Capping the Nation's Broadband Future?

Dwindling competition is fueling the rise of increasingly costly and restrictive Internet usage caps

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Summary

The past few years have been marked by unprecedented innovation and growth on the Internet. New digital platforms and rich content from voice-over-IP and video conferencing connect family and friends around the world at little or no cost, high quality video streams facilitate online learning and digital education along with new ways to view movies and TV shows, and a host of platforms and applications allow for the creation and sharing of original content and ideas through cloud based computing.

These examples are just a few of many innovations made possible by a relatively uncapped and unmetered Internet environment. Unfortunately that is rapidly changing. Even as new applications and content require increasing amounts of data, Internet service providers (ISPs) are clamping down on Internet use through putting in place more stringent and costly data limits on their subscribers. ISPs claim that these measures are necessary to manage the growth of Internet traffic on their networks and maintain quality of service. Yet, the technical or engineering rational for relying on monthly data caps to address network congestion is questionable, when congestion is often limited to certain peak hours and locations.

As this paper documents, data caps, especially on wireline networks, are hardly a necessity. Rather, they are motivated by a desire to further increase revenues from existing subscribers and protect legacy services such as cable television from competing Internet services. Although traffic on U.S. broadband networks is increasing at a steady rate, the costs to provide broadband service are also declining, including the cost of Internet connectivity or IP transit as well as equipment and other operational costs. The result is that broadband is an incredibly profitable business, particularly for cable ISPs. Tiered pricing and data caps have also become a cash cow for the two largest mobile providers, Verizon and AT&T, who already were making impressive margins on their mobile data service before abandoning unlimited plans.

The increasing prevalence of data caps both on the nation's wireline and mobile networks underscore a critical need for policymakers to implement reforms to promote competition in the broadband marketplace. Data caps may offer an effective means for incumbents to generate more revenue from subscribers and satisfy investors, but making bandwidth an unnecessarily scarce commodity is bad for consumers and innovation. The future is not just about streaming movies or TV shows but also access to online education or telehealth services that are just starting to take off. Capping their future may mean capping the nation's future as well.

Introduction

All around the world, personal and work-related activities are migrating online. As services like streaming video, cloud data storage, and videoconferencing become the norm, the amount of Internet data consumed by individuals has increased correspondingly. However, while new services and applications require more data, most major Internet service and mobile providers in the United States are moving in the opposite direction: discouraging Internet usage by implementing more restrictive and costly limitations or data caps.

Data caps generally take the form of limits on how much data an individual subscriber may download (and in some cases also upload) in a single month. Data caps come in two varieties: hard caps and soft caps. If a customer exceeds the limit on a hard data cap they may have their account suspended or even terminated. If a customer exceeds the limit on a soft cap they may be subject to fees for additional increments 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.

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. Prior to this, Comcast addressed "excessive use" by sending notices to its top 1,000 users. These users were told to either reduce their usage or be cut off from the network.[1] These punitive measures were compounded by a lack of transparency when customers in the top 1,000 inquired about their usage. This practice changed after an investigation by the Florida Attorney General's office, which stipulated that Comcast disclose usage to consumers and stop using the term "unlimited" to describe its services as long as it imposes caps. In response, Comcast introduced 250 GB cap.[2] Then in May 2012 Comcast announced changes to this policy. It implemented a soft data cap of 300 GB, after which customers are charged $10 for each 50 GB of additional use. At this time, Comcast continues to experiment with various data cap thresholds.[3]

Currently most ISPs have implemented various forms of hard or soft data caps. AT&T's DSL and U-verse services are subject to soft data caps of 150 GB and 250 GB, also with a subsequent fee of $10 per 50 GB in excess.[4] Charter Communications institutes hard data caps between 100 GB and 500 GB depending on the subscription plan.[5] Time Warner Cable does not include data caps as part of its national terms of service, but since 2009 has experimented with small market trials of different data cap and overage fee systems.[6] In 2011, Time Warner Cable's CEO called the shift to using data caps "inevitable."[7]

Mobile operators have also put caps in place to limit Internet data traffic for smartphone and mobile broadband users. In the past two years, AT&T and Verizon Wireless have both eliminated their unlimited data plans, replacing them with tiered plans that offer consumers data packages between 1 GB and 20 GB. Once a user hits the cap, he or she will be charged overage fees for each additional 1 GB consumed. T-Mobile offers smartphone users plans with 200 MB or 2 GB of data on its 4G network (after which they throttle speeds to 2G), as well as a more expensive unlimited option. Sprint is the only major carrier that charges mobile users a single fee for unlimited data. However, it uses

How much data does streaming use?

Discussions around data caps are often confusing for a lack of understanding of how online activity translates to file size and data consumption. Here are some general estimates.

NOTE: 1024 Megabytes (MB) = 1 Gigabyte (GB)

- 15 minute Voice-Over-IP Call = 7.5 MB
- 1 hour of SD video = 300 to 700 MB
- 1 hour of HD video = 1 to 2.3 GB

data caps and charges overage fees for non-smartphone mobile broadband services using a USB modem.

Data caps encourage a climate of scarcity in an increasingly data-driven world.

This combination of caps and higher prices also applies to services like text messaging. Even though "the cost a carrier incurs by transmitting an SMS message has not increased in recent years," carriers have continued raising prices and imposing limits.[8] As with data caps, the prices charged to consumers do not correspond with the costs for carriers.

ISPs often claim that caps are necessary to curb "excessive use" and only affect a small fraction of users. Although some providers are reexamining their data caps policies, many of the limits imposed several years ago have largely remained static, even as typical household bandwidth consumption has substantially increased. In 2008, Comcast reported that its median residential broadband user consumed 2.5 GB of data monthly.[9] In 2012, Comcast reports that this number has quadrupled to a median monthly usage of 8-10 GB per consumer.[10] Other sources report even higher usage numbers. According to the Federal Communications Commission's (FCC) Measuring Broadband America report, the median cable broadband user in the United States consumed about 28 GB a month in mid-2012.[11] As new Internet applications and devices continue to be created, yesterdays so called "bandwidth hogs" are today's typical users.

Data caps encourage a climate of scarcity in an increasingly data-driven world. Broadband appears to be one of few industries that seek to discourage their customers from consuming more of their product. Thus, even as the economic and engineering rationale for data caps on wireline broadband does not hold up given the declining costs of providing service and rapid technological advancement, the proliferation of data caps is increasing. The trend is driven in large part by a woefully uncompetitive market that allows the nation's largest providers to generate enormous profits as well as protect legacy business models from new services and innovators.

In the wireless sphere, the two leading mobile providers currently enjoy significant market power and are utilizing it to further boost revenues as consumers increase use of smartphones and data by instituting tiered pricing. Though mobile providers may need to utilize some usage limitations on their network given greater capacity constraints as compared to wired broadband, the use of flat monthly caps makes little sense when congestion on the network is likely to be time and geographically limited. Instead, the decision by AT&T Wireless and Verizon Wireless to move users onto tiered plans and the current price levels are largely influenced by Wall Street demands to report ever-growing revenue and profit margins.[12] Rather than effectively managing use of the network, data caps are a strategy for ISPs to increase their revenue per user. The result is that the average household is allocating more and more of its monthly budget to pay for mobile service. Since the economic crisis of 2008, consumer spending for wireless services has increased while in many other sectors it has declined.[13]

The paper examines the main arguments for data caps on both wireline and mobile networks including the costs of providing service, managing network congestion, and upgrading capacity. Costs to provide broadband service for the biggest ISPs are largely declining even as they add new subscribers to their networks and overall traffic is increasing. Moreover, the use of monthly caps are largely ineffective at limiting network congestion that is often limited to specific times and places. Lastly, a number of ISPs' capital expenditures have declined over the past several years, even as their profits on broadband service have substantially

increased. The evidence suggests that the imposition of costly or punitive data caps are largely a business decision by ISPs to boost revenues per subscriber or protect legacy services in a market where consumer have few choices and where consumers only switch services on a very limited basis.

The Cost to Move Bits

The Internet is fundamentally a network of networks. Part of the cost of data traffic comes from the fact that in order for an individual customer to access online content, their requests must travel over not only over their ISP's network but potentially over several other Internet backbone networks that span states, continents and oceans. Smaller network operators typically must purchase this connectivity or IP transit to gain access to the larger global Internet. But many large operators engage in a practice called "peering," a term which refers to agreements between operators of similar size with similar data volumes to exchange network traffic without charge. Although in some cases paid agreements are still required, given their size large operators usually pay less per megabit than smaller operators.

Across the board, the price for this kind of access is decreasing. TeleGeography's IP Transit Pricing Service, a database of wholesale Internet access price quotes from 50 carriers in 70 cities globally, reports lower charges. According to its 2012 report, "Transit in major Western cities remains competitive, so the reduced costs are passed on to the broadband carriers." As a result, "Internet traffic has been expanding at what would seem ferocious rates, but the carrier's net cost has been generally flat to down." In New York, for example, the median monthly lease price for a gigabit ethernet port dropped 50 percent over the last year, now costing around $3.50 per megabit.[14]

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>
> **-Dane Jasper, CEO of Sonic.net**

Similarly, network equipment—the industrial routers and switches that make up broadband networks—is declining in price and increasing in processing capacity at a rate similar to personal computers.[15] Dane Jasper, the CEO of Sonic.net, an independent ISP based in California, notes that although broadband consumption has increased, "the cost to deliver those bits, transport them, transit them, peer them off, and deliver them to the edge, has decreased at a greater pace than consumption."[16]

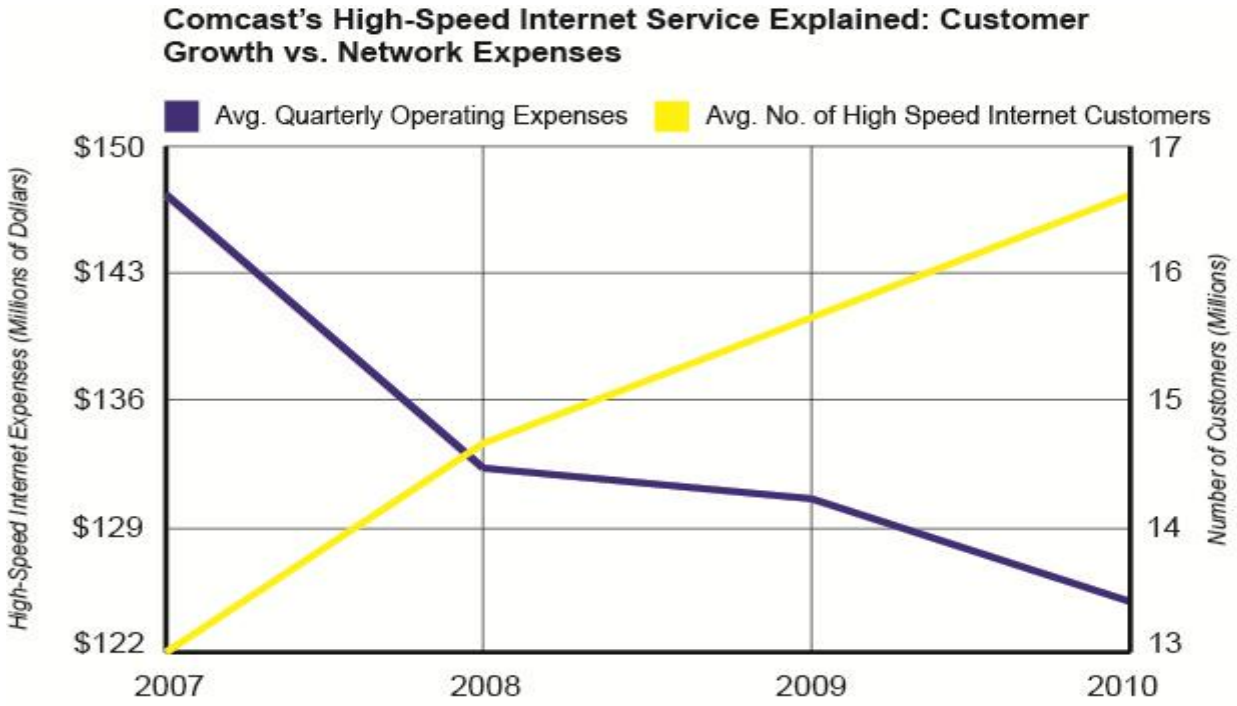

Figure 1

Source: Comcast 2009 and 2010 fourth quarter Trending Schedules. Data points are averages of quarterly figures.

It is worth noting that data caps on broadband connections are a recent phenomenon. Prior to 2008, Comcast and other providers did not impose caps on their consumers.[17] Given that some consumers have always used more data than others, ISPs should provide a compelling explanation of why data caps are suddenly a necessity and why monthly data caps are preferable to other network management practices. Yet, even as large incumbent wireline cable and telephone network providers bemoan high costs to the public, their reports to investors show rapidly declining costs for IP transit as a percentage of revenue, resulting in higher net profits. For example, Time Warner Cable's latest 10-K report shows that connectivity costs as a percentage of revenue have decreased by half, from an already modest 1.20% in 2008 to a little over 0.60% in 2011.

Until the end of 2010, Comcast publicly disclosed costs associated with its broadband service as a line item in their quarter financial reports. In 2007, the average quarterly operating expenses for its high-speed Internet service was $147 million to serve an average of just over 13 million customers. In 2010, average expenses had dropped to $122 million while the average number of customers grew to over 16.6 million. From 2007 to 2010 the trend was clear: it cost Comcast less to operate its broadband network even as it added more and more users. [See Figure 1]

The decreasing cost of connectivity for providers has also been highlighted by a range of industry leaders. Milo Medin, the head of the Google Fiber project, repeatedly emphasizes how little it will cost to move bits over Google's new fiber optic network in Kansas City. At the Google Fiber launch event on July 25, 2012, Patrick Pichette, Google's Chief Financial Officer, echoed the message. "There's no need to be limited," he said. "There's no need for caps."[18]

Despite the substantial decrease in the cost of operating a network and transporting data, consumers have not seen a resulting decline in the cost of service, nor have many providers increased the usage caps to reflect the decline in costs for Internet connectivity.

Managing network congestion

Many providers claim that data caps are necessary as their networks are becoming increasingly congested and unable to handle heavy usage. Yet monthly data limits are not the most efficient tool to address issues surrounding network capacity.

The main challenge for network engineers is how to deal with demand during peak hours. Prime time evening hours see the most demand for bandwidth on the network, and managing this traffic can be a challenge. But an individual's total aggregate data consumption over the course of a month is not a concern from an engineering point of view. When an individual consumes data matters more than how much data he or she uses.

Data caps do "not address the issue of network congestion, which results from traffic levels that vary from minute to minute."

- Comcast,

Letter to FCC, 9/19/2008

An analogy to rush hour traffic is useful here. Rush hour delays are generally caused by a spike in simultaneous demand for road access. Local governments often respond to this traffic congestion by instituting carpool lanes during certain hours, or introducing variable peak pricing for tolls, where prices are higher during the traditional workday commute than at other times. Both of these examples are methods to reduce demand during the time it is highest. It would make little sense to try and limit the total miles residents drive in a month as a means to solve rush hour congestion. Such monthly mile limits would needlessly impact residents who drive when the road is empty late at night and do not contribute to traffic congestion. Yet this is logic being employed when instituting monthly data caps. Monthly data caps are a tool that decreases consumption at all hours of the day.

When Comcast introduced a 250 GB data cap for its broadband customers in 2008, it explained that the goal was to create a tool to manage customers who were using an "excessive" amount of data and negatively impacting the online experience for other users by causing congestion on the network.[19] A flat cap unnecessarily limits use even when the network is not congested.

Indeed, even Comcast acknowledged this in a letter to the FCC. Admitting that its policies are " designed to prevent any one residential account from consuming excessive amounts of network resources as measured over the course of a month," the company acknowledges that this cap "does not address the issue of network congestion, which results from traffic levels that vary from minute to minute."[20]

Upgrading Capacity on Wireline Networks

The best way to resolve chronic network congestion in the long term is to invest and expand capacity. Yet, a review of the publicly available financial document for some of the largest ISPs in the country shows a decline in capital expenditures—the costs associated with building, upgrading and maintaining a network, such as construction, repairs, and equipment purchases—for their wireline networks. Many ISPs are spending less money on capital expenditures now, both as a ratio to revenue but also even in raw dollars, than they have in years past.

While some cost decreases can be explained by declines in hardware and equipment costs, these trends suggest that broadband providers are content to maintain the status quo and reap these efficiencies as a bonus rather than an opportunity to increase investment.

Cable companies like Time Warner and Comcast, whose networks were originally built for television services and have now been repurposed for broadband as well, are enjoying lucrative profits on networks that have long been paid off.[21] Some estimate that cable broadband providers enjoy gross margins as high as 95 percent, an exceptionally high rate of revenue relative to the supposed costs associated with offering the service.[22] For these companies, selling broadband packages even to the heaviest users is still quite profitable.

Even legacy telephone providers like AT&T and Verizon are seeing their broadband revenue grow, although both are experiencing an overall decline in total wireline revenue as customers continue to cancel their landline phone service. It is clear that in shifting a greater percent of their overall capital expenditures to their wireless segments, Verizon and AT&T are more interested in expanding their dominance in the wireless industry than they are in upgrading DSL or expanding fiber connectivity to provide aggressive competition for residential broadband service. Verizon's Chief Financial Officer recently made the following statement at an investor relations event:

> "The fact of the matter is wireline capital — and I won't give the number but it's pretty substantial — is being spent on the wireline side of the house to support wireless growth," [Verizon CFO Fran Shammo] said. "So the IP backbone, the data transmission, fiber to the cell, that is all on the wireline books but it's all being built for the wireless company."[23]

Therefore Verizon's spending on improving its

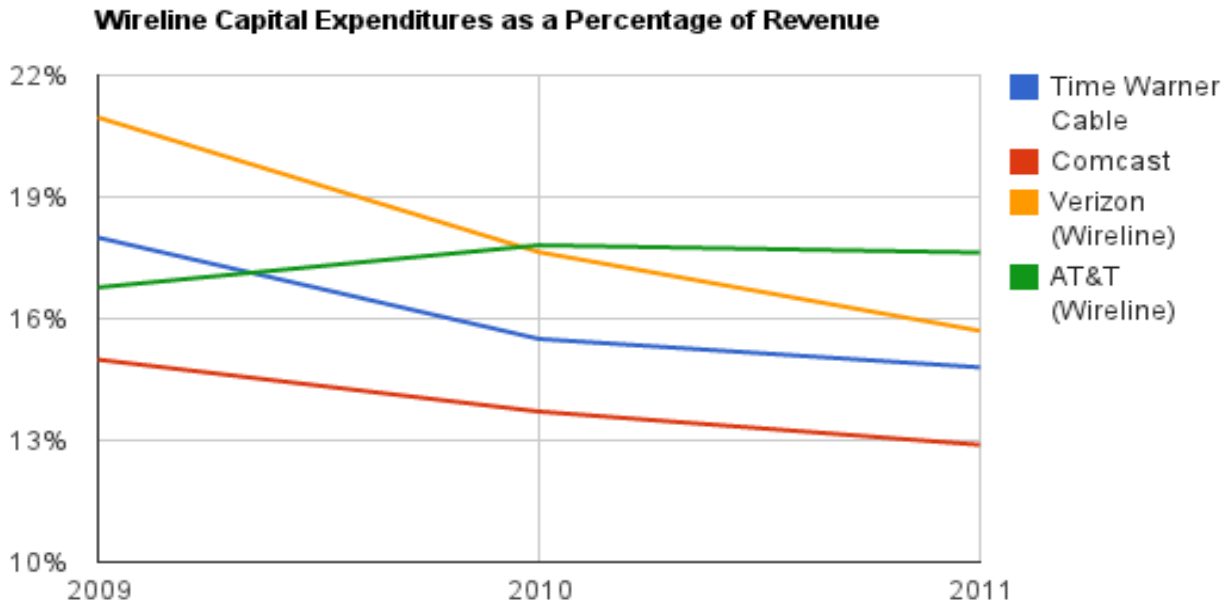

Figure 2

This chart shows capital expenditures as a percentage of revenue for Time Warner, Comcast, Verizon, and AT&T. For Time Warner and Comcast, whose businesses are entirely wired, these numbers reflect total capital expenditures and total revenue. For Verizon and AT&T, these numbers reflect investment in the wireline business as a percentage of wireline revenue.

Sources: Verizon 2011 10-K report, Comcast 2011 10-K report, AT&T 2011 10-K report, Time Warner Cable 2011 10-K report.

DSL products or expanding FiOS are even less than they appear on financial disclosures or in Figure 2. Verizon appears content to maintain their current FiOS network and not expand services to compete more aggressively with high speed offerings from cable broadband providers.

In November 2012, AT&T made an announcement that it plans to increase investments to improve DSL broadband in rural areas. The news drew praise from policy leaders in Washington and skepticism from some Wall Street analysts, highlighting the schism in priorities between the two.[24] Others noted that these new investment plans represent only a small annual increase in what AT&T typically already spends for construction and capital expenditures.[25] AT&T also announced upgrades to DSL speeds, but these will still lag behind the highest speeds available to cable of fiber broadband subscribers in urban areas. Buried in the announcement was the fact that AT&T is also seeking to discontinue wireline phone and DSL service in some rural areas and migrate those customers to more profitable and expensive wireless 4G plans with data caps much lower than wired services.

Protecting Legacy Services

Given the lack of engineering rationale, why are data caps still so prevalent on wireline networks? A number of industry observers speculate that data caps are less about network management and more about discouraging consumers from accessing content online which they traditionally consumed offline.[26] As suggested by the Department of Justice probe of data cap policies, caps are a useful tool for cable companies to protect their legacy video services. For example, pointing to the ways in which the Internet is causing "shifts in decades-old patterns of television viewing," commentators have noted that "Internet video providers like Netflix have expressed concern that the limits are aimed at stopping consumers from dropping cable television and switching to online video providers," adding that "they also worry that cable companies will give priority to their own online video offerings on their networks to stop subscribers from leaving."[27] Recent events, such as Comcast's decision to exempt its Xbox 360 video-on-demand service from its monthly broadband data caps, suggest that these fears may be warranted.[28]

These concerns are heightened by an examination of materials assembled by ISPs' partner consultants and investment firms. Take, for example, a 2011 Credit Suisse presentation intended to advise cable ISPs. The presentation outlines the ways in which consumption based billing can help ISPs prevent their users from using competitors' online video services, noting that:

> "over the longer term, consumption based billing could reduce the attractiveness of over the top video options (e.g., Netflix and Hulu), as the economic attractiveness of such over the top options could be partially offset by a [broadband] bill that is higher, due to [broadband] overage charges that would be driven by large amounts of data being streamed via a customer's [broadband] connection."[29]

Data caps have a chilling effect in the online marketplace, both on consumer behavior but also on potential service competitors. Earlier this year, citing concerns about Comcast's previous 250 MB hard cap, a Sony executive stated that the company was putting the development of an online video service on hold.[30]

Law professor Susan Crawford sums up the problems of the residential broadband marketplace, observing "the cable operators have a built in, giant conflict of interest. They want to make sure that only their own premium video products are successful, and they can twist all the dials to make sure that happens."[31] It is worth noting that Comcast's ongoing modifications to its

data caps policy began around the same time that they were questioned in the Justice Department's initial anti-trust investigation of online video and data caps.[32]

Mobile Data Caps: An Opportunity to Monetize Network Congestion?

American mobile carriers have also responded to the rise in mobile data consumption by insisting that data caps are necessary to curb "excessive" use by a small number of consumers.[33] Claims of congestion in the wireless realm are more legitimate than they are on the wireline side, as growth in data traffic in the past few years has put pressure on the capacity of existing mobile networks.

However, past warnings of overwhelming data demands have been exaggerated. Cisco Systems' annual Visual Networking Index report is often cited as a source for projections of future mobile data use. The 2008 report's forecast for mobile data traffic growth turned out to be seriously overstated, forcing Cisco to scale back some of its predictions by 40 to 50 percent. Today debate remains as to whether or not Cisco's forecasts are accurate.[34]

Though mobile traffic is certainly increasing at a substantial rate, new tiered pricing plans rolled-out by Verizon Wireless and AT&T Wireless appear to be less about managing network use broadly or addressing congestion, and instead are designed to further increase profit margins on existing consumer data usage as overall subscriber growth in the mobile market slows down.

Mobile congestion is influenced by a number of factors, including time of day, location, and tower infrastructure. Towers in business or commercial areas are likely to experience an influx in mobile use during normal working hours, whereas towers in residential suburban or urban areas have a significant increase during evening hours and weekends. Monthly mobile data caps are hardly the most effective way to solve the issue. If a subscriber is accessing a tower in an area during off-hours when the network is lightly used there is no reason why caps should apply.

In the past, mobile voice service has been similarly subject to congestion during peak demand periods. But mobile providers responded to this problem by offering plans that differentiated between peak and off-peak usage times, offering unlimited calling during the evening and on weekends but a limited number of minutes during the day. This solution, designed to narrowly address the problem, sought to curb usage only when demand could exceed existing network capacity, rather than discouraging use at all times with blunt monthly limits.

Mobile networks do face more challenges with respect to addressing capacity constraints. A key input of mobile capacity is spectrum. Generally speaking, the more spectrum available to a network, the more bits it can move. Access to spectrum is not unlimited and most mobile providers do not have an excess of unused spectral capacity at their disposal, although the amount of available spectrum varies from provider to provider. However, there are a variety of ways for mobile providers to make better use of their existing spectrum resources and increase capacity, including building more cell towers and upgrading network equipment to newer technology which is more spectrally efficient.[35] Investing in infrastructure by increasing the density of cell towers and replacing legacy networks will help mobile providers to ease congestion and prepare for future growth in data traffic.[36]

The current practice of offloading data from exclusively licensed carrier networks to Wi-Fi hotspots has also been part of the solution. With the rise in prevalence of dual-mode devices, which allow customers to connect either over the carrier's 3G or 4G network or over unlicensed spectrum via Wi-Fi routers in their homes, workplaces, or other locations, the percentage of mobile data being

transmitted via Wi-Fi has risen dramatically. Current estimates suggest that between 33 and 37 percent of all wireless traffic is offloaded each year via Wi-Fi,[37] although some estimates speculate that it could be as high 70 percent.[38] Of course, the use of the home wireless router for mobile device data transmission simply shifts consumption to the household's traditional cable, fiber, or DSL connection, subjecting such data use to any applicable wireline data caps.

Wireless providers are also embracing the use of their own hotspots by substantially increasing the number in the U.S.[39] In other countries like Japan, carriers have gone a step further in implementing hybrid networks. Mobile provider KDDI announced plans in 2011 to build 100,000 Wi-Fi hotspots to integrate into its 4G network to ease data traffic.[40] Rather than relying on the customer to switch from the cell network to Wi-Fi, these networks can automatically shift user data transmission to available Wi-Fi, which is capable of handling large amounts of data because of the relatively small cell size. And as the number of dual-mode devices increases,[41] making offloading more prevalent, other technological improvements also continue to increase the efficiency of wireless data transmission. This trend is in line with the observations of wireless pioneer Martin Cooper that spectral efficiency doubles roughly every 30 months.[42] The Long Term Evolution (LTE) standard, for example, represents a two to four times increase in spectral efficiency compared to 3G technologies.[43]

Upgrading equipment, building greater density, and offloading traffic to Wi-Fi can mitigate the impact of the rise of mobile data usage. Still, mobile providers like AT&T and Verizon have continued to frame the problem in the narrow terms of a spectrum "crisis," pressuring the government to make additional spectrum available and using it as justification for imposing restrictive data caps with high overage fees.[44] Yet, Sprint and T-Mobile, which have less prime spectrum for mobile broadband than either AT&T or Verizon, have refrained from passing on expensive data overage fees to consumers.[45] Sprint-Nextel is the only major U.S carrier that has not imposed either data caps or throttling for heavy users, while T-Mobile announced new unlimited 4G data plan with no fees or throttling in September 2012.[46]

Meanwhile, it became clear during the proposed merger of AT&T and T-Mobile that AT&T was sitting on large swaths of underutilized spectrum and maintaining several legacy networks rather than investing in network upgrades that would substantially increase capacity.[47] After the Department of Justice blocked the merger, AT&T CEO Randall Stephenson blasted the decision and suggested that greater competition on wireless networks would lead to less efficient spectrum allocation and higher prices.[48]

Prior to the merger's rejection, AT&T executives disclosed to investors that one of the major benefits of the acquisition would be the ability to "monetize" existing T-Mobile subscriber's data use by charging them overage fees, rather than throttling connections when they exceeded their monthly data allowance.[49] Thus AT&T and Verizon's move to tiered pricing and strict data caps seems largely tied to maintaining and growing operating profit margins, not necessarily managing congestion. Each is seeing record profit margins as a result of the new more expensive pricing schemes.[50] These margins are increased by upgrades to LTE, which make it even cheaper for wireless providers to deliver data.[51]

Monetization of mobile data caps

In July 2011, Verizon Wireless announced that it would be introducing a tiered pricing system for mobile users that included data caps. Previously, customers could purchase an unlimited data plan for $30 per month, but Verizon replaced this plan with three options for smartphone users: a 2GB plan for $30/month, a 5GB plan for $50/month, or a 10GB plan for $80/month. Users exceeding their monthly data allowance would be charged $10 for each additional gigabyte.[i] Verizon's announcement came nearly a year after AT&T eliminated its own $30 "all-you-can-eat" data plan in June 2010, replacing it with a similar metered system.[ii]

Since then, both Verizon and AT&T have reconfigured their data plans, simultaneously raising prices and data caps so that while users may be paying less per MB today than a year ago, they have to choose between a more expensive basic plan and incrementally higher tiers as well.[iii] Both companies have also introduced family share plans for data—similar to plans that allow families to share minutes and text messages—in which users share a single data cap, but pay a fee for each mobile device connected to the plan.[iv]

The results of this policy shift have been clear—the average revenue per user (ARPU) from monthly subscription wireless data plans has steadily increased since 2009, climbing at a higher rate than the ARPU for other metrics such as retail service and other postpaid fees. And the trend is likely to only increase as AT&T and Verizon push their new shared data plans, which offer additional opportunities to boost data ARPU. [v]

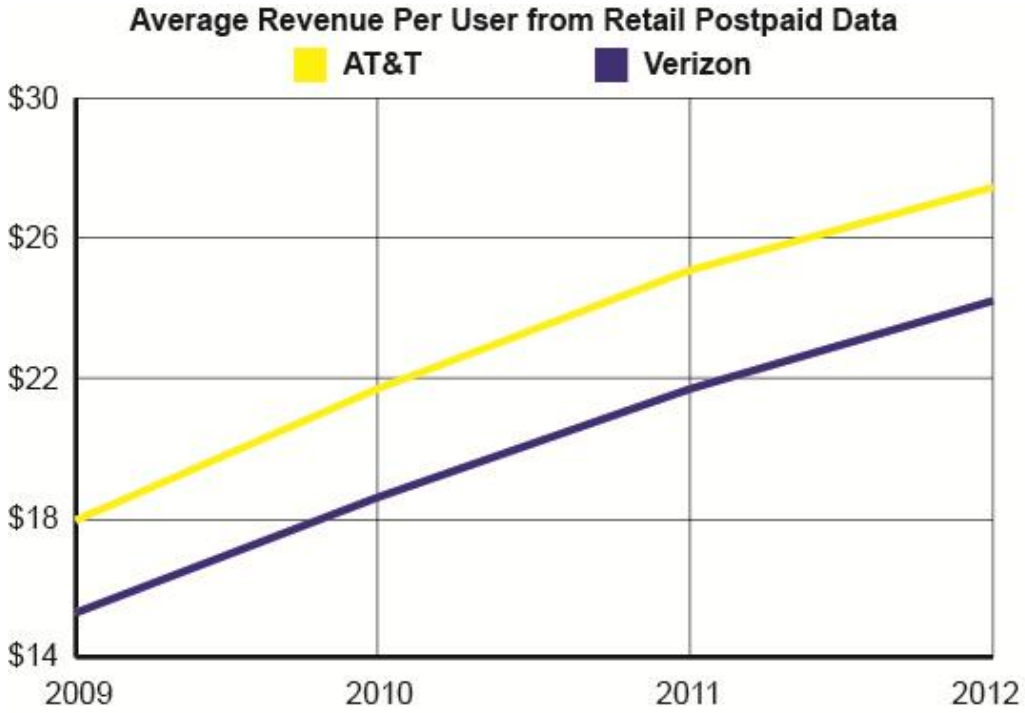

Figure 3

[i] Alex Colon, "Verizon's New Tiered Data Plans: What You Need to Know," *PC Mag*, July 6, 2011, http://www.pcmag.com/article2/0,2817,2388130,00.asp (accessed December 3, 2012).
[ii] Nick Bilton, "AT&T Eliminates the Unlimited Data Plan," *New York Times: Bits Blog*, June 2, 2010, http://bits.blogs.nytimes.com/2010/06/02/att-eliminates-unlimited-smartphone-and-ipad-data-plan/ (accessed December 3, 2012).
[iii] Kevin Fitchard, "AT&T boosts mobile data caps but hikes prices as well," *Giga Om*, January 18, 2012, http://gigaom.com/mobile/att-boosts-mobile-data-caps-but-hikes-prices-as-well/ (accessed December 3, 2012).
[iv] Brad Chacos, "AT&T vs. Verizon: Who's got the best family data plan?", *NBC News*, July 2012, http://www.nbcnews.com/technology/gadgetbox/att-vs-verizon-whos-got-best-family-data-plan-894120 (accessed December 3, 2012).
[v] Marguerite Reardon, "AT&T: We're 'thrilled' with our cash cow shared data plans," *CNET*, October 24, 2012, http://news.cnet.com/8301-1035_3-57539272-94/at-t-exec-were-thrilled-with-our-cash-cow-shared-data-plans/ (accessed December 3, 2012).

Conclusion: Caps and Competition

Data caps on wireline networks established even a few years ago seemed largely unreachable by the average user. Today, however, between laptops, gaming consoles, tablets, and smartphones, an American home typically has five or more connected devices.[52] Many of these devices are used simultaneously by different family members, which can add up quickly when all are subject to a single data cap threshold applied to the household broadband connection. Faster 4G mobile speeds offered by wireless companies make low data caps even more problematic. As Michael Weinberg, telecom policy expert at Public Knowledge, wrote that: "The fastest car in the world won't get you very far if you only have 20 feet of road, and a blazing-fast 4G LTE network is not worth much if you are limited to 2 GB of data per month."[53]

Yet as average consumer usage approaches the caps, the carriers have offered little if any data that supports their claims that the caps they have implemented are necessary. At the same time, broadband service has become an increasingly profitable business. In May 2012, Comcast exceeded profit and sales estimates and saw its net income rise 30 percent and average revenue per user increase by 7.8 percent. Even as it lost video subscribers, gains in broadband customers allowed the company to absorb these losses and continue its growth.[54] As consumer demand for mobile broadband increases, mobile data services are experiencing record operating income margins—29.7 percent for Verizon Wireless and 28.9 percent for AT&T Wireless in the first two quarters of 2012.[55] And increasing revenues from wireline broadband offerings are helping to overcome losses from diminishing legacy voice phone service. While some ISPs might try to frame growth in data consumption as a hardship, the trend is also clearly a boon to their business.

At the same time, overall growth in the number of broadband subscribers is leveling off, providing a significant incentive for both wireline and mobile providers to create scarcity and find additional revenue streams from their existing customer base. Charging for data usage through caps offers a lucrative means to do that, and providers are largely able to do so because of the lack of competition in the U.S. For example, a recent survey of the high-speed Internet offerings in 22 cities around the world, found that in addition to fewer choices, higher prices and slower speeds, ISPs in the U.S. trended toward tacking on additional fees and data caps far more frequently than their international peers. In competitive markets like Paris and Hong Kong, for example, few ISPs impose data caps on their wireline networks.[56]

In the mobile marketplace, AT&T and Verizon are able to charge these more expensive rates as a consequence of limited competition as well. Both companies have significantly larger spectrum holdings and more prime spectrum than the remaining competitors making it more difficult for other providers to offer similar speeds and coverage. Currently, both carriers also enjoy much lower churn rates—a term which refers to the gross loss of subscription-based customers per month—compared to other major wireless providers.[57] Recent quarterly reports indicate that customer churn rates for AT&T and Verizon are now below one percent,[58] underscoring that

"The fastest car in the world won't get you very far if you only have 20 feet of road, and a blazing-fast 4G LTE network is not worth much if you are limited to 2 GB of data per month."

- Michael Weinberg

"Speed's Other Needs," *TechCrunch*, 9/23/2012

consumers are increasingly "locked in," more and more likely to remain with their current wireless provider.

All of these factors underscore the fact that greater competition must be facilitated both in the mobile and the residential broadband marketplace. Wireless spectrum auctions should be structured to foster competition and new market entrants. Spectrum licenses should contain wholesale reselling provisions and "use-it-or-share-it" conditions to ensure that newly purchased spectrum does not simply sit idle.

Additional critical inputs for mobile broadband, such as special access lines that provide mobile networks with backhaul connections to the Internet, must be regulated to prevent anti-competitive pricing by Verizon and AT&T. Policymakers should also address the barriers to consumers switching mobile services. A lack of interoperability among smartphones and other locking mechanisms prevent consumers from taking their devices from one provider to another.

On the wireline side, policymakers need to promote policies that enable new competitors to enter the market and encourage competition from both the private and public sectors. Investment in infrastructure will ultimately be a major driver of U.S. competitiveness going forward. Rather than trying to curb consumer use and protect high profit margins on services over existing networks, it is critical that ISPs build for a future where the U.S. can provide competitive speeds and pricing in comparison to its international peers. Furthermore, in order to ensure a fair marketplace for consumers, ISPs must be transparent and accountable about their network management and data caps practices. Without fair mechanisms for consumers to track their data usage, it is impossible for consumers to make informed decisions.[59]

For the Internet to continue to serve as a catalyst for economic growth it is imperative that consumers and entrepreneurs not feel constrained online. In a recent speech, former FCC Executive Director and Chief of Staff Blair Levin highlighted the links between broadband abundance, innovation, and economic growth.

> "When it comes to the wireline access network, instead of talking about upgrades, we are talking about caps and tiers. Instead of talking about investment for growth, we are talking about harvesting for dividends," ... "[policymakers] should recognize that our progress demands an investment environment that creates the conditions that allows us to invent the future, not just harvest from the past."[60]

An uncapped Internet environment gave rise to a host of innovative and popular applications. Broadband and bandwidth must continue to be thought of as an abundant resource, not a rationed commodity, to ensure the vibrant online ecosystem can continue to flourish.

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