The Broadband Internet Economy is Thriving

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The first of three white papers examining the business broadband marketplace documents the explosive growth of the Internet over the past two decades, and the rise of competitors in the business data services market.

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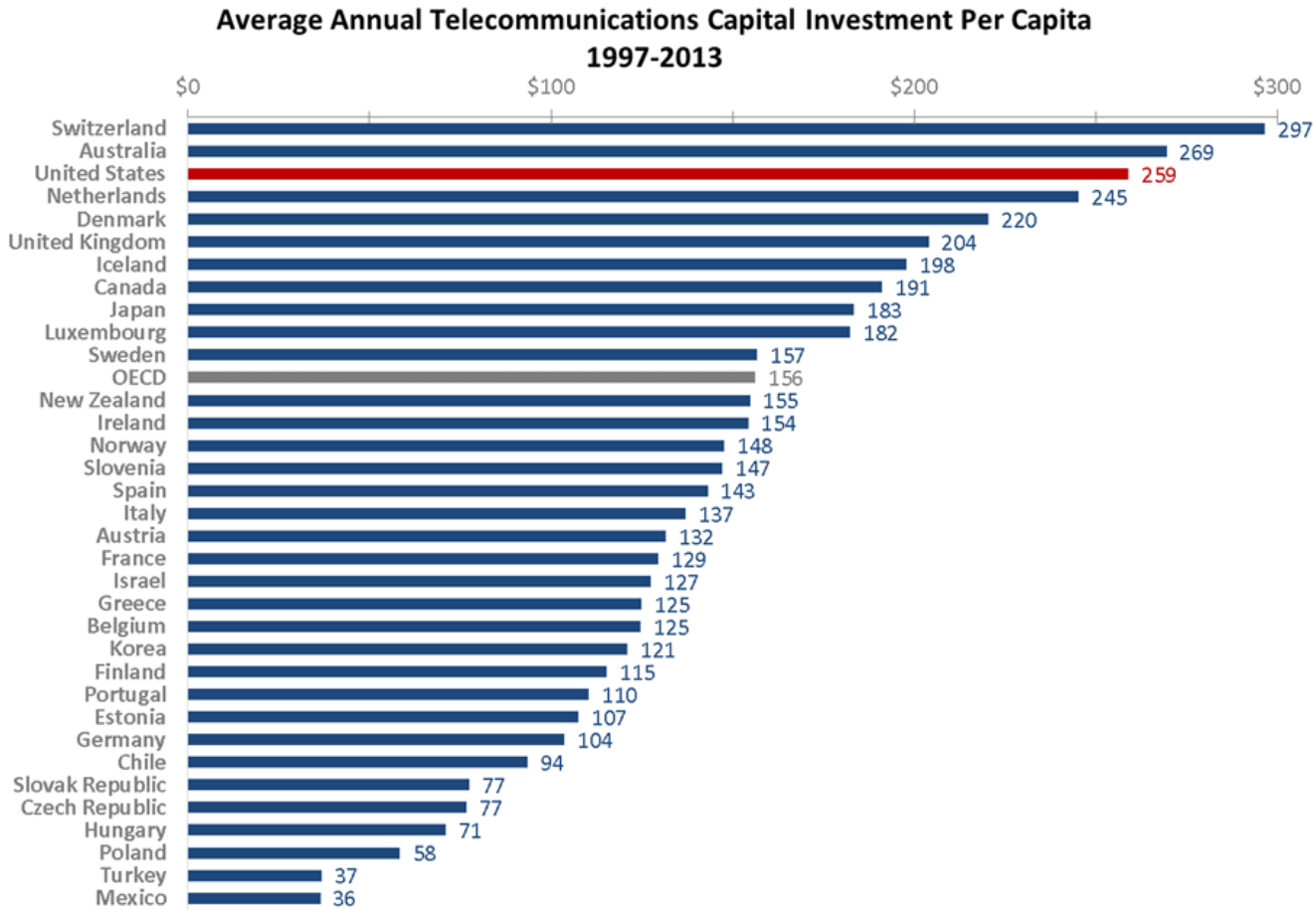
Exponential growth in new 21st Century high-speed broadband networks, services, and applications has transformed daily lives and reshaped the national and global economies. The Internet economy accounts for an estimated 5% of U.S. GDP and a greater share of recent economic growth – as much as 15% by some estimates.[1] Today, Americans spend an average of more than three hours per day online, with that total rising rapidly as broadband penetration grows and Internet use displaces traditional media and other activities.[2] The average U.S. consumer now spends less than $500 per year to access the Internet, and in return receives an average annual benefit of approximately $3,000.[3]

Since the Internet was first commercialized during the Clinton Administration, bipartisan policies have helped promote private sector investment and light-touch regulation under which the broadband Internet economy has thrived. Unlike voice services, broadband services – both wired and wireless – have been competitive from the outset. The Federal Communications Commission (FCC) has long exempted broadband from rate and other onerous economic regulations that typically impede investment and hinder innovation. These policies have encouraged more than $78 billion in private investment in broadband networks in 2014 alone, and more than $1.4 trillion over the past two decades.[4] This places the United States third among all nations in per-capita broadband investment, behind only Switzerland and Australia, countries of just 8 million and 23 million people, respectively.[5]

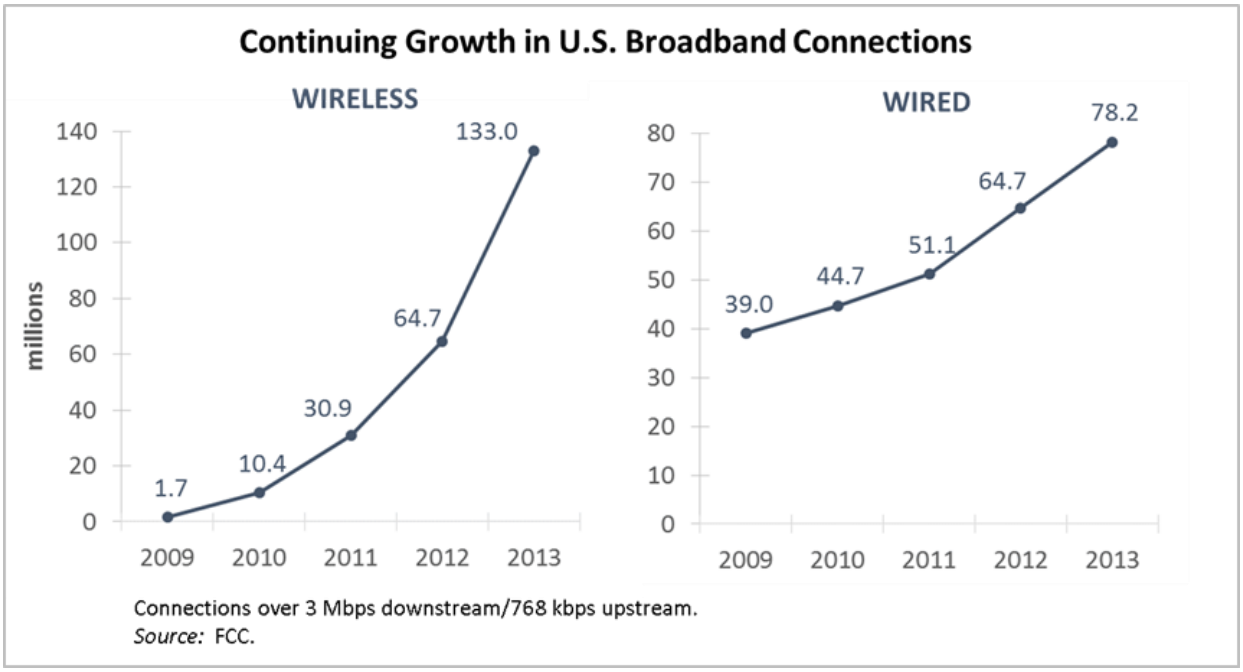


The Virtuous Circle of Broadband Investment and Innovation

The broadband Internet economy, as the FCC has recognized, is what economists label a "virtuous circle" in which "new uses of the network – including new content, applications, services, and devices – lead to increased end-user demand for broadband, which drives network improvements, which in turn lead to further innovative network uses."[6] As broadband investment grows, broadband usage increases as well, creating demand for still faster broadband, and so on.

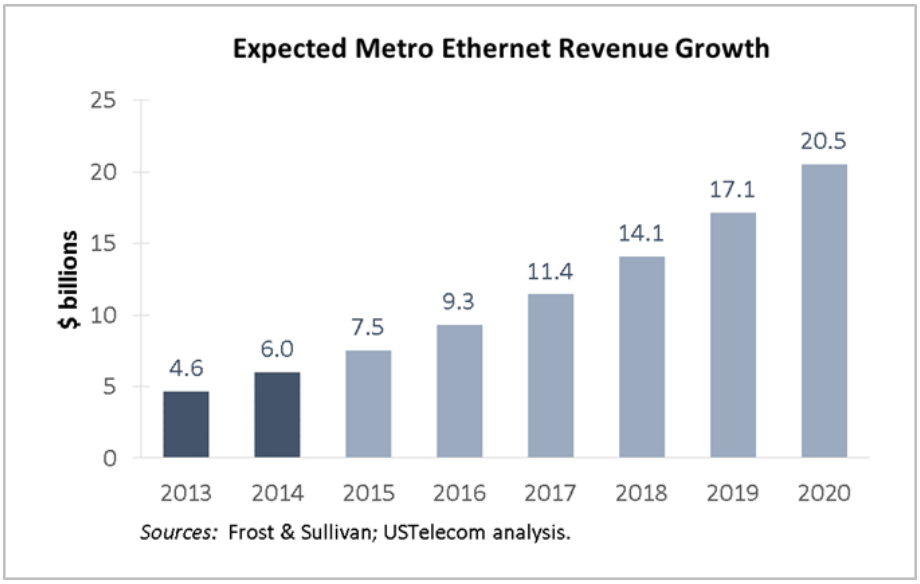
U.S. consumers have virtually unrivaled choice in wired and wireless broadband. Nearly 90% of U.S. homes can choose from two or more wired broadband alternatives plus two or more wireless broadband providers.[7] U.S. policies have successfully promoted next-generation broadband technologies that provide very high-speed connectivity.[8] Roughly 85% of U.S. homes can access networks capable of 100 Mbps, compared to less than half of European homes.[9] The difference, in part, results from massive U.S. investment in fiber-to-the-home networks, which represent 20% of the world's fiber connections – and roughly double the coverage of Europe.[10] Moreover, unlike Europe, the U.S. has benefitted from having competing facilities-based platforms, such as high-speed cable broadband networks.[11] These cable broadband networks have not been subject to the type of regulation that has inhibited the growth of broadband in Europe and much of the world.

The U.S. is a world leader in the ubiquitous availability and use of wireless broadband. The U.S. was a global leader in the robust deployment of 4G LTE five years ago; today, this service is available to more than 99% of the U.S. population, and more than four of five residents are able to choose among at least four LTE providers.[12] Approximately 40% or more of U.S. wireless subscribers already choose LTE, compared to 13% in Europe and 10% in Asia.[13] As a 2014 Deloitte report found: "The United States is in the enviable position of being the global leader in mobile broadband and has recently strengthened its position after losing a significant portion of its lead a few short years ago."[14]

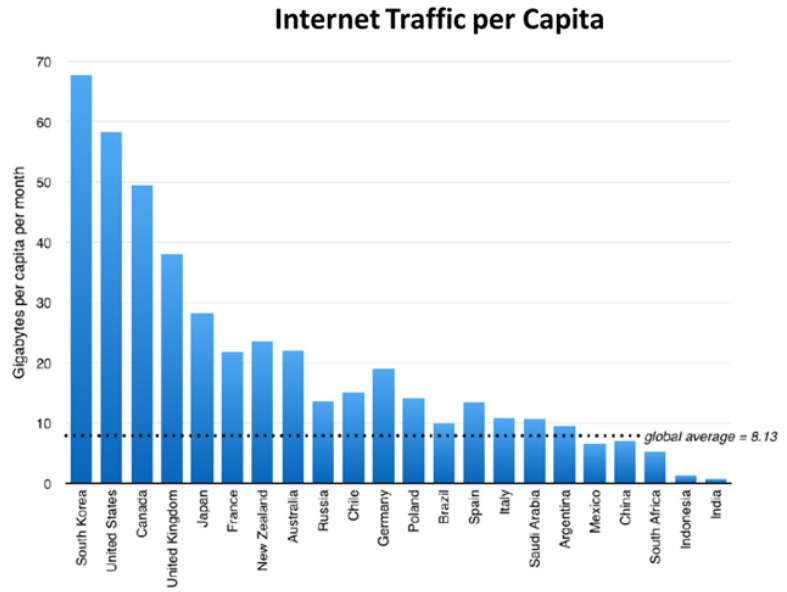


There has also been massive investment to deliver high-capacity services to U.S. businesses of all sizes, which has been integral to the success of the overall Internet economy. A decade ago, only an estimated 11% of the buildings with 20 or more employees had fiber, but in the past decade that has almost quadrupled to more than 42%, with significant expansion underway.[15] Moreover, the percentage of businesses with access to fiber is far greater, given that businesses tend to concentrate in multi-tenant structures that are typically the first buildings to attract fiber and other high-capacity facilities.[16]

Widespread fiber deployment has both facilitated and been driven by rising demand for new higher-capacity services that rely on packet-switched Ethernet and Internet protocol-based services. Businesses increasingly use these high-speed services for applications like data center interconnection, disaster recovery, video services, and access to cloud services. Traditional "special access" services — which as used here refers to the services that incumbent local exchange carriers (ILECs) provide using Time Division Multiplexing (TDM) technology, such as DS1 and DS3 services[17] — are inadequate to provide the bandwidth and other features that business customers increasingly demand. Consequently, there is a massive and ongoing migration away from traditional TDM-based special access services toward much higher capacity Ethernet services. As a result, Metro Ethernet revenues are expected to grow from more than $7 billion to more than $20 billion over the next five years.[18]



The increasing ubiquity of broadband infrastructure has enabled consumers to use their wireless and wired connections with an ever-expanding array of applications and activities beyond ordinary voice and data communications. Consumers currently use wireless devices to access news and information, listen to music, and watch video. As a result, data traffic is exploding. Wireless traffic alone grew more than 20-fold between 2009 and 2014, and is expected to increase another six-fold or more by 2019.[19] Given this demand, the U.S. now "generates more Internet traffic per capita and per Internet user than any other major nation except South Korea."[20]



Sources: Cisco Visual Networking Index, Central Intelligence Agency Factbook, and the author

Source: Bret Swanson, AEI, *Internet Traffic as a Basic Measure of Broadband Health*, at 6, Figure 1 (Nov. 2014), http://www.aei.org/wp-content/uploads/2014/11/2014-11-Swanson.final-template2.pdf.

Consistent with the virtuous-circle theory, the explosion of broadband usage and traffic is driving still further demand for greater capacity at all levels of the network. In order to support the transition from 3G to 4G wireless networks, for example, the "backhaul" connections from wireless cell towers to wireless carrier networks demand substantial upgrades. LTE requires ten times the bandwidth of 3G, and next-generation standards like LTE-Advanced will require six times the bandwidth of LTE (or 60 times the bandwidth of 3G).[21] Traditional special access services provided these backhaul connections to most locations in the past. The surging need for high-speed broadband, however, increasingly requires fiber facilities to support that demand. As a result, the wireless backhaul marketplace has attracted a wave of new competitive suppliers. Sprint, for example, stated that as part of its "recently completed modernization program, [it] modified [its] existing backhaul architecture to enable increased capacity to [its] network at a lower cost by utilizing Ethernet as opposed to time division multiplexing (TDM) technology."[22] And T-Mobile "resolved [its] backhaul problem for [its cell sites] several years ago" after implementing a "fiber to the cell" strategy that involved "dozens" of competitive suppliers.[23]

Increased Broadband Regulation is Unnecessary and Would Be Counterproductive

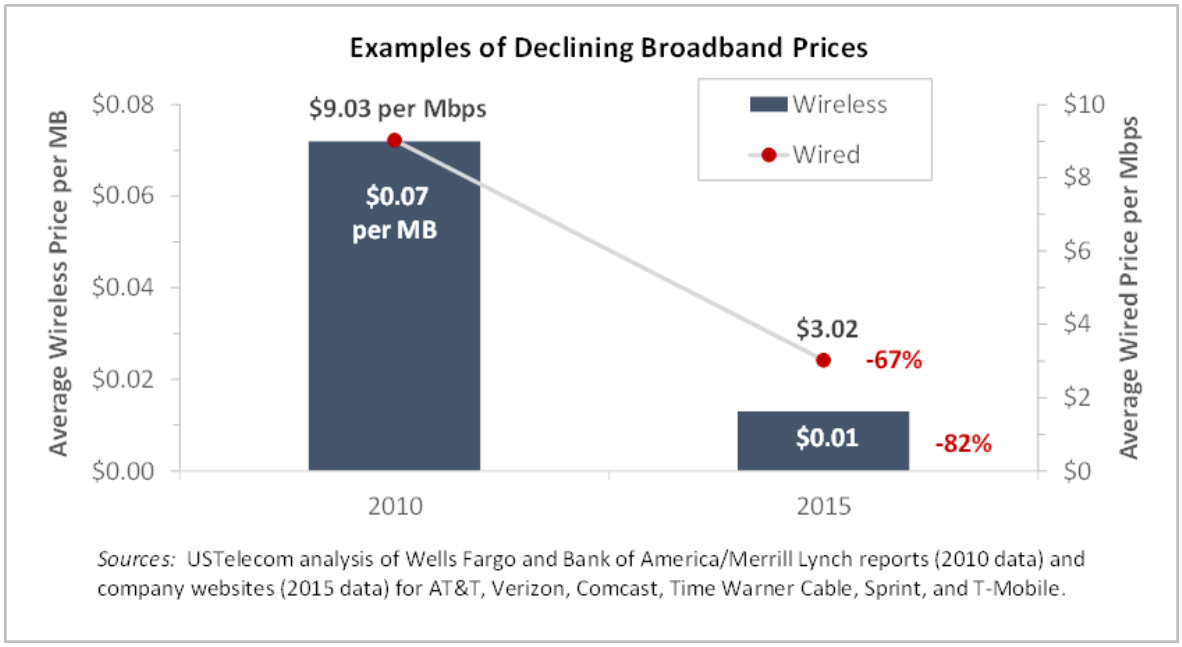
Despite the Internet economy's massive growth and success, some in Washington still seek greater regulation for some portions of the network that support it. They seek government intervention for the high-capacity services that ILECs provide on a wholesale basis to other service providers, including traditional special access services as well as newer Ethernet services. Not surprisingly, the leading voices for heavy handed regulation of high-capacity services are the very competitors that purchase high-capacity services from ILECs, who view Washington regulators as the vehicle to provide profitable returns beyond what a highly competitive marketplace can provide.

The FCC long ago decided to deregulate consumer broadband services because these services were competitive from the outset. Cable modem services, not phone company DSL services, have been the increasingly dominant form of accessing the Internet since the end of the dial-up era.[24] In the wireless marketplace, there have always been multiple competitors in every geographic area, including three or four major carriers who have raced to deploy broadband wireless services.[25]

High-capacity services provided to business customers have also been competitive for decades. The first competitive providers for these services emerged in the 1980s, just after the breakup of the Bell System. These companies deployed fiber networks in metropolitan areas to provide connections between large business customers and long-distance networks.[26] In response to this emerging competition, the Commission began to modernize its rules for special access in the late 1980s and early 1990s.[27] The local market opening measures in the 1996 Telecom Act further mandated competition in local markets, and business competition began to spread. By the time demand for broadband began growing in the late 1990s, these competitive providers had built multi -billion-dollar businesses for a rapidly growing industry segment.[28] Given expanding competitive alternatives in this marketplace, the FCC continued in 1999 to modify its regulatory framework by relaxing rate regulation on ILECs' traditional special access services in geographic areas where competitive alternatives exist.[29] Under this framework, increased competition allowed the FCC to gradually extend this so-called "pricing flexibility" to more and more areas across the nation.

As a matter of basic economics, price-regulating the networks that support the broadband Internet economy is unnecessary when competitive market forces are capable of ensuring affordable service to consumers. As the D.C. Circuit Court of Appeals has explained, rate regulation is justified only when there is (1) market failure or (2) the control of monopoly power,[30] neither of which is present in the provision of high-capacity services or broadband more generally. In economics, market failure occurs "when there is no incentive for private businesses to provide a service."[31] For example, government regulation of health care is premised, at least in part, on the concern that no private health care insurance provider is likely to provide coverage to individuals that are known to have serious and costly ailments. But situations like these are rare, and market forces are usually much better than regulators at meeting the needs of consumers.

Far from exhibiting signs of market failure, the broadband Internet economy exhibits all the signs of a healthy and vibrant marketplace, including with respect to the high-capacity services that ILECs provide and for which some competitors are now seeking increased regulation. First, the incredible growth, competition, and innovation that is occurring downstream in the retail markets for wireless and wired Internet services, as well as the vast ecosystem of applications and services that these services are used to access, provides compelling evidence that affordable access to these inputs has not constrained the marketplace itself or affected businesses' ability to obtain these services at reasonable prices. When an input market is failing, prices for these inputs typically rise, causing concomitant rises in prices for downstream products that use those inputs, which in turn constrict demand. Here, by contrast, demand is surging and prices have been falling. The average price per megabit per second for wired and per megabyte for wireless broadband has fallen dramatically, by approximately 67% and 82%, respectively, over the past five years.[32]



Second, the extensive and ongoing new entry into the business broadband marketplace also demonstrates the marketplace is not failing, but thriving. Cable's presence changes the dynamics of this marketplace. Cable operators expanded their increasingly dominant broadband networks first to serve small and medium-sized business customers, and more recently to go after the largest business customers as well. In September 2015, for example, Comcast formed a new business unit to target the Fortune 1000, announcing it will "continue to expand the network" and "will continue investing in Business Services expansion."[33] The largest U.S. cable operators – Time Warner Cable, Comcast, and Cox – are now the fifth, sixth, and eighth largest providers of Ethernet services in the United States, respectively.[34]

Fiber-based Competitive Local Exchange Carriers (CLECs) also continue to provide extensive and growing competition. These companies have won tens of thousands of customers and billions in revenues, capturing a significant share of the existing marketplace. Windstream, one of the nation's largest CLECs, states that it has a network "presence in virtually every city" and is "the provider of choice for four out of five Fortune 500 companies for data, voice, network and cloud solutions."[35] The Zayo Group, which was formed from acquisitions of more than 34 companies worth about $4.6 billion, now operates fiber networks covering "over 300 metro markets" in "46 states, plus Washington D.C."[36]

The future trajectory of competition also points to a healthy marketplace in no danger of failing. Given the extraordinary pace of broadband growth, most of the demand that will exist in five years' time does not exist today, leaving most of the market up for grabs once it materializes. With overall data traffic expected to grow two-and-a-half times and wireless traffic alone expected to grow six-fold or more over the next five years, competitive suppliers will have the opportunity to supply a rapidly growing volume of traffic that providers are currently not serving. In this environment, it is critical to ensure that all providers have adequate incentives to build out facilities to meet demand. Regulating one set of these providers unevenly would distort these incentives and therefore increase the risk of building sufficient capacity on a quick trajectory.

Third, pricing behavior in the marketplace demonstrates that competition is working. In an uncompetitive market, providers don't sharply discount their services to satisfy customers. But that is exactly what is occurring in the high-capacity marketplace. The CLECs who purchase backhaul and other high-capacity special access services are not ordinary consumers, but sophisticated companies with teams devoted to negotiating for lower prices and other favorable terms. These companies have secured significant discounts from the standard rates that ILECs are required to offer under tariffs that are filed with the FCC. These tariffed prices were originally set at price-cap regulation levels, which were designed to mimic a competitive market by limiting the prices providers were permitted to charge. Since those levels were set, the prices customers pay have steadily decreased, and discounts have become the norm.

Finally, rapid innovation in the provision of high-capacity services demonstrates the broadband marketplace is thriving. As noted above, until fairly recently, most dedicated services consisted of traditional special access such as DS1 and DS3 services. When Ethernet and IP-based services were introduced, some feared that ILECs wouldn't upgrade their networks to support these services, which offered lower revenues and profits, because they would "cannibalize" traditional special access services. With hindsight, it is clear those concerns were seriously misplaced. Customers have rapidly migrated to Ethernet services because they offer greater flexibility, ease of implementation, ability to transport multiple types of traffic, and higher bandwidth, all at lower cost.[37] A large number of competitors provide these services, including cable operators and numerous CLECs, in addition to ILECs. Indeed, the second largest U.S. provider of Ethernet services is Level 3, ranking ahead of two of the three major ILECs (Verizon and CenturyLink).[38]

End Notes

[1] *See*, *e.g.*, David Dean et al., Boston Consulting Group, *The Internet Economy in the G-20*, at 49 (Mar. 2012), https://www.bcg.com/documents/file100409.pdf (Internet economy made up 4.7% of GDP in 2010, and estimated to make up 5.4% of GDP in 2016); Organisation for Economic Cooperation and Development (OECD), *OECD Internet Economy Outlook 2012*, at 282, Table A5 (Oct. 4, 2012), http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-internet-economy-outlook-2012_9789264086463-en#page284 (in 2010, the Internet generated 4.65-7.21% of U.S. GDP); McKinsey Global Institute, *Internet Matters: The Net's Sweeping Impact on Growth, Jobs, and Prosperity*, at 16, Exhibit 5 (May 2011), http://www.mckinsey.com/~/media/McKinsey/dotcom/Insights%20and%20pubs/MGI/Research/Technology%20and%20Innovation/Internet%20matters%20-%20Nets%20sweeping%20impact/MGI_internet_matters_full_report.ashx (Internet's contribution to U.S. GDP growth was 15% from 2004-2009).

[2] *See*, *e.g.*, Leichtman Research Group, Inc., *Research Notes: Actionable Research on the Broadband, Media & Entertainment Industries*, at 5 (4Q 2014), http://www.leichtmanresearch.com/research/notes12_2014.pdf ("The mean reported time spent online at home per day is 2.8 hours among all individuals online at home – up from 2.2 hours per day in 2009.").

[3] *See*, *e.g.*, David Dean et al., Boston Consulting Group, *The Internet Economy in the G-20*, at 50 (Mar. 2012), https://www.bcg.com/documents/file100409.pdf (the average consumer spends $472 on the Internet while receiving a perceived $3,000 value, a surplus of $2,528).

[4] USTelecom, *Broadband Investment*, http://www.ustelecom.org/broadband-industry/broadband-industry-stats/investment ("Private sector broadband investment reached $78 billion in 2014, and the industry has invested $1.4 trillion since 1996.").

[5] *See* OECD, *Digital Economy Outlook 2015*, Table 2.31 (July 15, 2015), http://www.oecd.org/sti/ieconomy/deo2015data/2.31-InvestCapita.xls (Public Telecommunication Investment Per Capita); OECD, *OECD.Stat: Population*, http://stats.oecd.org/Index.aspx?DatasetCode=POP_FIVE_HIST (population for Switzerland and Australia).

[6] *Preserving the Open Internet*, Report and Order, 25 FCC Rcd 17905, ¶ 14 (2010).

[7] *See* NTIA: The Broadband Map, *Analyze – Summarize – Nationwide*, Number of Internet Providers Chart (June 2014), http://www.broadbandmap.gov/summarize/nationwide (the Wireline tab shows that 88.2% of households have access to two or more wired providers; the Wireless tab shows that 99.7% of households have access to two or more wireless providers.); NTIA, *Broadband Statistics Report: Broadband Availability in Urban vs. Rural Areas*, at 11 (Mar. 2015), http://www.broadbandmap.gov/download/Broadband%20Availability%20in%20Rural%20vs%20Urban%20Areas.pdf (showing that 99.4% of the urban population and 86.8% of the rural population nationwide have access to one or more wired providers).

[8] *See*, *e.g.*, Christopher S. Yoo, University of Pennsylvania & Center for Technology, Innovation & Competition, *U.S. vs. European Broadband Deployment: What Do the Data Say?*, at i (June 2014), https://www.law.upenn.edu/live/files/3352 ("The difference in regulation and competition models influenced the amount of broadband investment in the U.S. and Europe. In Europe, where it was cheaper to buy wholesale services from an incumbent provider, there was little incentive to invest in new technology or networks. In the U.S., however, providers had to build their own networks in order to bring broadband services to customers. Data analysis indicates that as of the end of 2012, the U.S. approach promoted broadband investment, while the European approach had the opposite effect ($562 of broadband investment per household in the U.S. vs. $244 per household in Europe).").

[9] *See*, *e.g.*, National Cable & Telecommunications Association, *America's Internet Leadership*, https://www.ncta.com/positions/americas-internet-leadership ("Notably, cable's robust fiber-rich broadband networks are available to 93 percent of all American households and 85 percent of U.S. homes are passed by cable technology capable of supporting broadband speeds of 100 Mbps or higher."); European Commission, *Broadband Coverage in Europe 2014: Mapping Progress Towards the Coverage Objectives of the Digital Agenda*, at 204 (Oct. 22, 2015), http://ec.europa.eu/newsroom/dae/document.cfm?action=display&doc_id=11195 ("Looking at the availability of at least 100 Mbps download speeds, it is possible to see that EU as whole is nearing the Digital Agenda goal of 50% of households having access to 100 Mbps broadband services by 2020 with 47.6% of European households being able to receive such speed in 2014.").

[10] *See*, *e.g.*, FierceTelecom Press Release, *Survey Says: Speedy Fiber Changing the Way We Use the Internet*, FierceTelecom (Nov. 16, 2015), http://www.fiercetelecom.com/press-releases/survey-says-speedy-fiber-changing-way-we-use-internet ("'Fiber's on fire in the U.S.,' said Heather Burnett Gold, President of the FTTH Council. 'Now, nearly one fifth of the world's fiber connections are here in the United States.'"); Christopher S. Yoo, University of Pennsylvania & Center for Technology, Innovation & Competition, *U.S. vs. European Broadband Deployment: What Do the Data Say?*, at 7 (June 2014), https://www.law.upenn.edu/live/files/3352 ("By the end of 2012, FTTP service increased to 23% of U.S. households and 12% of European households.").

[11] *See*, *e.g.*, Roslyn Layton, *When It Comes to High-Speed Internet, The Grass Isn't Greener in Europe*, Forbes (Feb. 7, 2014), http://www.forbes.com/sites/realspin/2014/02/07/when-it-comes-to-high-speed-internet-the-grass-isnt-greener-in-europe/ ("Seventy-four percent of Europeans rely on DSL technology – largely because Europe lacks competition among different broadband technologies – whereas only 34 percent of Americans do."); Roslyn Layton, American Enterprise Institute for Public Policy Research, *The European Union's Broadband Challenge*, at 4, Table 1 (Feb. 2014), https://www.aei.org/wp-content/uploads/2014/02/-the-european-unions-broadband-challenge_175900142730.pdf (the availability of cable broadband in the U.S. is 93 percent compared to 42 percent in the E.U.).

[12] *See*, *e.g.*, OpenSignal, *The State of LTE* (Sept. 2015), https://opensignal.com/reports/2015/09/state-of-lte-q3-2015/ (infographic showing that LTE first deployed in the U.S. in September 2010, when the U.S. was one of five countries that had deployed LTE); T. Sawanobori & Dr. R. Roche, CTIA, *Mobile Data Demand: Growth Forecasts Met*, at 4 (June 22, 2015) (4G LTE networks cover 98% of

the population); Comments of AT&T at 3, *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, WT Docket No. 15-125 (FCC filed June 29, 2015), http://apps.fcc.gov/ecfs/document/view?id=60001108102 ("If T-Mobile and Sprint follow through on their announced plans, all four national carriers will have deployed LTE to cover more than 300 million people by the end of 2015 – meaning that about 94 percent of Americans will soon have a choice of at least four LTE providers."); Cisco, *Visual Networking Index: VNI Forecast Highlights; United States – Mobile Highlights*, http://www.cisco.com/c/en/us/solutions/service-provider/visual-networking-index-vni/vni-forecast.html ("The United States' mobile data traffic grew 63% in 2014," and "will grow 7-fold from 2014 to 2019, a compound annual growth rate of 47%.").

[13] 4G Americas News Release, *Year-End 2014: Nearly Half a Billion LTE Connections Worldwide* (Mar. 11, 2015), http://www.4gamericas.org/en/newsroom/press-releases/year-end-2014-nearly-half-billion-lte-connections-worldwide/.

[14] Deloitte, *United States Expands Global Lead in Mobile Broadband: How Policy Actions Could Enhance or Imperil America's Mobile Broadband Competitiveness*, at 2 (Sept. 2014), http://www2.deloitte.com/content/dam/Deloitte/us/Documents/technology-media-telecommunications/us-tmt-mobile-index-09262014.pdf.

[15] *See* Vertical Systems Group, *Business Fiber Penetration Hits 42.5% in U.S.* (Mar. 31, 2015), http://www.verticalsystems.com/vsgpr/business-fiber-penetration-hits-42-5-in-u-s/.

[16] *See*, *e.g.*, *Unbundled Access to Network Elements*, Order on Remand, 20 FCC Rcd 2533, ¶ 154 (2005) (stating that when competitive LECs are deciding whether and where to build their own facilities, they "target areas that offer the greatest demand for high-capacity offerings (i.e., that maximize potential revenues) and that are close to their current fiber rings (i.e., that minimize the costs of deployment). The evidence in the record shows that the highest concentration of competitive LEC deployment of loops in the central business districts of large metropolitan areas are near where competitors have already deployed fiber rings."); Jonathan Kraushaar, Ind. Anal. Div., Common Carrier Bureau, FCC, *Fiber Deployment Update End of Year 1998*, at 22 (Sept. 1999) ("[E]conomies of scale can be realized where facilities are provided to large business customers or to other customers concentrated in large buildings."); Jonathan M. Kraushaar, Ind. Anal. Div., Common Carrier Bureau, FCC, *Fiber Deployment Update: End of Year 1990*, at 28 (1991) ("The key targets of [urban fiber systems] are large downtown office buildings in cities where the deployment cost and regulatory constraints of new fiber systems are not excessive.").

[17] *Cf.* Internet Innovation Alliance, *Special Access*, http://internetinnovation.org/images/misc_content/Special_access_one-pager.pdf.

[18] *See* Frost & Sullivan, *Business Carrier Ethernet Services Market Update, 2015*, at 37 (Sept. 2015) (metro segment revenue forecast for business carrier Ethernet); Frost & Sullivan, *Wholesale Carrier Ethernet Services Market Update, 2015*, at 30 (Aug. 2015) (metro segment revenue forecast for wholesale carrier Ethernet). *See also* Nav Chander, IDC, *Market Analysis: U.S. Carrier Ethernet Services 2015-2019 Forecast*, IDC #255002 (Mar. 2015) ("Total Ethernet revenue is expected to grow from $7.0 billion in 2014 to $12.1 billion in 2019, a compound annual growth rate (CAGR) of 11.4%.").

[19] *See* CTIA, *Annual Wireless Survey* (June 2015); Thomas K. Sawanobori & Dr. Robert Roche, CTIA, *Mobile Data Demand: Growth Forecasts Met*, at 1 and 7 (June 22, 2015), http://www.ctia.org/docs/default-source/default-document-library/062115mobile-data-demands-white-paper.pdf ("In 2009, approximately 191 billion megabytes (MB) traveled across U.S. wireless networks, or roughly 21.8 million MB an hour. By 2014, wireless providers reported handling more than 4 trillion MB.") ("Ericsson projects traffic in 2019 will be five times the traffic in 2014 while Cisco projects traffic in 2019 will be seven times the traffic in 2014. Averaging the two indicates that traffic in 2019 will be about six times higher than the traffic in 2014.").

[20] *See* Bret Swanson, American Enterprise Institute, *Internet Traffic as a Basic Measure of Broadband Health*, at 1 (Nov. 20, 2014), http://www.aei.org/wp-content/uploads/2014/11/2014-11-Swanson.final-template2.pdf. *See also,* Patrick Brogan, USTelecom, U*.S. Internet Usage and Global Leadership Are Expanding* at 6 (Aug. 12, 2015), https://www.ustelecom.org/sites/default/files/documents/081215%20Internet%20Usage%20%26%20Global%20Leadership.pdf.

[21] Ron Kline, Ovum, *Mobile Backhaul Forecast Report: 2014-19*, at 10 (July 17, 2014) (Ron Kline, Principal Analyst, Intelligent Networks, Ovum: "As mobile operators transition their networks to 3G and 4G/LTE, they must also evolve their backhaul infrastructure to support higher bandwidth requirements. LTE requires 10x the bandwidth of 3G, and LTE-A bandwidth requirements are 6x that of LTE (66x higher than 3G).").

[22] Sprint Corp., Form 10-K, at 27 (SEC filed May 26, 2015), http://www.sec.gov/Archives/edgar/data/101830/000010183015000012/sprintcorp201410-k.htm.

[23] TheStreet Transcripts, *T-MOBILE US INC (TMUS) Earnings Report: Q3 2015 Conference Call Transcript* (Oct. 28, 2015), http://www.thestreet.com/story/13341417/14/t-mobile-us-inc-tmus-earnings-report-q3-2015-conference-call-transcript.html (T-Mobile EVP & CTO Neville Ray: "For us, I mean to be quite frank, we resolved our backhaul problem for our [cell] sites several years ago. We embarked on a fiber to the [cell] strategy. It's five years ago, and that's been a huge help for us with our LTE rollout. Not only did we run fiber, we run very scalable fiber and great deals behind that, which have hugely helped us with the flat cost structure we've been delivering to the business.").

[24] *See*, *e.g.*, Ind. Anal. & Tech. Div., Wireline Competition Bureau, FCC, *High-Speed Services for Internet Access: Status as of December 31, 2004*, at Table 4 (July 2005), https://transition.fcc.gov/Bureaus/Common_Carrier/Reports/FCC-State_Link/IAD/hspd0705.pdf (showing cable's lead over other technologies providing residential and small business advanced services over 200 kbps in both directions, from 1999 to 2004); Ind. Anal. & Tech. Div., Wireline Competition Bureau, FCC, *Internet Access Services: Status as of June 30, 2009*, at 9, Table 4 (Sept. 2010), https://apps.fcc.gov/edocs_public/attachmatch/DOC-301294A1.pdf (same for residential connections over 200 kbps in both directions, from 2005 to 2009); Ind. Anal. & Tech. Div., Wireline Competition Bureau, FCC, *Internet Access Services: Status as of December 31, 2013*, at 26, Table 8 (Oct. 2014), https://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db1016/DOC-329973A1.pdf (same for residential connections at least 3 Mbps downstream and 768 kbps upstream, from 2009 to 2013).

[25] *See*, *e.g.*, *Implementation of Section 6002(b) of the Omnibus Budget Reconciliation Act of 1993*, Seventeenth Report, 29 FCC Rcd 15311, ¶¶ 10, 12 (2014) ("Providers of mobile wireless services offer an array of mobile voice and data services, including interconnected mobile voice services, text and multimedia messaging, and mobile broadband Internet access services." "As of year-end 2013, there were four facilities-based mobile wireless service providers in the United States that industry observers typically describe as 'nationwide.' These providers include AT&T, Sprint, T-Mobile, and Verizon Wireless. . . . Each of the four nationwide service providers has a mobile wireless network that covers in excess of 99 percent of the U.S. population.").

[26] *See*, *e.g.*, *Review of the Section 251 Unbundling Obligations of Incumbent Local Exchange Carriers*, Report and Order on Remand and Further Notice of Proposed Rulemaking, 18 FCC Rcd 16978, ¶¶ 44, 45 (2003) ("Within the enterprise market for telecommunications services, new entrants began competing with the incumbent LECs in the mid-1980s."); *Expanded Interconnection with Local Telephone Company Facilities*, Notice of Proposed Rulemaking and Notice of Inquiry, 6 FCC Rcd 3259, ¶ 2 (1991) ("[F]iber-based carriers, sometimes described as Competitive Access Providers (CAPs), now offer access services to large business customers in the central business districts of many major cities.").

[27] *See, e.g.,* 47 CFR §§ 61.41-42, 64.1401.

[28] *See*, *e.g.*, New Paradigm Resources Group, Inc. Press Release, *New CLEC Report ™ Tracks Over 200 Facilities-Based CLECs; Data Continues to Drive Explosive Growth of Competitive Local Telecom Industry* (May 1, 2000), http://www.nprg.com/Media/PDF/119-new-clec-report-tracks-over-200-facilities-based-clecs ("From revenue of $2 billion derived from access services in 1996, CLECs reported more than $28.5 billion in 1999 derived from a plethora of services they now offer.").

[29] *See Access Charge Reform*, Fifth Report and Order and Further Notice of Proposed Rulemaking, 14 FCC Rcd 14221, ¶ 19 (1999).

[30] *See Farmers Union Central Exchange v. FERC*, 734 F.2d 1486, 1508 (D.C. Cir. 1982) (citing S. Breyer, *Regulation and Its Reform* 15-16 (1982)).

[31] *MB Fin. Group, Inc. v. United States Postal Serv.*, 545 F.3d 814, 819-820 (9th Cir. 2008).

[32] *Compare* Marci Ryvicker et al., Wells Fargo, *Cable: "Naked" HSD Provides Sign. Upside Pot'l*, at 5, 7 (Aug. 24, 2010) (2010 data include wireline plans from Comcast, Time Warner Cable, Verizon, and AT&T) *with* AT&T, *Offers*, https://www.att.com/shop/unified/availability.html (using 9038 S Low Avenue, Floor 1, Chicago, IL 60620 as the address); Comcast XFINITY, *High Speed Internet Service from XFINITY by Comcast*, http://www.xfinity.com/internet-service.html (accessed Dec. 7, 2015 for Ashburn, VA 20146); Time Warner Cable, *High-Speed Internet Plans and Packages*, http://www.timewarnercable.com/en/plans-packages/internet/internet-service-plans.html (accessed Dec. 7, 2015); Verizon, *Verizon Fios High Speed Internet*, http://www.verizon.com/home/

fios-fastest-internet/#fastest-internet-plans (accessed Dec. 7, 2015); Verizon, *Verizon High Speed DSL Internet*, http://www.verizon.com/home/highspeedinternet/ (accessed Dec. 7, 2015; bundled with home phone; excludes speeds lower than 15Mbps). *Compare* Glen Campbell et al., Bank of America/Merrill Lynch, *Smartphones Are Hot, Data Cards Are Not*, at 5, Table 7 (Oct. 8, 2010) (2010 wireless pricing examples, excluding prepaid and unlimited plans) *with* AT&T, *Mobile Share Plans Configurator – AT&T*, https://www.att.com/shop/wireless/plans/planconfigurator.html (accessed Dec. 7, 2015); Sprint, *Cell Phone Plans & Smart Phone Plans from Sprint*, http://www.sprint.com/shop/plan-wall/#!/?plan=individual (accessed Dec. 7, 2015); T-Mobile, *Simple Choice Plan*, http://www.t-mobile.com/cell-phone-plans.html (accessed Dec. 7, 2015); Verizon Wireless, *Verizon Plan*, http://www.verizonwireless.com/landingpages/verizon-plan/ (2015 wireless pricing plans, accessed Dec. 7, 2015).

See also Blue Broadband, *US States with the Most Improved Broadband Speeds and Rates 2010-2014* (Sept. 30, 2014), http://www.bluefirebroadband.com/blog/broadband-speed-improvement/ ("Between 2010 and 2014 the average price of broadband in the United States dropped a whopping $3.06 per Mbps. As an example: Today, a 25 Mbps broadband connection costs $76.50 on average. In 2010, the same connection would have cost $166.75."); *Compare* OECD, *OECD Communications Outlook 2011*, at 271, Figure 7.23 (2011), http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-communications-outlook-2011_comms_outlook-2011-en#page273 (Sept. 2010 broadband subscription price range per Mbps of advertised speed, with line charges, USD PPP: $2.00-$29.99) *with* OECD, *OECD Digital Economy Outlook 2015*, at 119, Figure 2.37 (2015), http://www.keepeek.com/Digital-Asset-Management/oecd/science-and-technology/oecd-digital-economy-outlook-2015_9789264232440-en#page121 (Sept. 2014 range of fixed broadband prices per Mbps of advertised speed, USD PPP: $0.59-$57.71).

[33] Thomson Reuters StreetEvents, *CMCSA – Q4 2014 Comcast Corp Earnings Call*, at 16 (Feb. 24, 2015) (statement by Comcast Corp. EVP and Comcast Cable President & CEO Neil Smit).

[34] *See*, *e.g.*, Vertical Systems Group, *Mid-Year 2015 U.S. Carrier Ethernet LEADERBOARD* (Aug. 24, 2015), http://www.verticalsystems.com/vsglb/mid-year-2015-u-s-carrier-ethernet-leaderboard/ (Time Warner Cable, Comcast, and Cox are the fifth, sixth, and eighth largest providers of Ethernet services in the United States, respectively).

[35] *Windstream Communications at Citi Internet Media & Telecommunications Conference – Final*, FD (Fair Disclosure) Wire, Transcript 010714a5261028.728 (Jan. 7, 2014) (statement by Windstream CEO Jeff Gardner); Windstream Communications, *Why Windstream?*, http://www.windstreambusiness.com/why-windstream.

[36] Zayo Group Holdings, Inc., Form 424(B)(4) Prospectus, at 2 and 45-46 (SEC filed Mar. 13, 2015), http://www.sec.gov/Archives/edgar/data/1608249/000119312515090531/d877708d424b4.htm; Zayo Group, *About Zayo* (Sept. 5, 2015), https://web.archive.org/web/20150905225640/http://www.zayo.com/company/company-overview.

[37] *See*, *e.g.*, Roopashree Honnachari et al., Frost & Sullivan, *Business Carrier Ethernet Services Market Update, 2014*, at 7 (Mar. 2014) ("Carrier Ethernet continues to gain acceptance among enterprises, due to the benefits it offers: scalability, reliability, and cost efficient bandwidth."); Nav Chander, IDC, *Market Analysis: U.S. Carrier Ethernet Services 2015-2019 Forecast*, at 3 (Mar. 2015) ("Ethernet service can be purchased in granular bandwidth increments as small as 1Mb and scale to 10Gbps, allowing customers flexible bandwidth choices compared with static overprovisioning, as may be the case with private line connectivity."); Nav Chander, IDC, *Industry Developments and Models: Carrier Ethernet and Network Virtualization Market Trends* (Sept. 2014) ("Since 2013, there has been a significant global shift from private line TDM services for enterprise WAN communications to a Carrier Ethernet environment."); Matt Davis, IDC, *Market Analysis: U.S. SMB Telecom Voice and Data Services 2014-2018 Forecast*, at 5 (May 2014) (Ethernet services "have traditionally been targeted at the larger enterprise market, but IDC has seen service providers showing a greater focus on the SMB market by enhancing their reach with additional fiber builds — particularly into commercial buildings").

[38] Vertical Systems Group, *Mid-Year 2015 U.S. Carrier Ethernet LEADERBOARD* (Aug. 24, 2015), http://www.verticalsystems.com/vsglb/mid-year-2015-u-s-carrier-ethernet-leaderboard/.