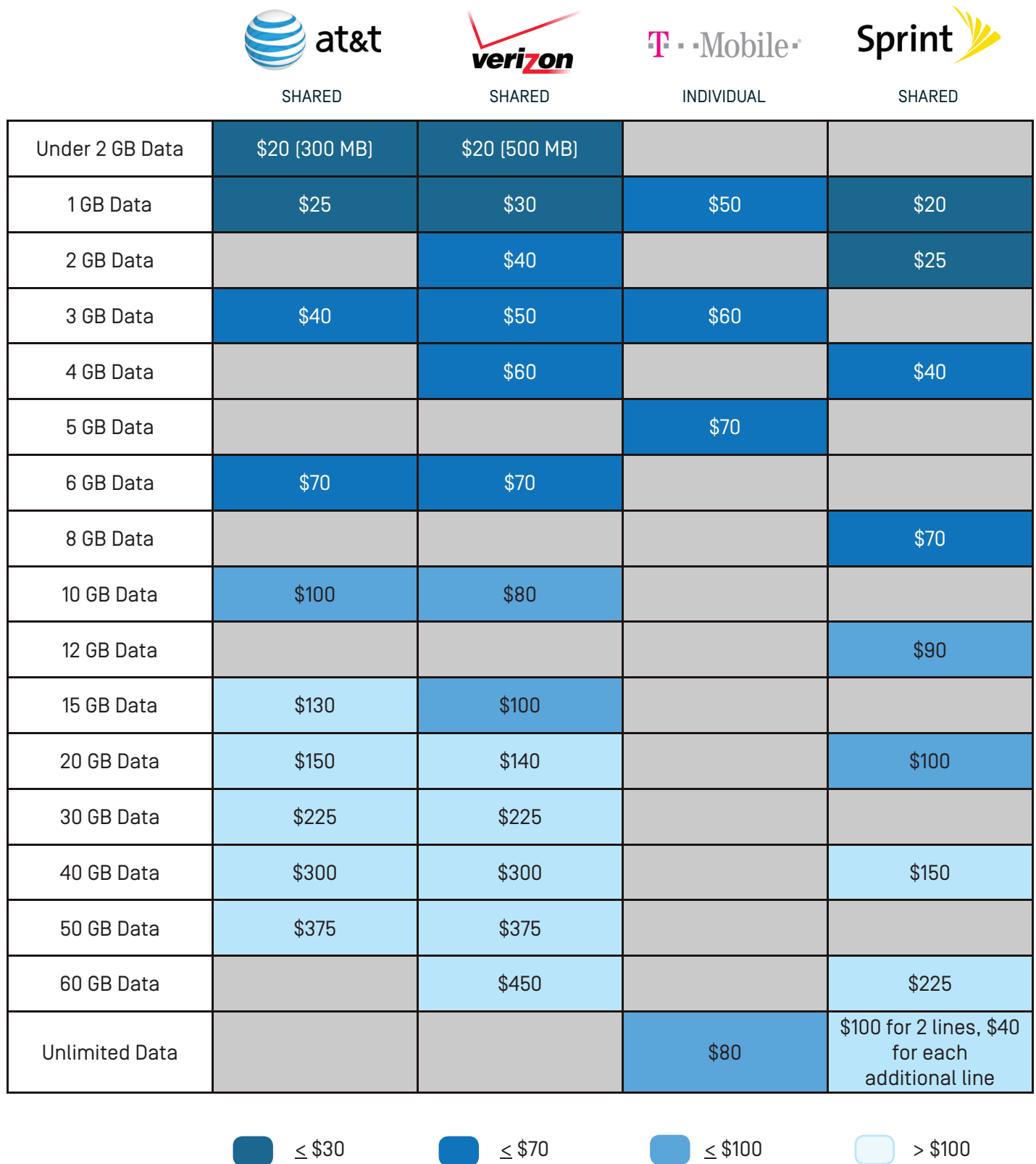
Source: Sandvine Global Internet Phenomena Reports

Sandvine data documents the steady increase in monthly data consumption from North American households since 2012. In 2014, Sandvine reported that a typical household exhibiting “cord cutter” tendencies (i.e., streaming a significant amount of online video) consumed 212 GB per month. This figure is four times the average and 10 times the median data consumption reported per household in 2014.

INCREASING REVENUES FROM DATA CONSUMPTION

In 2012, we documented how data services were a fast growing revenue stream for mobile providers, based on the detailed average revenue per user (ARPU) statistics that AT&T and Verizon reported for their wireless service, including the ARPU generated from mobile data charges. Unfortunately, these data are now reported differently, and with less granularity. By the beginning of 2014, both companies had changed their disclosure practices and now report only more general ARPU statistics (or in some cases ARPA, average revenue per account) without going into greater detail about data or other services.²³

FIGURE 3: MOBILE DATA CAPS



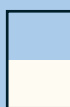
Sprint also offers an individual unlimited plan for \$60/month, and Verizon Wireless offers 80 GB and 100 GB shared data plans [for \$600 and \$750 per month, respectively] which are not included in this chart. Some data plans may come with additional costs, such as monthly device fees.

Data was collected in May and June of 2015.

FIGURE 4: WIRELINE DATA CAPS



COMPANY



DATA CAP



POLICY



TRIALS



None*

Had a 250 GB cap which was suspended in May 2012; now exploring various “usage plans” in certain markets

300 GB cap trials in several markets; discount trials where customers save \$5 if they use less than 5 GB on “economy plus” plans [3 Mbps]



None*

No data caps

Discount trials: users save \$8/month if they use less than 5 GB and \$5 if they use less than 30 GB [available on 2 Mbps, 6 Mbps, and 15 Mbps service]



150 GB, 250 GB, 500 GB, 1 TB

DSL service has 150 GB cap; U-verse service has 250 GB cap; Gigapower 100 and 300 Mbps services have 500 GB cap; Gigapower 1 Gbps service has 1 TB cap

None



None*

No data caps for FiOS service, though reports suggest that “excessive use” warnings begin at 4-7 TB

None



150 GB, 250 GB, unlimited

1.5Mbps service has 150 GB cap, greater than 1.5Mbps service has 250 GB cap; new 1 Gbps services do not have a data cap

NOTE: Centurylink does not count upstream traffic toward cap

None



150 GB, 250 GB, 350 GB, 700 GB, 2 TB

5 Mbps service has 150 GB cap; 15 Mbps service has 250 GB cap; 50 Mbps service has a 350 GB cap; 100 Mbps service has a 700 GB cap; 150 Mbps service has a 2 TB cap; 1 Gbps service has a 2 TB cap

Overage fee trial in the Cleveland, Ohio market



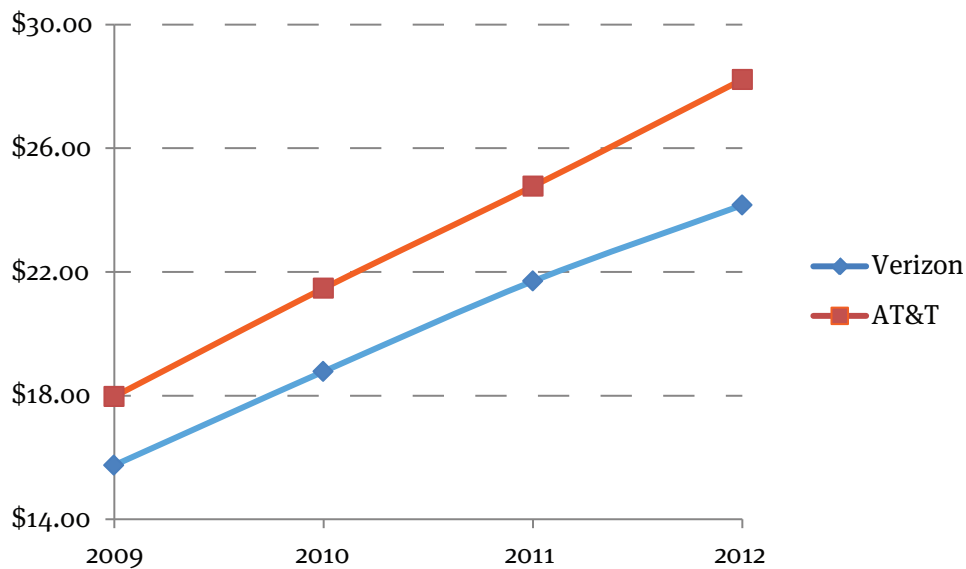
None*

Had 100 GB, 250 GB, and 500 GB caps for various speed tiers; removed reference to caps from terms of service in early 2015

None

* In their terms of service, companies reserve the right to contact customers for “excessive use” and in some cases take further action.

FIGURE 5: AVERAGE REVENUE PER USER FROM RETAIL POSTPAID DATA



Source: AT&T and Verizon 10-K reports

Company	ARPU (as of Q4 2014)
AT&T	Wireline: \$103.30 Wireless: \$65.86*
Verizon	Wireline: \$129.29 Wireless: \$162.98*
Comcast	\$139.95
Time Warner Cable	\$127.35
Charter	\$111.52

* Includes costs of phone payment plans.²⁴

Sources: Industry 4th Quarter Earnings Investment Updates; Ray Scheffer, “U-verse is driving average wireline revenue per household”; and CSI Market, “Wireline Consumer ARPU (\$) of Verizon Communications - CSIMarket.” See endnote 24 for full citations.

Note that Verizon Wireless now reports ARPA, not ARPU. In October 2012, Verizon switched from reporting statistics on average revenue per user to average revenue per account. Verizon executives said the change was needed to reflect the shift away from individual and towards shared plans, where multiple subscribers are included in a single account. They described ARPA as “a more meaningful metric going forward given our new shared data pricing plans.”²⁵

The behavior of the ISPs themselves also suggests that data caps are more about maximizing profit than managing congestion, even on the mobile side.²⁶ In August 2014, Sprint announced that it would double the high-speed data offered on its network²⁷ — and AT&T and Verizon quickly followed suit, doubling their customers’ data offerings as well.²⁸ Shortly thereafter, Sprint doubled down once again to stay ahead of AT&T and Verizon.²⁹ As Jon Brodtkin of *Ars Technica* explained: “Where did all this extra capacity come from? The carriers’ networks didn’t double in size overnight. The capacity was always there — carriers just weren’t allowing customers to use it until one decided to boost data and the others followed.”³⁰ Similarly, at the end of 2014, T-Mobile introduced a data rollover option that allows customers on certain plans to roll any unused data over for up to a year,³¹ after which AT&T announced its own, more limited rollover plan.³²

Notably, Google introduced a new mobile service in April 2015 that offers customers a refund for any data that they have not used by the end of the billing cycle.³³ This is one of the first data cap plans that actually offers customers “less for less,” rewarding restraint rather than creating artificial scarcity. The effect of this plan on the rest of the market remains to be seen, especially since the service is still in very early testing.

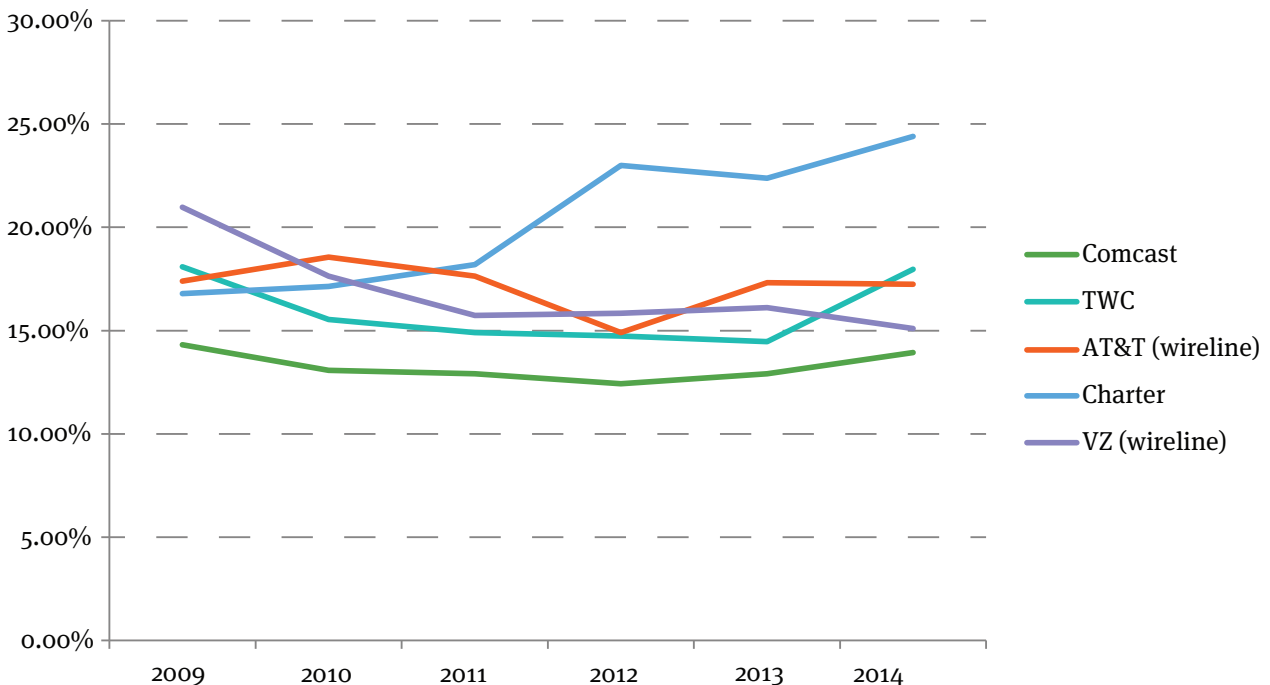
ISP INVESTMENT AND CAPITAL EXPENDITURE FIGURES

An analysis of ISP investment since 2009 shows that increases in consumer data consumption have not dramatically changed capital expenditures, especially when examined as a percentage of revenue. The money being generated by data caps does not appear to be reinvested in network upgrades, undermining a central pillar of the “fairness” argument advanced by some ISPs.³⁴ The numbers suggest that the primary purpose of data caps continues to be increasing revenues in an industry that is already extremely profitable.

It is also important to note that when companies report a more detailed breakdown of these capital expense figures, it becomes clear that they typically include a wide range of investment activity that has little to do with the costs associated with network upgrades or service area expansion.³⁵ For example, for the big cable companies,

customer-premise equipment (CPE) typically represents a large portion of overall capital expenditures. CPE generally refers the costs related to purchasing television set-top boxes and cable modems that are provided as part of a subscriber’s service.³⁶ Over 50 percent of Comcast’s 2014 capital expenses are classified as CPE,³⁷ and in its most recent annual 10-K report, Charter notes the impact CPE has on its investment numbers.³⁸ And while these legacy TV devices make up a significant percentage of these companies’ overall investment figures, their customers often pay additional money for those same devices through monthly equipment rental fees. Some analysts have found that — despite the fact that they have more broadband subscribers than TV subscribers — nearly all of the cable industry’s investments go to the pay-TV side of the business, with as little as 10 percent of their overall capital spending going toward network investments and upgrades.³⁹

FIGURE 6: CAPITAL EXPENDITURES AS PERCENT OF WIRELINE REVENUE



Source: 10-k reports from Comcast, Charter, Time Warner Cable, AT&T, and Verizon.

THE BEHAVIORAL IMPACT OF DATA CAPS

Data caps promote a climate of bandwidth scarcity, which may benefit the ISPs but has a detrimental effect on ordinary users. In particular, data caps can make it harder for consumers to make informed choices; decrease the adoption and use of existing and new online services; and undermine online security. Moreover, it is increasingly clear that they have a disproportionate impact on low-income and minority populations as well as groups like telecommuters and students.

Most consumers still do not understand how much data they consume each month, which increases the uncertainty created by data caps and exacerbates their behavioral impact.⁴⁰ A 2012 qualitative study of data caps by Marshini Chetty and a team of researchers suggest that home users “grapple with three uncertainties regarding their bandwidth usage: invisible balances, mysterious processes, and multiple users.”⁴¹ Every household participating in Chetty’s study indicated that data caps were the “overarching limiting factor” in their browsing habits, often leading to emotional strain or tensions between family and friends. The challenges of not knowing when they exceeded the “invisible balance” also impacted participants’ use of other services, such as their willingness to shift from storing data locally to relying on cloud computing. Further studies have confirmed these findings and demonstrated profound frustration from consumers about how data caps shape — and limit — their online activities.⁴²

THE UNCERTAINTY AROUND DATA CAPS MAKES IT HARDER FOR CONSUMERS TO MAKE INFORMED CHOICES

The opacity of data caps can lead consumers to make suboptimal purchasing decisions, such as buying too much or too little data. According to the GAO, “if consumers do not understand their data usage, they may choose plans that include allowances that are too large — and cost more — than needed. Alternatively, they may purchase too little data and potentially face overage charges.”⁴³ Other research similarly suggests that people tend to choose non-optimal bundles, and are often “risk averse in their bundling choices,” leading them to pay more for usage limits that are significantly higher than what they actually consume.⁴⁴ This can lead to difficult

and unnecessary budgeting tradeoffs, especially among lower income and minority households (as we discuss later in this paper).

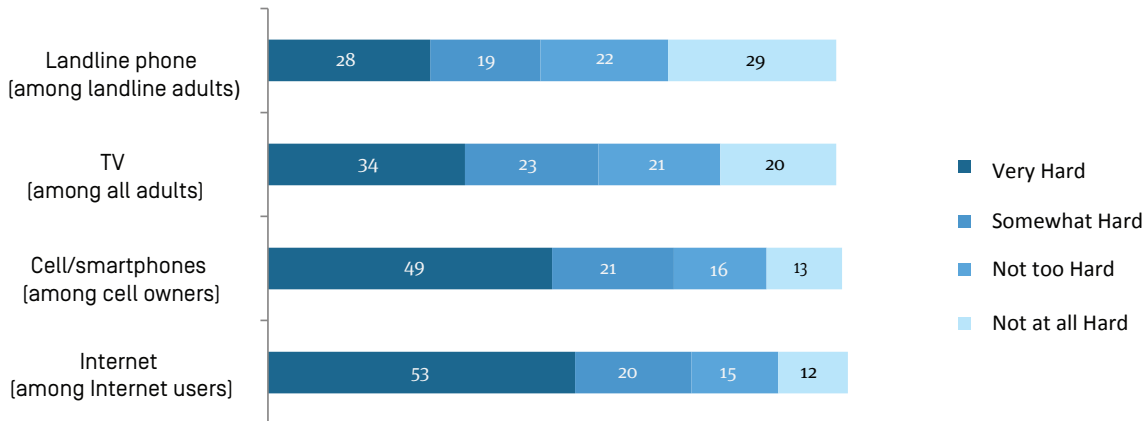
DATA CAPS CAN DECREASE THE ADOPTION AND USE OF EXISTING AND NEW ONLINE SERVICES

By forcing some users to make difficult budgeting tradeoffs, data caps can also have a broader impact on online innovation. In recent years, demand for broadband has become increasingly inelastic; market research has repeatedly demonstrated that consumers will cancel other services or reduce spending in other areas in order to keep their Internet subscription when faced with price increases.⁴⁵ According to Pew, 53 percent of Internet users indicated that the Internet would be “very hard” to give up in 2014, a 17 percentage point increase from 2006. More survey respondents indicated that Internet service would be much harder to give up than any of the other categories in the survey, which included cell phone, television, email, landline telephone, and social media services.⁴⁶ The practical result of price increases from data caps and overage fees can be that consumers forego video and telephony services to pay for broadband access. The macro-economic impact on consumer spending could be tremendous, as consumers are left with less disposable income for other items.

Even when price is not a primary factor, data caps can impact the use and development of online services. Chetty’s research found that a website that loads quickly is often perceived as less bandwidth intensive than one that loads slowly, even though speed is not a proxy for file size. Households often limit their time spent browsing even the most popular websites (e.g. social media sites like Facebook and Twitter) to prevent overuse, which suggests that less bandwidth intensive websites could be harmed by data caps.⁴⁷ The effect is even more pronounced on applications that are generally known to be bandwidth heavy, such as streaming video services. Data caps can discourage people from viewing online video content — and eliminating their TV subscriptions — which in turn reduces competition and innovation in the market for online video streaming services.⁴⁸ Some industry experts believe that data caps could inhibit the broader

FIGURE 7: HOW HARD WOULD IT BE TO GIVE UP THESE TECHNOLOGIES?

Percent of users of each technology who report how difficult it would be to give up...



Source: Pew Research Center (see endnote 46 for full citation).

innovation that happens as a result of experimentation and unlimited online usage.⁴⁹

DATA CAPS CAN UNDERMINE ONLINE SECURITY

Data caps decrease the likelihood that capped individuals will download important software updates and security patches.⁵⁰ Because individuals tend “to associate time with bandwidth use and... some individuals avoid... downloading software security updates out of fear of exceeding a cap,” about half of the households surveyed in Chetty’s 2012 study avoided software updates because of the bandwidth it required, regardless of the risk, while those who did update their software often did so reluctantly.⁵¹ This behavior is a result of a zero sum game mentality: individuals believe that one activity (e.g. watching online videos) is only possible at the expense of another (e.g. critical security updates). This increases the number of consumers using outdated software — a serious vulnerability that is one of the main causes of security breaches.⁵²

DATA CAPS HAVE A DISPROPORTIONATE IMPACT ON LOW-INCOME AND MINORITY POPULATIONS

Finally, data caps have the most direct impact on those who will feel the financial strain the most: students, low-income households, and minority populations. According to Pew, the “smartphone dependent” population — which reflects historically marginalized communities, including

non-whites, low-income and low-education individuals, and youths — rely more heavily on mobile data plans as their primary way to access the Internet, and also report that they are more likely to be impacted by mobile data caps. Nearly 50 percent of black and Latino smartphone owners report that they reach their monthly data limit at least occasionally, with around 20 percent indicating that it happens frequently. Roughly the same is true of individuals ages 18 to 29.⁵³ The GAO similarly found that usage-based pricing on home broadband subscriptions negatively affects certain populations, including students and telecommuters (who may use a lot of data at home) and those from a lower socio-economic group (who may opt for more affordable plans with lower data allowances).⁵⁴

Data caps could create a significant — and perhaps insurmountable — barrier for these populations to take advantage of new and innovative services. Consider, for example, trying to complete an online class using a mobile broadband connection with a data cap. Suddenly a “free” course comes with the risk of a substantial overage fee.⁵⁵

CONCLUSION

After several years of experimentation and study, the concerns about data caps are well-documented. In addition to an extensive array of independent studies (see the appendix for a more extensive literature review), government advisory groups like the GAO and the FCC's Open Internet Advisory Committee have urged the FCC to monitor the situation on an ongoing basis.⁵⁶ But little has been done to meaningfully address the consumer harms that they create.⁵⁷

In the wake of the 2015 Open Internet Order, the FCC has an important opportunity to look fundamentally and comprehensively at the role of data caps in communications policy.⁵⁸ While debates surrounding “zero rating” and “sponsored data”⁵⁹ appeared frequently in the context of the Open Internet proceeding, there was little consideration of the underlying question: is the existence of data caps sound policy in the first place?

An ecosystem of abundance — where users have the ability to access the full breadth of the Internet and ample capacity to use the myriad applications and services it offers to learn, communicate, create, and build — is the next step in ensuring that our networks are not only open but also provide sufficient capacity. Our research demonstrates the ways in which restrictive caps and the climate of scarcity that they promote can chill online behavior in damaging ways, particularly for low-income communities and communities of color.

The FCC may well have the opportunity to examine the implementation of zero rating and sponsored data arrangements through complaints under the general conduct rule of the Open Internet Order.⁶⁰ Determining whether or not those arrangements may violate the rules requires both an assessment of the arrangements specifically, as well as analysis of the data cap policies themselves. In fact, FCC Chairman Tom Wheeler has already expressed skepticism about whether data caps are a reasonable form of network management. As he explained in a July 2014 letter to Verizon Wireless, “Reasonable network management concerns the technical management of your network; it is not a loophole designed to enhance your revenue streams. It is disturbing to me that Verizon Wireless would base its network management on

distinctions among its customers' data plans, rather than on network architecture or technology.”⁶¹ His position on data caps indicates a departure from the previous FCC Chairman, Julius Genachowski, who remarked in 2012 that he supported data caps and under whose tenure the practice became fairly commonplace.⁶²

The FCC should, both in the context of the Open Internet Order, and in the broader context of its mandate to protect consumers and promote broadband access and adoption, continue to look carefully and critically at the role that data caps play and their impact on user behavior.

APPENDIX: DATA CAPS LITERATURE

Below we provide brief overviews of major government reports, academic articles, and research papers published since 2011 that focus on data caps and usage-based pricing. This list is not exhaustive but is meant to provide a relatively comprehensive picture of the existing scholarship. There may be some relevant academic articles which are exclusively available behind a paywall that we did not include.

GOVERNMENT REPORTS

“FCC Should Track the Application of Fixed Internet Usage-Based Pricing and Help Improve Consumer Education”

Government Accountability Office, December 1, 2014, available at <http://www.gao.gov/products/GAO-15-108>

In this report, the Government Accountability Office (GAO) combines industry analysis, original focus group research, and academic literature review to provide an overview of current data cap and usage-based pricing practices in the United States and makes recommendations to the FCC for future action. The GAO recommends that the FCC should “[c]ollaborate with fixed Internet providers to develop a voluntary code of conduct, similar to the Wireless Code of Conduct, to improve communication and understanding of data use and pricing by Internet consumers,” and “[m]ake use of existing data collection sources to track fixed-Internet UBP implementation and its effects on consumers nationwide so that FCC can take actions, if necessary, to protect consumer interests.”

“Policy Issues in Data Caps and Usage-Based Pricing”

Open Internet Advisory Committee, *Federal Communications Commission*, August 20, 2013, available at <https://transition.fcc.gov/cgb/oiac/Economic-Impacts.pdf>

The Open Internet Advisory Committee’s working group on Economic Impacts of Open Internet Frameworks contributed a section on “Policy Issues in Data Caps and Usage-Based Pricing” to the full committee’s 2013 annual report. The report notes a number of concerns regarding data caps on fixed broadband services and recommends additional research and discussion of the issue.

ACADEMIC ARTICLES AND RESEARCH PAPERS

“The Economics of Usage-Based Pricing in Local Broadband Markets”

Johannes Bauer and Steven Wildman, *Michigan State University*, December 2012, available at http://i.ncta.com/ncta.com/PDFs/Wildmanreport_web.pdf

This paper, which was funded by the National Cable and Telecommunications Association (NCTA), argues in favor of the benefits of data caps and usage-based pricing based on price discrimination theory and using economic modeling. The paper suggests that usage-based pricing could improve consumer welfare, particularly for price sensitive, low-bandwidth users, and could improve cash flows and provide an incentive for ISPs to invest more in their infrastructure.

“‘You’re Capped!’ Understanding the Effects of Bandwidth Caps on Broadband Use in the Home”

Marshini Chetty, Richard Banks, A.J. Bernheim Brush, Jonathan Donner & Rebecca Grinter, *Microsoft Research*, May 2012, available at <http://research.microsoft.com/apps/pubs/default.aspx?id=162079>

This study looks at online behavior when individuals are subject to data caps on home broadband service. The researchers found that individuals are not good at estimating their bandwidth usage, in part because they tend to to associate time spent online, rather than type of activity, with greater bandwidth use. The study also found that data caps cause some individuals to alter or distort their normal online behavior, for example, by avoiding downloading software security updates out of fear of incurring a data cap overage penalty.

“uCap: An Internet Data Management Tool for the Home”

Marshini Chetty, Hyojoon Kim, Srikanth Sundaresan, Sam Burnett, Nick Feamster & W. Keith Edwards, *CHI* 2015, April 2015, available at <http://www.cc.gatech.edu/~hkim368/publication/ucap15.pdf>

This paper builds on previous research described in “You’re Capped!’ Understanding the Effects of Bandwidth Caps on Broadband Use in the Home.” Researchers tested a broadband bandwidth monitoring program called “uCap” on 21 households in three countries. They found that participants still did not fully understand their data caps and the study made a number of recommendations about ways to design and test tools to help users better understand their caps.

“How Do ISP Data Caps Affect Subscribers?”

Wei Dai & Scott Jordan, *University of California, Irvine*, March 2013, available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2240424

This paper uses economic modeling to predict the impact of data caps and usage-based pricing plans on theoretical broadband consumers. The research finds that, depending on their general preferences, how much they value streaming video, and income level, consumers can either benefit from or be hurt by data caps.

“Capping the Nation’s Broadband Future: Dwindling competition is fueling the rise of increasingly costly and restrictive Internet usage caps”

Hibah Hussain, Danielle Kehl, Benjamin Lennett & Patrick Lucey, *New America’s Open Technology Institute*, December 2012, available at <http://www.newamerica.org/oti/capping-the-nations-broadband-future/>

This Open Technology Institute report argues that there is no technical or engineering rationale behind monthly data caps, and that they are not an efficient tool to manage network congestion during peak usage times. Instead, the report finds that data caps are motivated by a desire to further increase revenues from existing subscribers by monetizing network usage and protect legacy services (e.g. cable television) from competing over-the-top online services.

“Capped Internet: No Bargain for the American Public”

Hibah Hussain, Danielle Kehl, Benjamin Lennett & Patrick Lucey, *New America’s Open Technology Institute*, February 2013, available at <http://www.newamerica.org/oti/capped-internet-no-bargain-for-the-american-public/>

In a follow up to “Capping the Nation’s Broadband Future,” this report examines the cable industry’s shift in rhetoric around data caps in early 2013. The paper notes that the industry began to describe data caps and usage-based pricing as a “fair” way to allocate networks costs, but argue that there is little evidence that light users pay “less for less” or that cable companies are investing more in their networks to meet growing demands for capacity.

“The Impact of Data Caps and Other Forms of Usage-Based Pricing for Broadband Access”

Daniel Lyons, *Mercatus Center at George Mason University*, October 2012, available at http://mercatus.org/sites/default/files/UsagebasedPricing_Lyons_v-1_1.pdf

This paper from the Mercatus Center provides an overview of approaches to broadband pricing and describes how data caps could potentially improve consumer welfare. The author argues that usage-based pricing would allow providers to charge “less for less,” i.e., to offer low-bandwidth users who are price sensitive discounted broadband plans with low data caps. It concedes that data caps could also be used to harm consumers and undermine competition, but argues that ISPs should be free to experiment with different pricing models.

“Bounded Rationality and Consumer Choice: An Evaluation of Consumer Choice of Mobile Bundles in China”

Miao Miao & Krishna Jayakar, *Chinese Journal of Communication* 7(2) 191-211, April 2014, available at <http://phdtree.org/pdf/30843688-bounded-rationality-and-consumer-choice-an-evaluation-of-consumer-choice-of-mobile-bundles/>

This study looks at the bundled mobile voice, text, and data subscriptions of 4000 random and anonymized China

Telecom users and compares the bundles that consumers subscribe to with actual usage patterns. The researchers found that individuals consistently purchased plans that exceeded their actual needs (“non-optimal bundles”) and paid more than they should as a result.

“Know Your Limits: Considering the Role of Data Caps and Usage Based Billing In Internet Access Service”

Andrew Odlyzko, Bill St. Arnaud, Erik Stallman & Michael Weinberg, *Public Knowledge*, April 23, 2012, available at <https://www.publicknowledge.org/documents/know-your-limits-considering-the-role-of-data-caps-and-usage-based-billing>

This paper reviews the history and economics of flat-rate pricing, the trend toward usage-based pricing in both wired and wireless broadband markets, and describes the negative effects data caps could have if implemented. The authors make a series of recommendations, including calling for greater transparency and accountability among ISPs and a requirement that data meters must be clear and accurate. The report argues that federal policymakers should monitor usage-based pricing plans and make sure that ISPs invest in their networks rather than using data caps as a way to create and profit from artificial bandwidth scarcity.

“The Wrong Tool for the Job: Data Caps, Price Discrimination, and Bandwidth Pricing”

Public Knowledge, April 2013, available at <https://www.publicknowledge.org/files/thewrongtoolforthejob.pdf>

This policy brief describes the change in ISP rhetoric from describing data caps as a means to manage network congestion to a strategy for price discrimination. The authors argue that data caps are not the only way for ISPs to offer differentiated products to consumers, and suggest that traditional methods that rely on speed, rather than data consumption, are a better way to differentiate products.

“A Survey of Smart Data Pricing: Past Proposals, Current Plans, and Future Trends”

Soumya Sen, Carlee Joe-Wong, Sangtae Ha & Mung Chiang, *ACM Computing Surveys*, Vol. 146, No. 2, June 2014, available at <http://arxiv.org/abs/1201.4197v4>

Assuming that growth in broadband data usage will continue, this paper from researchers at Princeton provides an overview of several different versions of static and dynamic pricing models that ISPs could use for broadband service, including flat-rate pricing, usage-based pricing, and congestion pricing.

“U.S. Smartphone Use in 2015”

Aaron Smith, *Pew Research Center*, April 1, 2015, available at <http://www.pewinternet.org/2015/04/01/us-smartphone-use-in-2015/>

This Pew survey describes the evolving role that smartphones play in providing Internet access to the American public. Researchers found that smartphones are an increasingly critical communication tool for some segments of the population, including minority and low-income households that are more likely to rely on smartphones as their primary — or in some cases only — means of Internet access. The report also notes that data caps have a disproportionate impact on low-income and minority communities, since those who depend on smartphones for Internet access are significantly more likely to exceed their monthly limits than those who have other forms of supplementary Internet access.

“4G + Data Caps = Magic Beans”

Michael Weinberg, *Public Knowledge*, May 2011, available at https://www.publicknowledge.org/assets/uploads/documents/4G_Magic_BeansFINAL.pdf

This paper focuses on data caps on new (at the time) 4G mobile data plans. It argues that strict data caps on 4G service fundamentally constrain the new technology, which is supposed to provide consumers with faster speeds and access to more advanced online applications. The researchers include calculations on how quickly consumers would hit their data caps when engaging in various online activities like streaming videos and download large media files.

ENDNOTES

1. For a good summary of the shift from flat rate pricing to usage-based pricing, see Andrew Odlyzko, Bill St. Arnaud, Erik Stallman, and Michael Weinberg, “Know Your Limits: Considering the Role of Data Caps and Usage Based Billing in Internet Access Service,” *Public Knowledge*, May 2012, <https://www.publicknowledge.org/documents/know-your-limits-considering-the-role-of-data-caps-and-usage-based-billing>.
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