

September 21, 2017

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 Twelfth Street, SW

Washington, DC 20054

Via Electronic Filing

In the Matter of)
)
Inquiry Concerning Deployment of Advanced) GN Docket No. 17-199
Telecommunications Capability to All Americans)
in a Reasonable and Timely Fashion)

Dear Ms. Dortch,

I¹ offer these comments to aid the Commission in framing its 706(b) report on advanced telecommunications progress. I also filed comments in last year’s 706 inquiry.²

Summary

1. Rather than setting an arbitrary standard for the definition of “advanced telecommunications capability” or broadband, the Commission should rely on an objective, empirical measure sensitive to application requirements. The standard should be devised by measuring the requirements of the world’s most popular applications. The FCC’s goal should be to ensure that America’s networks are good enough to ensure that these applications are not performance-limited by our

¹ I am an independent network engineering consultant and policy analyst, presently working at High Tech Forum as editor and founder and as an independent consultant. These remarks are offered in my personal capacity and do not necessarily represent the opinions of any client or sponsor. My CV is available at <http://www.bennett.com/resume.pdf>

² Richard Bennett, “FCC Comment on Broadband Progress,” *High Tech Forum*, September 7, 2016, <http://hightechforum.org/fcc-comment-broadband-progress/>.

networks in the typical household.

2. Wireless networks have become America's primary Internet connections. We move more data over wireless networks and spend more time using wireless devices than we do with legacy devices. Consequently, the evaluation of broadband deployment should stress wireless over wired networks. Wired networks increasingly serve a single need: they enable us to use video streaming services without concern for exceeding data caps. With the advent of 5G, they will take on a supporting role in backhaul.
3. Wireline networks are still important, but they have a different role in the 5G era than they've had in the past. Just as Internet backbones have become feeder networks to CDNs across the Internet generally, wired networks at the Internet's residential edge are becoming feeders to Wi-Fi access points and small 5G cells. Permitting processes are not keeping pace with the needs of fiber backhaul networks.
4. A US broadband policy that seeks to diffuse the broadband technology deployed in the cities and states with the best capabilities across the nation as a whole effectively brings the entire nation to the top rank of international capability. The cost of deploying broadband across a nation is largely a function of two factors: 1) the average distance of customer premises equipment (CPE) from the carrier facility; and 2) the average distance of CPE from the nearest Internet Exchange Point. Consequently, it is unrealistic to expect the US to create networks that are both faster and cheaper than those in Singapore and Hong Kong.
5. The FCC's current method of mapping broadband deployments to population uses the Form 477 survey of offerings by Census Blocks. It would be wise for the Commission to consider turning this system on its head and estimating population coverage from something like the coverage maps published by wireless carriers. This method would simply require the superimposition of coverage maps on

population density maps. It should not be difficult for wired broadband providers to convert their data on coverage of units with political boundaries to the format used by wireless carriers.

1. The definition of “Advanced Telecommunications Capability” should mirror the objective requirements of top applications.

Rather than setting an arbitrary standard for the definition of “advanced telecommunications capability” or broadband, the Commission should rely on an objective, empirical measure sensitive to application requirements. This standard should be devised by measuring the requirements of the world’s most popular leading-edge applications. The FCC’s goal should be ensuring America’s networks are good enough to fully enable these applications on our networks in the typical household without network-induced performance restrictions.

We know how to do this. The FCC measures US broadband speed through its Measuring Broadband America (MBA) reports. These reports show the median broadband speeds available across the nation as well as the broadband requirements of certain applications, such as web browsing and video streaming.

MBA data has consistently shown that web pages load as fast on 12 - 15 Mbps broadband connections as they do on higher speed networks at 50 Mbps, 100 Mbps, or even 1 Gbps.³ This is just one application, however. So the MBA program should be expanded to include a (small) basket of applications that represent “advanced networking” at each measurement period. This set of applications might be informed by the comScore Mobile Apps Report and similar inventories of desktop and IoT applications.⁴

³ Richard Bennett, “You Get What You Measure: Internet Performance Measurement as a Policy Tool” (TPRC 45, Arlington, VA: Social Science Research Network, 2017), <https://papers.ssrn.com/abstract=2944402>. Oddly, the MBA reports produced by the Wheeler FCC twice claimed the plateau was 25 Mbps even though the data presented in the reports continued to show 12–15 Mbps as the proper standard.

⁴ comScore, “The 2017 U. S. Mobile App Report” (comScore, 2017), <https://www.comscore.com>.

Presently, the top 10 mobile apps are Facebook, YouTube, Facebook Messenger, Google Search, Google Maps, Instagram, Snapchat, Google Play, Gmail, and Pandora.⁵ Aside from the rather astonishing fact that eight of the ten are owned by Google or Facebook, none demands greater communication capacity than the typical web or streaming application for the desktop. The greatest demand for capacity probably comes from video surveillance systems; they require upstream bandwidth that is often in short supply. Video conferencing and Augmented Reality are also bandwidth-intensive in both directions.

Applying this metric to the present standard devised by the Wheeler FCC, it becomes apparent that the 25 Mbps download goal is somewhat too high while the 3 Mbps upload goal is too low. The average mobile broadband speed measured in the US by the Speedtest Global Index is a better reflection of current needs: 23 Mbps download and 8 Mbps upload.

⁵ Ibid.

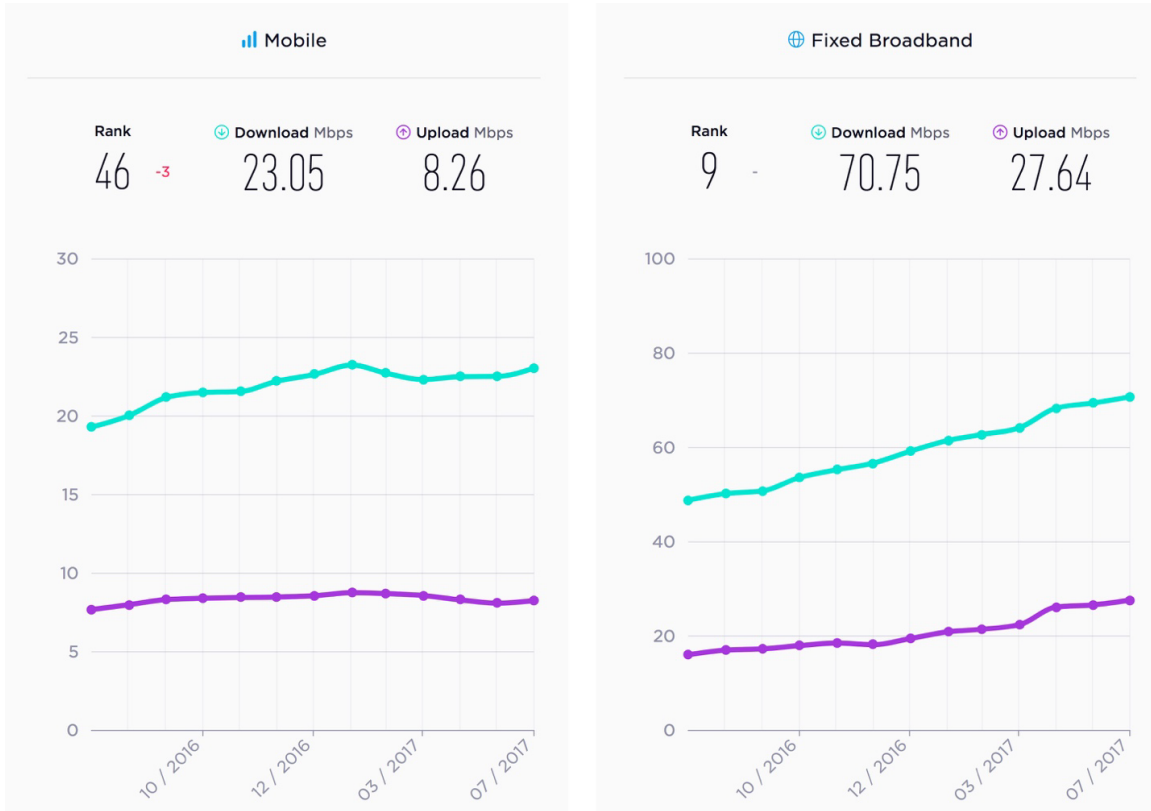


Figure 1 US broadband speeds 2016-2017. Source: Speedtest Global Index⁶

Perhaps the benchmark speed should combine download and upload with the apportionment left to the carrier. Thus, the Wheeler Standard would be 28 Mbps while the Ookla reality would be 31 Mbps.

The Wheeler Standard appears to reflect the requirement claimed by Netflix for its 4K video streams and not the broader innovation needs of America’s entrepreneurs and Internet users.⁷ The Netflix desire for 25 Mbps for a single application doesn’t reflect the reality of its service, however. The minimal benefits of 4K over true HD are fully

⁶ Ookla, “United States’s Mobile and Broadband Internet Speeds,” *Speedtest Global Index*, July 2017, <http://www.speedtest.net/global-index/united-states#fixed>.

⁷ Netflix, “Internet Connection Speed Recommendations,” *Help Center*, accessed September 22, 2017, <https://help.netflix.com/en/node/306>.

apparent at 15 – 20 Mbps and are completely non-existent without the High Dynamic Range feature (HDR 10 or Dolby Vision) absent from most 4K TV sets.⁸

2. Wireless networks have become America’s primary Internet connections.

Wireless networks have become America’s primary Internet connections. We move more data over wireless networks and spend more time using wireless devices than we do with legacy personal computers attached to wired networks.⁹ Consequently, the evaluation of broadband deployment should stress wireless over wired networks. Wired networks increasingly serve a single need: they enable us to use video streaming services without concern for exceeding data caps.¹⁰

This suggests that the frontier of advanced telecommunications is the deployment of high speed, uncapped wireless networks. In fact, the 5G networks currently being tested by several providers of networks and network equipment fill this bill. 5G networks offer high speeds. This is not only important because speed enables unknown new data-hungry applications. The primary and immediate benefit of speed on shared medium wireless networks is capacity: the ability of the network to carry large quantities of data. Increased capacity is the key to relaxing data caps and creating more broadband competition.¹¹

Consequently, the assessment of advanced network deployment must emphasize the 5G buildout over all other factors. 5G happens to be in a situation in which deregulatory

⁸ Steve Kindig, “What’s the Difference between HDR 10 and Dolby Vision?,” *Crutchfield*, accessed September 22, 2017, <https://www.crutchfield.com/I-rFBKcVSL/learn/whats-the-difference-between-hdr-10-and-dolby-vision.html>.

⁹ Cisco Systems, “The Zettabyte Era: Trends and Analysis,” *Cisco*, June 7, 2017, <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/vni-hyperconnectivity-wp.html>.

¹⁰ Cisco Systems, “Cisco Visual Networking Index: Forecast and Methodology, 2016–2021,” *Cisco*, September 15, 2017, <https://www.cisco.com/c/en/us/solutions/collateral/service-provider/visual-networking-index-vni/complete-white-paper-c11-481360.html>.

¹¹ William P. Rogerson, “THE ECONOMICS OF DATA CAPS AND FREE DATA SERVICES IN MOBILE BROADBAND August 17, 2016” (CTIA, 2016), <https://www.ctia.org/docs/default-source/default-document-library/081716-rogerson-free-data-white-paper.pdf>.

actions can reap major benefits. The buildout is threatened by antiquated permitting processes and potentially high fees for the use government-owned light poles and other street furniture.¹² States that wish to lead in 5G deployment are setting appropriate standards for municipalities that may harbor different goals. As Chairman Pai has said: “As networks evolve, our rules should too.”¹³

3. Wireline networks have a different role in the 5G era.

Wireline networks are still important, but they have a different role in the 5G era than they’ve had in the past. Just as Internet backbones have become feeder networks to CDNs across the Internet generally, wired networks at the Internet’s residential edge are becoming feeders to Wi-Fi access points and small 5G cells.¹⁴

In many locales, we need new fiber strands to support the new networks. Fiber is much less expensive to install than copper because it doesn’t pose the same concerns about safety, weather, and weight as copper. Consequently, it is wise to survey the extent to which permitting requirements and processes are up to date with the reality of optical fiber.

In particular, fiber can be installed in micro-trenches that are much narrower and shallower than traditional below-ground ducting. Codes that don’t permit micro-trenching should be examined and revised as needed.¹⁵

¹² Barry Umansky, “State Should Consider Small Cell Legislation,” *St. Cloud Times*, March 11, 2017, <http://www.sctimes.com/story/opinion/2017/03/11/state-should-consider-small-cell-legislation/98920476/>.

¹³ Jenna Ebersole, “FCC’s Infrastructure Votes Pave Way For Bold 5G Push,” *Law360*, April 21, 2017, <https://www.law360.com/articles/915851/fcc-s-infrastructure-votes-pave-way-for-bold-5g-push>.

¹⁴ Joon Ian Wong, “The Internet Has Been Quietly Rewired, and Video Is the Reason Why,” *Quartz*, October 5, 2016, <https://qz.com/742474/how-streaming-video-changed-the-shape-of-the-internet/>.

¹⁵ Kristen Mosbrucker, “Google Fiber Texas LLC Wants the City of San Antonio to Change Rules on Microtrenching,” *San Antonio Business Journal*, September 22, 2016, <https://www.bizjournals.com/sanantonio/news/2016/09/22/google-fiber-pitching-faster-way-to-lay-fiber-in.html>.

4. Comparing US states to nations yields a global top 10 list that is half American.

Global broadband surveys such as Akamai's State of the Internet and the Speedtest Global Index show that the states and cities in the US with the highest wired broadband speeds are as fast as the nations and foreign cities with the most advanced networks. Treating US states as if they were nations yields a top ten 10 list that is half American.¹⁶ Consequently, a US broadband policy that seeks to diffuse the broadband technology deployed in the cities and states with the best capabilities across the nation as a whole effectively brings the entire nation to the top rank of international capability.

The NOI proposes to measure "75 communities in at least 25 countries that have developed broadband markets, which have readily available data." This does not appear to be a very fruitful exercise. In the first place, it's doubtful that 25 comparable countries exist. The US is a very large nation with considerable sparsely-populated areas, a low rate of population in multiple-dwelling unit housing, and relatively low density cities. At 10,000 people per square km, New York is much less dense than Seoul, Hong Kong, Singapore, Paris, Athens, and Barcelona, for example.

Two of my international studies will be helpful to the FCC in understanding how to compare nations: *The Whole Picture: Where America's Broadband Networks Really Stand* (ITIF, 2013) and *G7 broadband dynamics: How policy affects broadband quality in powerhouse nations* (AEI, 2014).¹⁷

¹⁶ Richard Bennett, "Akamai State of the Internet: Q1 2016," *High Tech Forum*, June 30, 2016, <http://hightechforum.org/akamai-state-internet-q1-2016/>.

¹⁷ Richard Bennett, Luke A. Stewart, and Robert D. Atkinson, "The Whole Picture: Where America's Broadband Networks Really Stand" (Washington, DC: Information Technology and Innovation Foundation, February 12, 2013), <http://www.itif.org/publications/whole-picture-where-america-s-broadband-networks-really-stand>; Richard Bennett, "G7 Broadband Dynamics: How Policy Affects Broadband Quality In Powerhouse Nations" (Washington, D.C: American Enterprise Institute, November 2014), <http://www.aei.org/wp-content/uploads/2014/11/G7-Broadband-Dynamics-Final.pdf>.

One important takeaway from my G7 report is that the cost of providing broadband service depends primarily on two factors: 1) the average distance of customer premises equipment (CPE) from the carrier facility; and 2) the average distance of CPE from the nearest Internet Exchange Point.

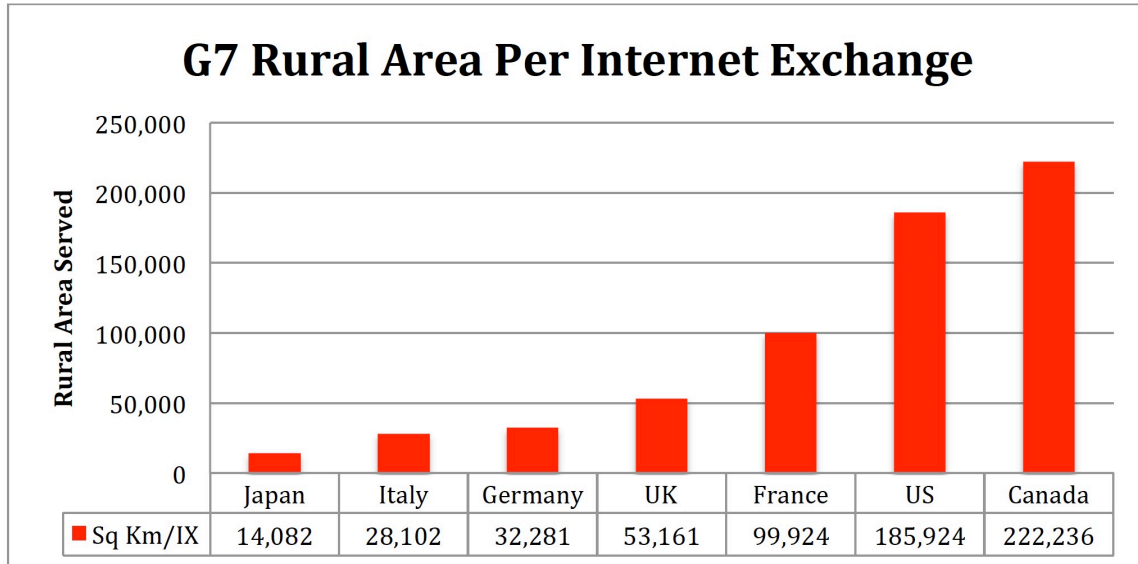


Figure 2 Rural Area Served by Each Internet Exchange Point in Nation or Nearby; Sources: Author's calculations from World Bank, The Little Green Data Book 2011; and Aemen Lodhi et al., "Using PeeringDB to Understand the Peering Ecosystem," ACM SIGCOMM Computer Communication Review (CCR) 44, no. 2 (April 2014): 21–27.

Nations with large amounts of land area per Internet Exchange are more heavily wired than those with small land area to cover. IXP density is thus a key metric for cost, reliability, and performance.

5. Wireless coverage maps are useful for estimating population coverage.

The FCC's current method of mapping broadband deployments to population uses the Form 477 survey of offerings by Census Blocks. This method is inherently inaccurate because Census Blocks aren't the same size (either geographically or by population) and

the presence of one provider offering service to one residence in the Block doesn't tell us much.¹⁸

It would be wise for the Commission to consider turning this system on its head and estimating population coverage from something like the coverage maps published by wireless carriers. This method would simply require the superimposition of coverage maps on population density maps. It should not be difficult for wired broadband providers to convert their data on coverage of units with political boundaries to the format used by wireless carriers.

Conclusion

In 2017, “advanced telecommunications capability” means 5G wireless networks. One way or another, the FCC’s 706(b) report should examine the rate of 5G deployment and the actions it can take to make the rollout as fast and painless as possible.

5G is going to make the edge networks of today – DSL, cable, FTTH and 4G – obsolete and irrelevant. Full deployment requires new chips, devices, and software. It also means permitting for small cell builds with backhaul to the legacy network.

And it means enriching the infrastructure for CDNs and providing QoE for 5G applications. Rather than spinning another round of the old networking battles over thresholds and “neutral networks” that don't do what we need, the FCC should focus on the things it can do to resolve regulatory obstacles to universal 5G.¹⁹

¹⁸ Richard Bennett, “American Broadband Policy: Information over Manipulation,” *High Tech Forum*, April 20, 2017, <http://hightechforum.org/american-broadband-policy-information-manipulation/>.

¹⁹ Richard Bennett, “Helping the FCC Get Broadband Right,” *High Tech Forum*, September 19, 2017, <http://hightechforum.org/helping-fcc-get-broadband-right/>.