Comments of TechFreedom[1]

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in Response to Oppositions to Petition in the Matter of

Applications of Comcast Corp. and Time Warner Cable, Inc.

For Consent to Assign or Transfer

Control of Licenses and Authorizations

MB Docket No. 14-57

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Executive Summary

Those that fear there is insufficient choice in broadband providers, especially at higher speeds, and that this merger will make that worse, are wrong on two fronts. First, this merger will not lead to any loss in choice because Comcast and Time Warner Cable do not compete in any relevant broadband market; no broadband competitor will be removed as a result of this merger. Second, claims that there is insufficient choice in broadband providers are based on factually unsubstantiated assertions about the inability of copper/DSL-based architectures to be an effective competitor to cable broadband outside of limited locations like clustered business parks and downtown buildings.

In fact, American telcos are in the midst of a landmark upgrade of their traditional DSL to much faster VDSL service — a reality to which critics of this merger seem willfully blind. ADTRAN, Inc. a leading manufacturer of DSL and VDSL equipment around the globe, has clearly explained the technical capabilities of VDSL in its comments in this docket. For example, with improved electronics and building fiber out closer to the premises, VDSL today can provide speeds up to 100 Mbps. The upgrade path that ADTRAN describes is essentially no different from the data over cable service interface specification ("DOCSIS") upgrades that boosted cable speeds far beyond those of traditional DSL: pushing fiber deeper into the network and extracting even higher speeds via more sophisticated network electronics. Those who persist in deriding DSL as perpetually inferior to cable have attempted to obscure these technical facts to fit a pre-conceived regulatory agenda.

American telcos have made enormous progress implementing VDSL technologies— particularly in the year that has elapsed since the data on which pessimistic claims about the state of the market rest. We provide case studies of how AT&T and CenturyLink have implemented these technologies, and also consider FTTP services being deployed by Verizon FiOS, AT&T Gigapower, CenturyLink, and Google Fiber. Most notably, AT&T's accelerated investment of $14 billion (Project VIP) brought upgraded versions of VDSL service to 75% of its wireline DSL footprint — roughly half the country. AT&T promises that if its merger with DirecTV is approved, it will upgrade an additional 20% with a mix of FTTP, VDSL and 4G LTE fixed wireless — bringing faster service than traditional DSL to 95% of its wireline footprint within four years of the deal closing.

VDSL is a highly effective competitor to cable broadband because it can provide speeds up to 45 Mbps — and, in some cases and using some techniques, several times that. Often the rapid uptake in VDSL-based services like U-verse are obscured by statistics: telcos generally combine subscriber growth data for legacy and upgraded DSL in their reported financial data. We have carved out upgraded VDSL-based subscriber growth data for AT&T's U-verse service to illustrate that upgraded DSL is indeed a highly effective competitor.

Financial data from Comcast and AT&T show that AT&T's U-verse (VDSL) broadband had roughly more than twice as many average quarterly broadband net-adds as did Comcast from Q2 2013 to Q3 2014. Legacy DSL cannot effectively provide download speeds above about 6 Mbps, but VDSL certainly can. Legacy DSL is fast declining as a share of telcos' broadband subscriber base as they upgrade at a rapid rate. The focus by critics on legacy DSL misses the point that the market increasingly sees it as being replaced by upgraded VDSL. This again shows the disconnect between critics' rhetoric, and market reality. For example U-verse broadband subscribers made up 75% of AT&'s wireline broadband subscribers in Q3 2013, up from 59% just a year earlier. At this rate, legacy DSL will soon be effectively reduced to only

limited areas where VDSL upgrades are not yet cost-effective. Opponents of this merger provided no sound reason to think that telcos cannot compete effectively with cable.

The policy of facilities-based competition that has been the foundation of the unique American success of broadband Internet has enabled this leapfrogging by competing technologies, all to the benefit of American consumers. Telcos' VDSL upgrades were spurred by the innovation of cable broadband providers through DOCSIS.

By claiming that only FTTP is competitive with cable broadband and that DSL is dead is essentially saying that the U.S. policy of facilities based competition has not worked. Our analysis shows that that policy has indeed worked and will continue to work, and this merger is part of that process of dynamic and rapid changes.

Finally, assertions that the competitiveness of the market should be based on a 25 Mbps speed threshold are unsupported by anything other than supported only by fuzzy math contrived to reach an arbitrarily high threshold. There is no basis in the record or elsewhere that broadband services offering speeds below 25 Mbps are not effective competitors, or that customers do not view these speeds as adequate alternatives in many cases.

DSL Architectures: Myth & Fact

Underlying all of the opposition to the proposed merger between the two largest cable providers, Comcast Corporation ("Comcast") and Time Warner Cable ("TWC"),[2] is a static — and misguided — mindset about the state of broadband competition that dismisses next-generation DSL as an effective competitor to cable.

Public Knowledge, *et al.* rest their entire argument on the assertion that "[o]nly fiber can provide a service comparable to cable — after all, cable and fiber together account for 99% of current 25 Mbps broadband subscribers."[3] They continue: "This is strong empirical evidence that cable and FTTP together are the technologies best able to meet America's broadband needs."[4] While their petition relies on June 2013 data,[5] Public Knowledge directed us, upon request, to the Media Bureau's December 2013 data showing essentially the same thing: 99.2% of 25+ Mbps subscribers were on either cable or FTTP services.[6]

This argument makes two key errors:

1. Even the updated data is already a year out of date, and it excludes the very period, 2014, in which telcos made the biggest progress in deploying 25+ Mbps service using next-generation DSL technologies.
2. It focuses on an inherently lagging indicator — the percentage of customers who subscribe to telco service — rather than on the availability of telco service at a given speed.

Free Press, in its Petition to Deny, makes essentially the same errors, but buries them in dozens of pages of analysis as to why traditional ADSL is in a different market than cable and FTTP service — with no discussion of VDSL at all.[7]

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[2] *See* Commission Seeks Comment on Applications of Comcast Corporation, Time Warner Cable Inc., Charter Communications, Inc., and SpinCo to Assign and Transfer Control of FCC Licenses and Other Authorizations, *Public Notice*, MB Docket No. 14-57 (July 10, 2014), *available at* http://apps.fcc.gov/ecfs/document/view?id=7521374780. See also Applications of Comcast Corp., Time Warner Cable Inc., Charter Communications, Inc., and SpinCo for Consent to Assign and Transfer Control of FCC Licenses and Other Authorizations, *Comments of TechFreedom,* MB Docket No. 14-57 (Aug. 25, 2014) *[TechFreedom Comments], available at* http://apps.fcc.gov/ecfs/document/view?id=7521817683.

[3] Applications of Comcast Corp., Time Warner Cable Inc., Charter Communications, Inc., and SpinCo for Consent to Assign and Transfer Control of FCC Licenses and Other Authorizations, Petition to Deny of Public Knowledge & Open Technology Institute, MB Docket No. 14-57 (Aug. 25, 2014) [PK & OTI Petition], available at http://apps.fcc.gov/ecfs/document/view?id=7521817048 .

[4] *Id.* at 12.

[5] See *PK & OTI Petition* at Worksheet 2 (citing FCC, *Internet Access Services: Status as of June 30, 2013*, at 30 https://apps.fcc.gov/edocs_public/attachmatch/DOC-327829A1.pdf).

[6] FCC, MB Docket No. 14-57, at 8, Exhibit 4 (Dec. 9, 2014), *available at* http://transition.fcc.gov/Daily_Releases/Daily_Business/2014/db1209/DOC-330922A2.pdf.

[7] Applications of Comcast Corp., Time Warner Cable Inc., Charter Communications, Inc., and SpinCo for Consent to Assign and Transfer Control of FCC Licenses and Other Authorizations, *Petition to Deny of Free Press*, MB Docket No. 14-57 (Aug. 25, 2014) [Free Press Petition], *available at* http://apps.fcc.gov/ecfs/document/view?id=7521818670.

This kind of static thinking has long dominated debates about the future of communications networks. FCC Chairman Tom Wheeler's September speech drew from this deep well of pessimism. Wheeler lamented that, as of December 2013, only 74.7% of Americans had more than one choice for a broadband provider offering speeds greater than 4 Mbps, 61.3% at 10+ Mbps, 25.3% at 25 Mbps, and 17.6% at 50 Mbps.[8] Thus, he concluded:

> Today, cable companies provide the overwhelming percentage of high-speed broadband connections in America. Industry observers believe cable's advantage over DSL technologies will continue for the foreseeable future.[9]
>
> Traditional DSL is just not keeping up, and new DSL technologies, while helpful, are limited to short distances. Increasing copper's capacity may help in clustered business parks and downtown buildings, but the signal's rapid degradation over distance may limit the improvement's practical applicability to change the overall competitive landscape. … In the end, at this moment, only fiber gives the local cable company a competitive run for its money.[10]

In fact, telcos are in the midst of — or, in AT&T's case, have just recently completed — a massive transition from "traditional DSL" (<6 Mpbps[11]) to the "new DSL technologies" Wheeler dismisses as ineffective. Consider AT&T's service:

- As discussed below, in November 2014, AT&T, the largest telco, announced that it had achieved its goal of upgrading its traditional DSL service to VDSL to 57 million customer locations (or 75% of its wireline broadband footprint) — potentially reaching half of all Americans.
- In six of the seven quarters through the third quarter of 2014, AT&T's U-verse service recorded net-subscriber gains above 600,000 subs per quarter — as shown in the chart below.[12]
- By comparison, AT&T U-verse broadband added roughly twice as many average quarterly net new broadband subscribers as Comcast did from the second quarter of 2013 to the third quarter of 2014: U-Verse's broadband quarterly net-adds averaged 608,167, while Comcast's averaged just 294 000.
- In total, AT&T grew its U-verse broadband subscriber base by 25% (to 12.1 million) from 3Q13 to 3Q14.[13]

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[8] Prepared Remarks of FCC Chairman Tom Wheeler "The Facts and Future of Broadband Competition" (Sept. 4, 2014), *available at* https://apps.fcc.gov/edocs_public/attachmatch/DOC-329161A1.pdf (Citing NTIA State Broadband imitative data).
[9] *Id,* at 3.
[10] *Id*. at 4-5.
[11] AT&T, *DSL High Speed Internet* (last visited Dec. 22, 2014) http://www.att.com/shop/internet/internet-service.html#fbid=rTKBSVqgFtQ.
[12] *See* AT&T, *AT&T Reports Strong Results in First Quarter While Investing in Growth Transformation* (Apr. 22, 2014), *available at* http://about.att.com/story/att_first_quarter_earnings_2014.html (showing a net gain of 634,000 U-verse subscribers during the first quarter of 2014, which "marks seven consecutive quarters with U-verse broadband net adds of more than 600,000").
[13] AT&T, *U-verse Update: 3Q14* - https://www.att.com/Common/about_us/pdf/uverse_update.pdf.

- Roughly 62% of those subscribers chose a plan delivering speeds up to at least 12 Mbps, indicating that at least this percentage of AT&T's U-verse footprint had been upgraded beyond traditional DSL.[14]

This shows that VDSL-based services like U-verse broadband are indeed effective competitors to cable broadband at higher speeds.

While AT&T's traditional DSL business is, indeed, shrinking, its upgraded U-verse service is growing rapidly. Thus, the chart shows that, despite the dramatic U-verse broadband growth, overall wireline broadband growth has been largely flat. Yet this obscures dramatic growth in VDSL-based U-verse broadband. AT&T is rapidly reducing the share of its customers who are on traditional DSL: For example, U-verse broadband subscribers in Q3 2014 were 75% of AT&T's wireline broadband subscribers, up from 59% a year earlier.[15] This means AT&T is starting to gain ground against cable overall by placing increasing shares of its broadband customers on U-verse broadband, and also going after cable broadband customers. Importantly, the net-adds column *understates* the competitiveness of U-verse against cable because it was only in the last quarter that AT&T completed deployment of U-verse.

Period	U-verse Broadband Net Adds	AT&T All Wireline Net Adds
Q1 2013	730,000	Data unavailable
Q2 2013	641,000	-61,000
Q3 2013	655,000	-26,000
Q4 2013	630,000	-2,000
Q1 2014	634,000	78,000
Q2 2014	488,000	-55,000
Q3 2014	601,000	38,000

[16]

[14] *Id*.

[15] *Compare* AT&T, Q3 2013 – 59% - http://www.att.com/gen/press-room?pid=24925&cdvn=news&newsarticleid=37119&mapcode *with* AT&T, Q3 2014 – 75% - (slide 9) http://www.att.com/Investor/Earnings/3q14/slides_3q14.pdf.

[16] AT&T's Management Discusses Q1 2013 Results - Earnings Call Transcript at http://seekingalpha.com/article/1364001-at-and-ts-management-discusses-q1-2013-results-earnings-call-transcript?part=single; AT&T's Q2 2013 Earnings at http://www.att.com/gen/press-room?pid=24550&cdvn=news&newsarticleid=36758&mapcode=; AT&T's Q3 2013 Earnings at http://www.att.com/gen/press-room?pid=24925&cdvn=news&newsarticleid=37119&mapcode=; AT&T's Q4 2013 Earnings at http://www.att.com/gen/press-room?pid=25228&cdvn=news&newsarticleid=37405&mapcode=corporate AT&T's Q1 2014 Earnings at http://about.att.com/story/att_first_quarter_earnings_2014.html; AT&T's Q2 2014 Earnings at

In short, new DSL technologies are competing quite effectively because they are doing precisely what some claim they cannot: allowing telcos to give each "local cable company a competitive run for its money." Critics claim that the technical characteristics of copper, most notably its signal propagation rates, will forever render it a second-class broadband medium. But telcos are using three techniques to overcome these limitations and to compete with cable even without the significant expense of deploying FTTP:

(1) **Pair-bonding** (combining multiple lines, where available[17]),
(2) **Vectoring** (noise cancellation on a single line),[18] and
(3) Shortening loop distances by **pushing fiber deeper** into their networks (i.e., from the central office interconnection point to more localized street cabinets using DSLAMs outside central offices).

It is important to note that these fiber-to-the-node ("FTTN") techniques are essentially the same as what cable operators have used to extract higher speeds from their hybrid fiber-coaxial networks: building fiber closer and closer to the customers' premises (or "fiber deep") and then upgrading the electronics of the network. Copper networks, just like cable networks, can achieve significant speed upgrades through iterative investments, without incurring the massive expense of going all-fiber.

DSL equipment manufacturer ADTRAN explains the state of the art and what is actually commercially practicable in its comments:

> Using VDSL2 technology and two-pair bonded loops, broadband download speeds of 80 Mbps can be provided on loop lengths up to 2500 feet. Alternatively, using ADSL2+ technology and two-bonded loops, the subscriber can get speeds of 25 Mbps on loop lengths of up to 10,000 feet. And where there are additional loops (which may be the case for most residences, or for broadband service to businesses or to remote terminals), multi-pair bonding can be used to provide hundreds of Mbps download speeds.[19]

ADTRAN also said that upgrading the hardware used inside broadband networks allows for even greater gains in speeds:

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http://about.att.com/story/att_second_quarter_earnings_2014.html; AT&T's Q3 2014 Earnings at http://about.att.com/story/att_third_quarter_earnings_2014.html.

[17] "VDSL2 bonding typically combines 2 regular VDSL2 lines into a single, virtual "big pipe" that allows operators to double the bitrate for existing subscribers (since you're using 2 lines). Alternatively, it allows them to deliver the same bitrates over longer distances (covering subscribers that were previously out-of-reach, thereby also reducing the number of cabinets that need to be built to cover a given area)." http://www.ospmag.com/issue/article/vdsl2-turning-copper-gold

[18] "VDSL2 vectoring works on a single pair and is based on the concept of "noise cancellation", much like the headphones people have started to use increasingly on planes, to reduce or cancel background/engine noise when listening to music or watching a movie. VDSL2 vectoring calculates the interference between all pairs in a binder, based on the actual signals, and will use this information to generate a noise cancellation signal on each pair, effectively removing all crosstalk. The net gain is between 25% and 100%."
http://www.ospmag.com/issue/article/vdsl2-turning-copper-gold

[19] Applications of Comcast Corp., Time Warner Cable Inc., Charter Communications, Inc., and SpinCo for Consent to Assign and Transfer Control of FCC Licenses and Other Authorizations, *Comments of Adtran, Inc.*, MB Docket No. 14-57, at 3 (Aug. , 2014) [Adtran Comments], *available at* http://apps.fcc.gov/ecfs/document/view?id=60000979824.

> One of the challenges limiting DSL performance is crosstalk between the loops within the same binder group in the network. A solution to mitigate crosstalk is vectoring, which uses advanced signal processing techniques to alleviate crosstalk. By performing the signal processing jointly among a group of lines at the DSL Access Multiplexer (DSLAM), rather than performing the signal processing on a line-by-line basis, the crosstalk can be significantly reduced or eliminated, thereby increasing capacity. Using vectoring, DSL download speeds of 100 Mbps can be provided on loops of up to 3400 feet with two-pair bonding. Vectoring thus provides significant enhancements on relatively short copper loops, and combined with bonding, it allows service on loops of up to 3400 feet at the 100 Mbps download speeds adopted as the longer term goal under the Commission's National Broadband Plan. In addition, companies continue to refine these DSL technologies. Moreover, advances in Outside Plan DSLAMs (OSP DSLAMs) are making it more economical to limit the length of the DSL copper loops to the customer premises, so that these download speeds can be provided on a cost effective basis to many more subscribers. Indeed, because of its cost and capabilities, DSL is the last-mile technology of choice for high-speed broadband services in Europe.[20]

ADTRAN notes that its own ActivReach technology can triple the range of 100 Mbps Ethernet over copper wires in older buildings, to 1600 feet.[21] ADTRAN also notes that it has already introduced a technology that allows VDSL2 to coexist with G.fast, the likely successor standard to VDSL2.[22] G.fast would allow telcos to move fiber even closer to the home by installing miniature DSLAMs closer to end-users than the street cabinets relied upon by VDSL2.[23] While VDSL2 uses channel sizes ranging from 17 MHz to 30 MHz, G.fast uses channel sizes of 106 MHz and will eventually use 212 MHz.[24] The first two test phases of the G.fast specification have enabled download speeds of up to 700 Mbps and 1.25 Gbps over 300 and 225 feet, respectively, and G.fast could soon support speeds of up to 1 Gbps at a distance of about 300 feet or 500 Mbps at about 800 feet.[25] Finally, Alcatel Lucent's Bell Labs has already successfully tested XG-FAST, which is capable of download speeds up to 10 Gbps when used with channel bonding and over a relatively short distance.[26]

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[20] *Id.* at 3-4.

[21] Id at 4-5. *See also* Adtran, *NetVanta 1535P* (last visited Dec. 22, 2014), https://www.adtran.com/web/page/portal/Adtran/product/1702595G10.

[22] *See* Brian Santo, *Adtran Paves VDSL2-to-G.fast Trail*, CED Magazine (Aug. 14, 2014), *available at* http://www.cedmagazine.com/news/2014/08/adtran-paves-vdsl2-to-gfast-trail ("Adtran has introduced a variation of DSL technology that ... would enable DSL carriers to deploy G.fast on a node by node basis, rather than having to upgrade entire markets from VDSL2 to G.fast.").

[23] *See* Sean Buckley, *Adtran Tackles G.fast, VDSL2 Vectoring Compatibility with Frequency Division Vectoring Technology*, FIERCETELECOM (Aug. 15, 2014), *available at* http://www.fiercetelecom.com/story/adtran-tackles-gfast-vdsl2-vectoring-compatibility-frequency-division-vecto/2014-08-15.

[24] Paul Spruyt & Stefaan Vanhastel, *The Numbers Are In: Vectoring 2.0 Makes G.fast Faster*, ALCATEL-LUCENT (July 4, 2013), *available at* http://www2.alcatel-lucent.com/techzine/the-numbers-are-in-vectoring-2-0-makes-g-fast-faster/.

[25] *Id.*

[26] Alcatel-Lucent, *Alcatel-Lucent Sets New World Record Broadband Speed of 10 Gbps for Transmission of Data Over Traditional Copper Telephone Lines*, Press Release (July 9, 2014), *available at* http://www.alcatel-lucent.com/press/2014/alcatel-lucent-sets-new-world-record-broadband-speed-10-gbps-transmission-data-over-traditional.

Upgrading from ADSL to ADSL2 to VDSL to VDSL2 to G.fast to XG-FAST may not sound as sexy as building "fiber to the home," but it may be a far more cost-effective strategy for deploying high speed networks in urban and suburban areas. An iterative approach avoids the major expense of installing fiber directly to the customers' premises, relying instead for final transmission on the legacy copper infrastructure still in place, while allowing investments to be staggered over time as consumer demand for greater speed grows.

Telco Deployment: The Good News Story

Petitioners' gloomy assessment of the market rests on market data collected up through December 2013. Thus, it does not reflect major upgrades in speed offered by telcos, such as AT&T and CenturyLink, that have chosen an iterative upgrade path. Below, we offer more-current data to illustrate that both the current availability and likely future trajectory of VDSL services suggest a far brighter picture than the gloomy prognostications of Public Knowledge, Free Press, and Chairman Wheeler.

AT&T. In November 2012, AT&T announced its Project Velocity IP ("VIP"), a $14 billion investment planned over three years (above its regular annual capital expenditure, which is generally in the range of about $15 billion to $18 billion)[27] to upgrade both its wireless and wireline networks with two specific goals:

- $6 billion for upgrading U-verse broadband speeds up to 75 Mbps for 33 million customer locations (or 43% of its footprint) and up to 45 Mbps for another 24 million customer locations (or 32% of its footprint).[28]
- $8 billion for providing 4G LTE fixed-wireless Internet access to offer VoIP and broadband services to 300 million people.[29]

On November 10, 2014, AT&T announced that it had completed its U-verse upgrades to all 57 million customer locations it targeted back in 2012 (75% of the customer locations within its wireline service footprint) in the third quarter of 2014 — over a year ahead of schedule.[30] In one fell swoop, T has upgraded its legacy DSL network and brought VDSL and other improvements to half of all U.S. households.[31] AT&T also noted that 2014 was the peak year for its U-verse broadband upgrades.[32] This news alone should make the pessimists rethink the dreary predictions made by Petitioners based on the FCC's December 2013 data. This sudden change in telcos' wireline broadband strategy and future prospects also suggests

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[27] AT&T, Form 10Q U.S. SEC Filing, 11/10/2014 and at AT&T press release at http://about.att.com/story/att_to_acquire_mexico_wireless_provider_iusacell.html

[28] AT&T has publicly stated that 57 million customer locations represent 75% of its wireline service area. This means its wireline footprint is 76 million customer locations. See "Investing in Wireline IP Network Growth" at http://www.att.com/gen/press-room?pid=23506&cdvn=news&newsarticleid=35661

[29] *See* AT&T, AT&T to Invest $14 Billion to Significantly Expand Wireless and Wireline Broadband Networks, Support Future IP Data Growth and New Services (Nov. 7, 2012), *available at* http://www.att.com/gen/press-room?pid=23506&cdvn=news&newsarticleid=35661&mapcode.

[30] AT&T, Form 10-Q Filed with U.S. Securities and Exchange Commission, 17 (Nov. 10, 2014), available at http://bit.ly/1Gk4nKs ("As part of Project VIP, we announced a goal to expand our IP-broadband service to approximately 57 million customer locations and we achieved that goal during the third quarter.").

[31] AT&T has deployed Project VIP to 57 million households, *supra* note 30 and associated text, of a grand total of 115.6 million households in the U.S. U.S. Census Bureau, *State and County Quickfacts* (last visited Dec. 22, 2014), *available at* http://quickfacts.census.gov/qfd/states/00000.html.

[32] AT&T press release at http://about.att.com/story/att_to_acquire_mexico_wireless_provider_iusacell.html

need for a greater humility about any regulator's ability to predict the future of dynamic markets and complex technologies such as broadband.

In June 2014, as part of the deal to acquire DirecTV, AT&T announced a further acceleration of its deployment of U-verse and other broadband upgrades — above and beyond the Project VIP upgrades recently completed.[33] AT&T said it would also reach an additional 2 million premises with its expanded GigaPower FTTP and 13 million premises with a mix of U-verse VDSL2 and fixed 4G LTE wireless service at 10-15 Mbps.[34]

Approval of AT&T's pending merger with DirecTV would allow the combined company to execute a comprehensive investment strategy that would bring higher speeds to an additional 20% of its footprint — above the 75% already upgraded to VDSL under Project VIP for a total of 95%, upgraded from DSL through a mix of U-verse, FTTP GigaPower and fixed wireless within four years of the DirecTV deal being closed. Clearly this is evidence that the broadband access market is not as static as some would claim — and that cable does not have a monopoly, even where it does not currently face competition from a FTTP provider.

Verizon. Verizon has deployed FiOS FTTP service to 65% of its footprint[35] and plans to continue building out to 70% (19+ million homes).[36] FiOS has proven to be hugely popular with consumers, at an enviable penetration rate of 40.6%, meaning that almost half of all customers with access to FiOS have chosen to subscribe to it.[37]

Verizon, alone among major telcos, has chosen to upgrade most of its infrastructure to FTTP. This decision must be understood in the context of population density; Verizon has deployed FiOS in the most densely populated parts of the country: the Northeast Corridor and southern California.[38] The population density in New Jersey, for example, is *fourteen* times higher than in the rest of the U.S.[39] Even this comparison understates the relative density of the FiOS footprint compared to the rest of the country because, while FiOS is available in every county in New Jersey, it is not necessarily available everywhere in each county. At 26,403 inhabitants per square mile, the New York City area is *three-hundred* times denser than the rest of the country; at 7,068 inhabitants per square mile, the Greater Los Angeles Area is *eighty* times denser.

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[33] *See* U.S. Sec. & Exch. Comm'n, *AT&T Inc. Form 8-K Current Report* (June 3, 2014), *available at* http://www.sec.gov/Archives/edgar/data/732717/000073271714000049/qa8k.htm.
[34] *See id.*
[35] *See* Verizon, *Financial and Operating Information, 16* (Sept. 30, 2014), *available at* http://www.verizon.com/about/file/3717/download?token=cJaGzDMo.
[36] Jacob Siegal, *Verizon Just Killed Your Dreams of Getting FiOS in Your Neighborhood,* BGR (May 14, 2014) http://bgr.com/2014/05/14/verizon-fios-expansion-2014/ ("We'll continue to fulfill our FiOS LFAs (franchise agreements) we will complete (the FiOS deployment) with about 19 million homes passed," Shammo announced at the Jefferies 2014 Global Technology, Media and Telecom Conference. "That will cover about 70 percent of our legacy footprint; 30 percent we're not going to cover.").
[37] Thomson Reuters StreetEvents, *Edited Transcript: VZ — Q3 2014 Verizon Earnings Conference Call*, 7 (Oct. 21, 2014), *available at* http://www.verizon.com/about/investors/quarterly-reports/3q-2014-quarter-earnings-conference-call-webcast/.
[38] Fiber for All, *Finally a Verizon FiOS Availability Map* (last visited Dec. 22, 2014) http://fiberforall.org/fios-map/.
[39] U.S. Census Bureau, *Statistical Abstract of the United States* (2012), *available at* http://www.census.gov/compendia/statab/2012/tables/12s0014.pdf.

In short, a FTTP approach may make sense at this time for very densely populated areas, but not for most of the country.

It would be a mistake to assume, as many pessimists have, that there is not another telco broadband architecture (besides FTTP) that can compete with cable — and to assess the competitive effects of cable company mergers based on that assumption.

CenturyLink. The nation's third largest telco, CenturyLink, has also made enormous strides in deployment.[40] As the FCC's recent speed data (through September 2013) show, CenturyLink was, in the previous year, able to "double" its broadband speeds in certain markets by upgrading parts of its network.[41] Such a tremendous jump in speeds is strongly representative of the greater point being made here: a snapshot of the broadband market today (or, given the inevitable lag in the data, ten months ago or more) is, at best, a rough gauge for what it will look like tomorrow — or even what it looks like today. In March 2014, CenturyLink disclosed that it had FTTN service (a form of VDSL) with speeds of at least 10 Mbps to 65% of its footprint (8 million of 13 million homes).[42] Yet Petitioners apparently felt no need to address these figures in their comments — with CenturyLink market shares cited in tables, but not once discussed in text. Like AT&T, CenturyLink is deploying FTTP service in cities with population density high enough to make FTTP cost-effective. In August CenturyLink announced that its 1 Gbps FTTP service had reached residential and business customers in eleven major cities across the West and Midwest, and business customers in additional five cities.[43]

Telco FTTP Services. These DSL upgrades are in addition to the enormous investments that telcos are making to invest in FTTP in certain markets. For example, in April 2014 AT&T announced plans to expand its GigaPower FTTP network in 25 major metropolitan areas nationwide.[44] In accordance with these plans, GigaPower FTTP is currently available in five metropolitan areas: Austin, Fort Worth, Dallas, Raleigh-Durham, and Winston-Salem. And AT&T has confirmed that it will soon become available in 12 additional areas: Atlanta, Charlotte, Chicago, Greensboro, Jacksonville, Houston, Kansas City, Miami, Nashville, St. Louis, San Antonio, and San Jose.[45] In addition, AT&T is exploring the following eight cities for GigaPower FTTP deployment: Augusta, Cleveland, Fort Lauderdale, Los Angeles, Oakland, Orlando, San Diego, and

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[40] *See 2014 Measuring Broadband America Report*, at 14 ("[T]hose ISPs using DSL technology show little or not improvement in maximum speeds, with the sole exception of Qwest/CenturyLink, which this past year doubled its highest download speed within specific market areas.").

[41] *Id.*

[42] *See* CenturyLink, *Ex Parte: In re Connect America Fund: CenturyLink Rural Broadband Experiment Expression of Interest*, WC Docket No. 10-90 (Mar. 7, 2014), *available at* http://apps.fcc.gov/ecfs/document/view?id=7521089735.

[43] CenturyLink, *CenturyLink Expands its Gigabit Service to 16 Cities, Delivering Broadband Speeds Up to 1 Gigabit Per Second* (Aug. 5, 2014), *available at* http://news.centurylink.com/news/centurylink-expands-its-gigabit-service-to-16-cities-delivering-broadband-speeds-up-to-1-gigabit-per-second.

[44] AT&T, *AT&T Eyes 100 U.S. Cities and Municipalities for its Ultra-Fast Fiber Network*, Press Release (Apr. 21, 2014), available at http://about.att.com/story/att_eyes_100_u_s_cities_and_municipalities_for_its_ultra_fast_fiber_network.html#sthash.uxluIPgX.dpuf.

[45] AT&T, *U-verse with AT&T GigaPower is Expanding* (last visited Dec. 22, 2014), *available at* http://www.att.com/att/gigapowercities/.

San Francisco.[46] In conjunction with its proposed acquisition of DirecTV, AT&T also committed to extend GigaPower service to at least 2 million additional customer locations, beyond those areas listed above, within four years of closing the transaction.[47]

Google Fiber. Finally, Google Fiber is also poised to announce its own expansion plans to as many as 34 cities in nine metro areas.[48] But, like AT&T, Google recently announced that it would delay making a decision on which cities to deploy in until sometime in 2015.[49] While Google did not offer a reason for its delay, its timing implies that, like AT&T, Google may be waiting to see whether the FCC plunges into what FCC Chairman Bill Kennard rightly called the "morass of Title II"[50] because of the added costs of regulatory compliance and the possibility of local loop unbundling being imposed on Google's new fiber deployments.

In short, various versions of VDSL — and newer technologies like G.fast that are already out of the labs — have enabled — and will enable — legacy DSL to be upgraded as a highly effective competitor to cable broadband. The claims by some, including the Chairman, that so-called new DSL technologies are limited to short distances, such as clustered business parks and downtown buildings, simply have little bearing in market realities. Contrary to the claims of pessimists, DSL isn't dead; it's being reborn. Regulators should be careful not to make sweeping judgments about this merger on the basis of unsubstantiated claims about the current and future capabilities of DSL broadband technologies.

Properly Assessing Competition in Broadband Networks

Capital investments in the broadband market (as in most markets) are influenced by many factors, including consumer demand, regulatory climate, availability of financing, technological characteristics, and upgrade cycles. Critics seize upon one of these factors — technological characteristics — to dismiss telco competition unless, like Verizon's FiOS, it brings fiber directly to the home. They essentially argue that twisted-copper wiring, which has served the communications needs of Americans for almost a century, is now obsolete, and that only coaxial and fiber optic cables can effectively support the bandwidth necessary for modern American communications. This argument is based upon an unfair and incorrect assessment of the capacity of upgraded DSL networks to provide higher speeds and robust competition to Comcast and other cable ISPs. It also reflects a lingering assumption that telcos are the

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[46] *Id.*

[47] Robert W. Quinn, Jr., Senior Vice President, Federal Regulatory, AT&T, Letter to Marlene H. Dortch, Secretary, Federal Communications Commission, in *re Applications of AT&T Inc. and DIRECTV for Consent to Assign or Transfer Control of Licenses and Authorizations*, MB Docket No. 14-9 (Nov. 25, 2014), available at http://apps.fcc.gov/ecfs/document/view?id=60000988497.

[48] *See* Google, *The Future of Fiber* (last visited Dec. 22, 2014), https://fiber.google.com/newcities/*; see also* Stephanie Mlot, *34 Cities Working to Land Google Fiber*, PCMag (Feb. 19, 2014), *available at* http://www.pcmag.com/article2/0,2817,2453662,00.asp (describing Google's plans to solicit interest and feedback from cities for potential fiber deployment).

[49] Stephanie Mlot, *Decision on Next Google Fiber Cities Delayed*, PCMag (Dec. 19, 2014), *available at* http://www.pcmag.com/article2/0,2817,2473959,00.asp (describing how Google's fiber expansion plans were scheduled to be released by year-end 2014, but have been delayed).

[50] "Consumer Choice Through Competition," Remarks by William E. Kennard, Chairman, FCC, at the National Association of Telecommunications Officers and Advisors, 19th Annual Conference, Atlanta, GA, at 5 (Sept. 17, 1999).

incumbents in this network, whose onetime dominance — first in telephony and then in dial-up Internet — was long ago and permanently disrupted by cable companies using a network architecture better suited to broadband. In fact, in the back-and-forth of facilities-based competition, disruptee and disruptor can change places repeatedly.

The fact that cable companies clearly led among 25+ Mbps subscribers in December 2013 says little about the competitiveness of the market at present, in the coming years, or beyond. The economic literature on dynamic markets is clear: market share at a particular point in time resulting from upgrade cycles is not a bug, but a feature, as it merely represents one side of the market leapfrogging over the other, which encourages the other side to respond.[51]

Network innovation inevitably works through cycles of leapfrogging, with competitors all trying to outdo each other, so it is wrong to dismiss as irrelevant any particular technology at a particular moment in time based on its current technical characteristics. As history has shown, new advances in technical standards and software protocols can dramatically improve the underlying functionality of a given network or device. What's more, these huge upgrades — once developed and tested in-house — cost relatively little to roll out, and can yield tremendous benefits for consumers relatively quickly.

From the telegraph to the telephone to video to broadband, communications network owners have always had to dance the "infrastructure two-step": squeezing the most value out of existing infrastructure while upgrading or deploying new infrastructure as needed. After the 1996 Telecom Act made it legal for telcos to offer video service (repealing cable's *true* legal monopoly),[52] telcos were desperate to figure out how to use the existing copper-based networks built only to carry telephony to compete with the cable networks built to carry video. This led telcos to invest heavily in the development of new technical standards: first, high-bit-rate digital subscriber line ("HDSL") technology — the first commercial version of DSL — and, later, ADSL, which dedicated more channels to downward throughput in order to supply consumers' demand for ever-growing cable TV packages.[53] As the Internet grew in importance relative to video service, telcos found themselves well-positioned to meet demand for data — since ADSL was designed to handle the sort of download-heavy traffic that forms the bulk of Internet usage — and telco dial-up Internet initially dominated the broadband market.[54]

Cable companies responded by investing heavily in developing the technology needed to deliver high-speed broadband alongside their traditional video services. The result, DOCSIS has been implemented and updated repeatedly since it was first rolled out in the late 1990s. Through DOCSIS, many cable operators have been able to outperform legacy DSL operators in the broadband market. Having already sunk billions of dollars into their wireline infrastructure, telcos have essentially two upgrade paths for competing with

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[51] *See, e.g.*, Gary Becker, *Dynamic Competition and Anti Trust Policy*, THE BECKER-POSNER BLOG (Sept. 2, 2013), *available at* http://www.becker-posner-blog.com/2013/09/dynamic-competition-and-anti-trust-policy-becker.html.

[52] *See* Telecommunications Act of 1996, Pub. L. No. 104–104, § 302(a) (1996) (codified at 47 U.S.C. §§ 571–73).

[53] *See, e.g.*, SCOTT A. VALCOURT, *A Comparison of the Current State of DSL Technologies, in* BROADBAND SERVICES, BUSINESS MODELS AND TECHNOLOGIES FOR COMMUNITY NETWORKS, 163, 164–65 (2005), *available at* http://www.frsf.utn.edu.ar/matero/visitante/bajar_apunte.php?id_catedra=300&id_apunte=4204.

[54] "33% of US Households currently have internet access, with 92% of them using dial-up, or narrowband, connections" Remarks of (former) Federal Communications Commissioner Gloria Tristani (Jan. 9, 2001), at http://transition.fcc.gov/Speeches/Tristani/2001/spgt101.txt

cable's ever-improving DOCSIS capabilities. The first is upgrading to an all-fiber infrastructure, as Verizon has done with FiOS and other telcos are doing in certain urban markets.[55] The second is more iterative, but potentially far more cost-effective: upgrading DSL to VDSL, as discussed above.

Those obsessed with the "cable monopoly" seem convinced that, among major telcos, the fact that only Verizon has chosen FTTP as its primary deployment strategy proves that telcos aren't serious about competing. Again, pushing fiber deeper into the last mile and then using electronics to extract even higher speeds is exactly the same iterative approach cable companies have used to extract higher speeds through the various iterations of their DOCSIS standard. In other words, telcos and cable are competing with each other using similarly iterative approaches to infrastructure investment. Even Verizon has taken an iterative approach to installing the network equipment needed for higher speeds on its all-fiber network — because it simply has not been cost-effective to buy the routers and modems needed to deliver Gigabit speeds.'

In fact, European telcos have relied heavily on an iterative VDSL approach, instead of FTTP, to bring high speed broadband access to their citizens. VDSL has achieved 25% coverage in the E.U., compared to 39% coverage for DOCSIS cable and 12% coverage for FTTP, to achieve 54% overall next generation network coverage.[56] The Netherlands is often cited as a leader in next generation broadband network deployment in the E.U.; its carriers used a dual strategy of DOCSIS cable and VDSL to achieve an impressive 98% coverage for next generation broadband networks: 98% for DOCSIS cable and 60% for VDSL.[57] On the other hand, FTTP coverage in the Netherlands is only 18%.[58] This means that policymakers in the E.U. have not discarded upgraded DSL as irrelevant, as the critics would have the FCC do in the U.S. Instead, E.U. policymakers clearly see VDSL as a legitimate and robust competitor to DOCSIS cable.

Since the late 1990s, the core of U.S. broadband policy has been encouraging facilities-based competition, principally between cable and telcos. Following the direction of Congress in the 1996 Telecommunications Act, Bill Kennard, then Chairman of the FCC, wisely chose not to do what many European countries had done, and would continue to do: rely on a nationwide network of terminating monopolies. Instead of trying to create artificial competition among resellers over shared lines, Kennard worked to pit telcos against the cable companies in a no-holds-barred battle for the broadband and video markets. As the National Broadband Plan notes, "[I]n 2004 the mean advertised download peak speeds of cable and DSL were similar, and the maximum and minimum advertised peak speeds were identical."[59] Cable companies then leapt ahead to offer mean and maximum download speeds that more than doubled their DSL counterparts by investing in DOCSIS and hybrid-fiber architectures, and now telcos are responding with FTTH service in dense markets and VDSL hybrid-fiber architectures in others.[60]

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[55] *See, e.g.*, Jim O'Neill, *AT&T Plans Major 1 GB Internet Rollout to as Many as 100 Cities*, OOYALA (Apr. 21, 2014), *available at* http://www.ooyala.com/videomind/blog/att-plans-major-1-gb-internet-rollout-many-100-cities.
[56] Christopher S. Yoo, *U.S. vs. European Broadband Deployment: What Do the Data Say?*, U. Pa. Inst. for L. & Econ., at 23 (June 3, 2014) *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2510854.
[57] *Id.* at 42.
[58] *Id.*
[59] FCC, *Connecting America: The National Broadband Plan*, 42 (2010), *available at* http://transition.fcc.gov/national-broadband-plan/national-broadband-plan.pdf.
[60] *Id.* ("By 2009, the mean advertised cable speed was about 2.5 times higher than DSL, while the maximum peak advertised speed was three times higher than DSL.").

Assessing the competitiveness of the market based on a single snapshot — whether December 2013 or the present or some single point in the near future — misses the forest for the trees: competition is an ongoing process of one-upmanship.

Properly Assessing Broadband Demand

While VDSL is perfectly capable of providing speeds well in excess of 25 Mbps, neither the FCC nor Petitioners have articulated any methodologically defensible justification for setting the threshold at 25 Mbps, rather than 10 Mbps — or any other number — as part of any merger analysis.

Public Knowledge, *et al.* claim that a "forward-looking market definition" would be one that "sets a minimum downstream speed for broadband of 25 Mbps."[61] Petitioners arrive at this number as follows:

> The average HD video stream requires 5 Mbps of capacity, and the average American home has three television sets. A 25 Mbps threshold ensures that viewers can watch television while still having sufficient leftover capacity for mobile devices, online backup services, and other applications. The Commision [sic] has already found that speeds in excess of 15 Mbps are necessary for "[b]asic functions plus more than one high demand application running at the same time" — 10–25 Mbps for three high-demand applications plus basic functions is a reasonable extrapolation of this metric.[62]

Essentially, Public Knowledge's proposed equation may be written as (video speed x number of television sets) + other simultaneous streaming activities = minimum speed threshold. Every piece of this equation distorts actual user behavior in order to produce a number contrived to justify a pre-determined policy outcome.

To start, Public Knowledge makes the same mistake that Chairman Wheeler recently made when, to justify raising the FCC's definition of broadband for its Section 706(b) inquiry (to 10 Mbps, not the 25 Mbps level advocated by Public Knowledge), Chairman Wheeler asserted that "Four megabits per second isn't adequate when a single HD video delivered to home or classroom requires 5 Mbps of capacity."[63] In fact, even on Google Fiber's 1,000 Mbps service, Netflix still streams, on average, at between 3.5 and 3.65 Mbps[64] — not significantly higher than some cable companies, and only 25% faster than, say, Comcast (2.82 Mbps in July 2014).[65] The 5 Mbps number is, in fact, merely Netflix's *recommendation* for HD quality.[66] Furthermore, real-time streaming is only one way to deliver and consume video content over the Internet. Among other things, content can be downloaded and cached for future viewing on even the slowest of networks. The key point here is that the Commission should be focused on hard data about how consumers actually use the Internet, not anecdotal examples of how many consumers like to use the Internet.

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[61] *PK & OTI Petition,* at 8.
[62] *Id*.
[63] *1776 Speech*, *supra* note **Error! Bookmark not defined.**.
[64] *See* Netflix, *USA ISP Speed Index Results Graph* (April 2014 – July 2014) (last visited Dec. 22, 2014), *available at* http://ispspeedindex.netflix.com/results/usa/graph.
[65] *Id.*
[66] *See* Netflix, *Internet Connection Speed Recommendations* (last visited Dec. 22, 2014), *available at* https://help.netflix.com/en/node/306.

Similarly, even if it is true that "the average American home has three television sets," it hardly follows that Americans regularly (or even ever) simultaneously stream content on all three. Indeed, in 2010, the average American household had just 2.59 persons.[67] The critics do not offer any actual data as to how often Americans might watch multiple televisions simultaneously. And even if they did, such data would fail to account for another important aspect of the market: innovation at the edge.

For all that critics talk about the vital importance of "edge providers" innovating in the context of net neutrality, they seem to have in mind only the simplest form of pure-streaming business models. But as Americans switch to OTT video providers and rely on them to stream to multiple devices simultaneously, should we not expect streaming services and devices to become smarter, too? If simultaneous bandwidth is the relevant constraint, should we not expect that streaming services and devices will pre-cache at least some of the content they expect users to watch? For example, a service could algorithmically predict the likelihood that a user will watch the next episode, next two episodes, etc. of a series. At some point, perhaps not after the very first episode, it may become more cost-effective for the service to upload those episodes to the user in advance, perhaps during off-peak hours when the costs for sending the content are lower. And this will become especially easy if the service interacts with a specialized device or an application on one of the user's devices that can receive the content during, say, the middle of the night and store it until it is demanded by the user. The point is that no one really knows exactly what the future will look like, but it is extremely unlikely to look quite like what Public Knowledge predicts.

Finally, Public Knowledge breezily asserts that "leftover capacity for mobile devices, online backup services, and other applications" will require an additional 10 Mbps.[68] Again, Public Knowledge offers no data to substantiate its claim.[69] And, again, Public Knowledge repeats the stasis fallacy that seems to undergird its entire filing when it implies that bandwidth-intensive, but non-urgent, applications like automated backup will regularly take place while three simultaneous video streams (at 5 Mbps, of course; 40% faster than on Google Fiber) *and* VoIP calls and online browsing are taking place. Apparently, for all Public Knowledge's talk of "smart" applications and "dumb" networks, in the future PK is fighting to preserve, applications are equally dumb — if not dumber.

This is the worst kind of market-analysis-by-conjecture. Each of the three terms in the equation, being essentially arbitrary and unsupported by actual evidence, introduces a wide margin for error. To show just how wide that margin is, suppose that the actual data show that the use case that actually drives the marginal consumer's decision about broadband and video service is streaming HD quality Netflix (3.65 Mbps, to take the Google Fiber number) on two (not three) devices plus a certain amount of web browsing and a VoIP call (1.5 Mbps[70]). If the web browsing figure is 1.2 Mbps, that equation would suggest that the relevant threshold is a mere 10 Mbps — a scant 40% of the figure arrived at by Public Knowledge's conjecture.

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[67] U.S. Census Bureau, *Table 61. Households and Persons Per Household by Type of Household: 1990 to 2010* (2012), *available at* http://www.census.gov/compendia/statab/2012/tables/12s0062.pdf.
[68] *PK & OTI Petition*, at 8.
[69] *See id.*
[70] *See, e.g.*, Skype, *How Much Bandwidth Does Skype Need?* (last visited Sept. 23, 2014), *available at* https://support.skype.com/en/faq/FA1417/how-much-bandwidth-does-skype-need (recommending 100kbps / 100 kbps for calling and 1.5 Mbps / 1.5 Mbps for HD video calling).

The point is that any assessment of this number requires rigorous methodology grounded in actual, current and reasonably foreseeable future uses — because it is highly subject to manipulation. The best, simplest way to set the number would be to focus on what data plans consumers actually choose. If, for example, consumers have the option of choosing a 25 Mbps plan or higher, but choose only a 10 Mbps plan, that would suggest that, at that price, they simply do not value the potential to simultaneously stream video to multiple devices as much as Public Knowledge, in its superior wisdom from the Olympian Heights of "consumer advocacy," thinks they should.

Conclusion: Good Reason for Optimism

"Night is darkest just before the dawn," goes the old saying. The Chairman and Petitioners see darkness, indeed, because they are stuck in what used to be called the "Hour of the Wolf." As the marketing materials for Ingmar Bergman's 1968 *film noir* by that name explained the old folk term:

> The Hour of the Wolf is the hour between night and dawn. It is the hour when most people die, when sleep is deepest, when nightmares are most real. It is the hour when the sleepless are haunted by their deepest fear, when ghosts and demons are most powerful. The Hour of the Wolf is also the hour when most children are born.[71]

The "deepest fear" that drives broadband debates, the nightmare of a cable monopoly, is just that: a haunting fear of the sleepless. If cable's critics would but wait for the future, rather than predict it, they might see that, even as they kept a nervous vigil, new technological "children" were being born — right now: the technologies that are already allowing telcos to compete with cable around the country. In short, as sci-fi giant William Gibson remarked, "The future is already here — It's just not evenly distributed yet."[72]

What really matters, in assessing the competitive effects of a merger, are its reasonably foreseeable competitive effects, which in turn hinge upon the likely state of the marketplace both with and without the merger. Petitioners insist that only FTTP service can compete with cable even as reality proves otherwise. They simply have not deigned to confront the increasing speeds being offered by telcos through upgrades to DSL service: VDSL in its variants and other technologies, such as G.fast, currently out of the lab and in active field testing. We urge the FCC to reject all arguments against this merger — and, in general — based on static assessments of the current marketplace.

Any assessment of the U.S. broadband marketplace should keep in mind international comparisons — with the appropriate caveat. In mid-2012, 82% of American households had access to at least one broadband provider offering speeds of 25 Mbps or greater.[73] Of the eight largest western E.U. nations surveyed by Professor Christopher Yoo, the average coverage was just 54%. Only the Netherlands exceeded the U.S., at 98% — but, with an average population density over *fourteen* times that of the

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[71] Wikipedia, *Hour of the Wolf* (last visited Dec. 22, 2014), http://en.wikipedia.org/wiki/Hour_of_the_wolf. Trailer available at https://www.youtube.com/watch?v=doQQpOqPKP4.

[72] *See* Pagan Kennedy, *William Gibson's Future is Now,* N.Y. Times (Jan. 13, 2012), *available at* http://www.nytimes.com/2012/01/15/books/review/distrust-that-particular-flavor-by-william-gibson-book-review.html?pagewanted=all&_r=0.

[73] *See generally* Yoo, *supra* note 56 (analyzing data on broadband deployment in the E.U. and the U.S. and offering various comparisons).

U.S.,[74] this would be like comparing the densely populated U.S. Northeast Corridor (where, not coincidentally, Verizon has deployed FiOS) with the rest of the U.S. Sweden, the only one of these eight major European countries with a lower population density than the U.S. — indeed, the only one roughly comparable to the U.S. in density — had a coverage rate of just 57%.[75] The lead of the U.S. in rural coverage was even more stark: 48% versus 12% overall.

This is, of course, just one snap shot in time, but it does help to illustrate that longstanding U.S. policy of encouraging facilities-based competition is working — through leapfrogging. The fact that cable leapt into a large temporary lead in the market is not an unintended consequence of that dynamic, but a necessary, albeit it likely temporary, result of such dynamic competition. The "future" is one of ongoing upgrades from both cable and telcos, with new providers entering the market, too — and it's becoming more "evenly distributed" all the time.

[74] 498 v 35 persons per square kilometer in 2014. The World Bank, *Population Density (people per sq. km of land area)* (last visited Dec. 22, 2014), http://data.worldbank.org/indicator/EN.POP.DNST.
[75] *Id.* (24 v. 35 persons per square kilometer, about two-third the U.S. density level).