IMPROVING THE NATION'S DIGITAL INFRASTRUCTURE

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Introduction

This paper aims to contribute to the ongoing discussion about a national-infrastructure plan by highlighting three points relevant to communications, namely:

1. *Improving the nation's digital infrastructure should be a significant part of any national-infrastructure plan, as the economic upside for the country from accelerating investment in broadband is likely greater than from most other areas of infrastructure investment.*

2. *The primary goal of federal actions with respect to digital infrastructure should be to increase and accelerate profitable, incremental, private-sector investment to achieve at least 98% nationwide deployment of future-proofed, fixed broadband networks.*

3. *The policy measures that can be used to achieve this goal are: (i) direct funding support to reduce the cost of capital; (ii) changes to the tax code to increase the return on invested capital, and (iii) operations-related actions that enhance the productivity of capex. A national-infrastructure plan should include initiatives in some, or all, of these categories.*

Each of these points is considered in more detail below.

1. Improving the nation's digital-infrastructure should be a significant part of any national-infrastructure plan, as the economic upside for the country from accelerating investment in broadband is likely greater than from most other areas of infrastructure investment.

Like other forms of infrastructure that were largely built out in the 20th century – such as transportation, energy, water and sewage – broadband is a foundation for economic activity across many sectors. But, unlike other potential infrastructure priorities, the public benefits of broadband could grow exponentially in the coming decades, as the nation is just beginning to realize the potential innovation and productivity gains from combining high-bandwidth, low-latency connectivity with massive sensor, computing, and storage capabilities in areas such as:

- *Industry verticals,* including transportation (e.g., autonomous vehicles including trucks, cars, drones), energy, healthcare, and manufacturing.
- *Consumer sectors*, including education and job training, disability access and empowerment, apps, entertainment, and augmented/virtual reality.

- *Government*, including efficient delivery of e-services, public safety, and smart cities.

Unlike most other types of infrastructure, the nation's digital infrastructure is largely corporate owned and generates revenues from paying subscribers. However, the private carriers who invest in broadband capex do not, in general, capture the full benefits of those investments (e.g., the positive externalities of the internet economy and the multipliers from increasing innovation and efficiency in adjacent sectors), so their investment levels are lower and slower than would be optimal for the country.[1] The public-policy challenge, therefore, is to increase largely *private* capital flows to levels consistent with the potential *public* benefits of abundant, ubiquitous broadband without crowding out existing private-sector investment.[2]

2. The primary goal of federal actions with respect to digital infrastructure should be to increase and accelerate profitable, incremental private-sector investment to achieve at least 98% nationwide deployment of future-proofed, fixed broadband networks.

As of December 2015, approximately 14% of the ~160m U.S. residential and small-and-medium business locations lack access to 25x3 Mbps-capable fiber-to-the-premise (FTTP) and/or cable service.[3] Achieving ubiquitous fixed-broadband deployment by providing incentives for companies to build out in these areas will have spillover benefits for U.S. leadership in 5G mobile broadband – e.g., because many of the same facilities can be used for high-capacity backhaul, particularly in rural areas that would otherwise lack widely-deployed fiber – as well as for stimulating the economy-wide innovation and productivity gains described above.

We estimate that the total upfront capex required to deploy FTTP to the 14% of locations lacking access would be ~$80b but, because of the shape of the cost curve, ~98% coverage could be attained for ~$40b (see *Figure 1*). Unlike the last 2%, moreover, we do not expect these first 12% of locations will require material ongoing support once the network has been built, as subscriber revenues should be sufficient to pay for ongoing network costs.[4]

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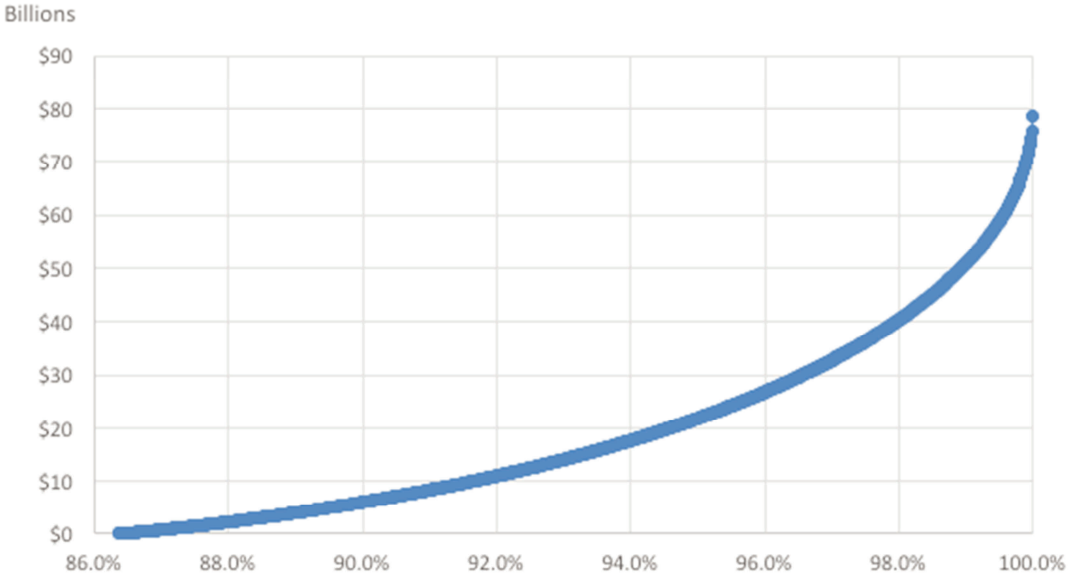
[1] As the focus of this paper is on infrastructure deployment (i.e., supply), it does not directly address competition, pricing, or adoption, which are critical components of a national broadband agenda.

[2] Though states and localities should be free to raise money for government-owned last-mile networks if they so choose (e.g., via general obligation bonds, revenue bonds, and/or tax increases) there are few examples of such initiatives being successful, and no evidence that such efforts will scale-up nationally in the face of the current industry structure in which almost all broadband infrastructure is privately designed, deployed, operated, and owned.

[3] Locations that currently have 25x3 Mbps-capable FTTP or cable likely have a commercial upgrade path to low-latency, gigabit (or faster) service, e.g., as DOCSIS 3.1 is rolled out.

[4] Taking the revenue and cost assumptions used in the Connect America Fund cost models ($52.50 average monthly revenue per location passed – equivalent to a 70% take rate of a $75 average-revenue package – and ongoing annual replacement/maintenance capex ≈ 3% of the initial investment). For the locations between 98% and 100%, however, there is not enough addressable revenue to cover ongoing costs, so – in addition to the initial capex – an annual subsidy of ~$2b would be required to keep the networks operating.

Figure 1: Estimated cumulative investment required to increase fixed broadband deployment from the current 86% to 100% of U.S. locations.



Source: www.fcc.gov/general/connect-america-fund-phase-ii-models (last visited January 16, 2017).

To stimulate infrastructure deployment to these unserved locations, public-policy measures should aim to increase the expected return on incremental investment in these areas relative to the cost of capital. Some potential ways to achieve this are discussed below.

3. The policy measures that can be used to achieve the goal of accelerating private-sector investment to achieve ubiquitous digital infrastructure for the nation are: (i) direct funding support to reduce the cost of capital; (ii) changes to the tax code to increase the return on invested capital, and (iii) operations-related actions to enhance the productivity of capex. A national-infrastructure plan should include initiatives in some, or all, of these categories.

There are three categories of policy measures that can increase and accelerate profitable, incremental private-sector investment in digital infrastructure by enhancing the expected return on incremental invested capital, namely:[5]

i. Direct funding support to reduce the cost of capital, while avoiding the crowding out of private funding.

As cash is fungible from the recipient's perspective, in principle there is little inherent difference between alternative direct-funding structures (e.g., grants, loans, loan guarantees).[6] The ideal approach would be legislation providing broad funding authority

[5] Not all the initiatives in this section are in the purview of the FCC – some would require Congressional, other federal agency, state, and/or municipal actions.
[6] From the government's perspective it is likely more efficient to subsidize capex directly rather than provide opex support in the hope that it will lead to increased capex.

with the flexibility to choose the public-financing structure that would maximize the leverage from private sources given the capital-market environment at the time of allocation. This flexibility would be easier to institutionalize in some form of infrastructure bank[7] rather than in a dedicated program such as BTOP/BIP or USF.[8]

To avoid displacement of existing capex, recipients of public support could be required to both certify (subject to audit) that projects undertaken with government funding would not have been executed under existing business plans and also contribute matching funds (e.g., ≥ 20% of total eligible project costs).

Once the direct funding structure has been decided the three main aspects of a digital infrastructure plan are:

- *Defining the objective of the effort*: For example, the primary objective could be to provide one-time funding for capex to build FTTP to currently unserved locations or for fiber deployment in areas where it will have the most effect in accelerating the roll out of small-cell coverage for mobile 5G.[9]
- *Allocating the funds*: Funding should be allocated as objectively as possible to qualified recipients, potentially via reverse auctions at a national/regional level to the eligible provider who is willing to meet the service requirements at the lowest cost.
- *Oversight of funding recipients*: To ensure that recipients are meeting their commitments on an ongoing basis, an independent third party with the requisite capabilities (e.g., an auditing/accounting firm) should be selected through an RFP and given oversight responsibility.

To help realize the benefits of the multiplier effect in other sectors from abundant, ubiquitous broadband, it could also make sense to set up separate financing pool(s) for deployment that explicitly enable communications-based innovation in industrial, consumer, and government applications. For example, a small percentage of existing government funding (e.g., DOT, FAA, and/or state/city) could be explicitly allocated to support infrastructure for 5G wireless connectivity along roads to facilitate autonomous vehicles;[10] for anchor institutions to enable education, government, and healthcare

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[7] For a review of alternative infrastructure-bank structures based on proposals introduced in the 114th Congress see "How a National Infrastructure Bank Might Work," Congressional Research Service Insight (September 15, 2016) available at https://fas.org/sgp/crs/misc/IN10572.pdf (last visited January 16, 2017).

[8] Note that many recipients of USF have significant amounts of debt and so effectively add leverage to the public funding, but likely not in the most efficient way given the pools of capital to which they have access (e.g., requiring high dividend yields).

[9] Estimates of the cost of ubiquitous 5G coverage under different supply and demand assumptions can be found, for example, at: www.costquest.com/blog/news-and-events/post/the-5g-mobile-ubiquity-price-tag (last visited January 16, 2017).

[10] This should include sensors, as the resulting massive datasets generated on traffic flows – by being open for any third party to analyze (rather than being the proprietary property of the connectivity provider) – would create a virtuous circle for vehicle/application innovation.

applications; and for "Smart Cities," expanding current initiatives[11] to help local communities tackle challenges such as reducing traffic congestion, fighting crime, fostering economic growth, and improving the delivery of city services. The expertise of the FCC and NTIA could be made available to assist with project selection and execution.

ii. Tax-related initiatives to increase the return on invested capital.

Changing the way in which digital infrastructure investments are treated under the tax code would increase potential returns and hence stimulate investment. Areas that should be considered include:

- *Clarifying and accelerating depreciation schedules for broadband-related capex*, e.g., on fiber and fiber-related equipment.
- *Targeting tax credits for broadband-related investments*, e.g., by type of investment and/or geography.
- *Ensuring that direct funding to stimulate capex is treated as a contribution to capital under Section 118 of the Internal Revenue Code* rather than as taxable income.

As recently suggested by Ross & Navarro,[12] the cost of tax credits to encourage infrastructure deployment could be offset against a repatriation tax on overseas retained earnings.

iii. Operations-related initiatives to enhance the productivity of capex.

Numerous initiatives could be taken to help remove barriers to the efficient deployment of digital infrastructure, including:

- *Streamlining siting approvals*, e.g., for federal, municipal, and tribal properties. As an example, towers that already have at least one antenna could be deemed to have complied with NEPA/NHPA requirements for additional collocations.
- *Reducing local pre-deployment barriers to reduce deployment costs and delays*, e.g., with respect to rights-of-way, dig once, pole-attachment rates, and one-touch make ready.
- *Promoting shared facilities*, for example via municipal-driven incentives to share wireless equipment and fiber facilities.
- *Improving access to information*, e.g., about the location of fiber and rights-of-way access facilities and the procedures, timing, and point of contact for any required governmental reviews.
- *Smart buying by government*, e.g., facilitating commercial deployment in areas that can be served using network builds organized around public anchor institutions.

[11] www.whitehouse.gov/the-press-office/2015/09/14/fact-sheet-administration-announces-new-smart-cities-initiative-help (last visited January 16, 2017).
[12] See http://peternavarro.com/sitebuildercontent/sitebuilderfiles/infrastructurereport.pdf (last visited January 16, 2017).

- *Establishing more effective build-out conditions*, so that spectrum assets are put to productive use and redlining is prevented.
- *Improving inter-agency processes and cooperation* targeted at realizing benefits from incorporating broadband in other areas of the economy – industrial, consumer, government – for example via closer coordination between the FCC and DOT to accelerate the deployment of mobile coverage along roads.

The FCC can undertake many of these initiatives without any change in law – for example, the Commission's Wireless Telecommunications Bureau recently sought comment on how federal law applies to local government review of wireless facility siting applications and local requirements for gaining access to rights of way.[13]

Congress may wish to consider additional initiatives to remove barriers to broadband deployment. The Appendix to this paper contains several areas for potential legislative action.

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[13] See *Comments Sought on Mobilitie, LLC Petition for Declaratory Ruling and Possible Ways to Streamline Deployment Of Small Cell Infrastructure*, Public Notice, DA 16-1427 (Wireline Tel. Bur. December 22, 2016), available at: www.fcc.gov/document/fcc-seeks-comment-mobilitie-petition-small-cell-deployment (last visited January 16, 2017).

APPENDIX: POTENTIAL LEGISLATIVE PROPOSALS TO PROMOTE WIRELESS INFRASTRUCTURE

1. "Deemed Granted" Remedy for Local Reviews not Completed Within a Reasonable Period of Time.

47 U.S.C. §332(c)(7)(B) requires State and local governments to act on wireless-infrastructure-deployment applications "within a reasonable period of time," and the FCC has established that, as a general matter, the maximum "reasonable" amounts of time for action are 90 days for collocation applications and 150 days for applications involving facilities other than collocations.

In large part because the statute specifies a judicial remedy for anyone "adversely affected by any final action or failure to act by a State or local government," the FCC has not adopted a "deemed granted" remedy for failure to act within a reasonable time. The siting proponent therefore has the burden of obtaining a judicial ruling. Shifting that burden to the tower opponent would promote certainty and expeditious resolutions.

Proposed legislative approach: *Amend Section 332(c)(7)(B)(v) to remove the judicial remedy as the avenue for relief, replacing it with an express "deemed granted" remedy together with a provision allowing any party opposed to the "deemed granted" to seek judicial relief.*

2. Touch Once Make-Ready/Climb Once/Dig Once.

Broadband-infrastructure deployment projects often entail significant excavation and construction, and multiple parties may undertake construction in the same place at different times. One-touch make ready policies (sometimes referred to as "climb once" or "dig once") try to avoid delay and redundancy by having all make-ready work (such as rearranging several existing attachments) performed at the same time by a single crew.

Proposed legislative approach: *Support one-touch legislation that has previously been introduced.*

3. Exempting Small Cell Deployments from Historic and Environmental Review.

Small-cell and DAS antennas are much smaller and less obtrusive than traditional macro-cell deployments. For that reason, the FCC has already taken steps to streamline the historic and environmental review of such antennas, and to exclude some from review altogether, but is limited in what it can do without agreement from the Advisory Council on Historic Preservation.

Proposed legislative approach: *Exclude from the historic and environmental review processes all collocations on existing structures that meet a size threshold, or are minimally visible from public spaces*.

4. Municipally-Owned Poles.

Section 224 of the Communications Act requires investor-owned utilities to provide telecom carriers and cable systems with access to poles, ducts, conduits, and rights of way, but municipally and coop-owned poles are not subject to those requirements.

Proposed legislative approach: *Remove the exemption for municipal and coop-owned facilities*.

5. Pole-Attachment Fees.

Having different statutory rate formulas for pole attachments by cable systems and telecom carriers has led to many issues over the years. The FCC has acted to harmonize the two formulas, but litigation on this matter is ongoing. Eliminating the disparity in the statute would eliminate any dispute over how to calculate attachment fees.

Proposed legislative approach: *Amend Section 224 to eliminate the telecom rate (Section 224(e)) and make the cable rate (Section 224(d)) applicable to all pole attachments.*