

October 11, 2016  
National Telecommunications and Information Administration  
U.S. Department of Commerce  
1401 Constitution Avenue NW, Room 4887  
Washington, DC 20230  
Attn: National Broadband Research Agenda

The Information Technology and Innovation Foundation<sup>1</sup> appreciates this opportunity to comment on a National Broadband Research Agenda to be developed by the National Telecommunications and Information Administration (NTIA) and the National Science Foundation (NSF).<sup>2</sup> Below we offer some high-level guiding principles for broadband research to help shape the coming research agenda, as well as more specific answers to question posed by the NTIA and NSF in the request for comments.

## **INTRODUCTION AND OVERARCHING GOALS**

ITIF has long supported policies that would see continued investment and expansion of our nation's broadband infrastructure. Ensuring that our society fully benefits from the information technology revolution means policymakers must devote the same, if not higher, level of attention to it than they give to more conventional economic policy areas. Broadband networks are the tendrils of information technology—robust and evolving broadband networks are critical to delivering the dividends of productivity growth through information technology.

As a general matter, ITIF encourages all policymakers to craft and execute national broadband plans; ensure that tax policies allow providers to depreciate network investments quickly; subsidize build-out to high-cost areas; ensure adequate spectrum availability while using spectrum auctions as a way to allocate a scarce resource, rather than as a way to raise revenues; and provide flexible pole attachment and tower siting policies.

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<sup>1</sup> The Information Technology and Innovation Foundation (ITIF) is a nonpartisan research and educational institute—a think tank—whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring prosperity, ITIF focuses on innovation, productivity, and digital economy issues.

<sup>2</sup> Department of Commerce & National Science Foundation, *Request for Comments on “National Broadband Research Agenda,”* Docket No. 160831803–6803–01, RIN 0660–XC031, Rel. Sept. 9, 2016, *available at* [http://www.ntia.doc.gov/files/ntia/publications/fr\\_rfc\\_national\\_broadband\\_research\\_agenda\\_09092016\\_2.pdf](http://www.ntia.doc.gov/files/ntia/publications/fr_rfc_national_broadband_research_agenda_09092016_2.pdf).

We also support facilitating broadband adoption by providing subsidies for computers and connectivity in schools and low-income households.<sup>3</sup>

For these reasons, we support the goals articulated in the March Presidential Memorandum establishing the Broadband Opportunity Council (BOC), and the general thrust of the report produced by the council.<sup>4</sup> The federal government should identify and address regulatory barriers that may unduly impede wired and wireless broadband deployment and investment as well as promote the adoption of broadband technology. But beyond more immediately achievable policy goals articulated by the BOC, a long-term research agenda is key to identifying opportunities for improved use of resources, developing breakthrough technology, and formulating effective policy.

ITIF research has repeatedly shown that the general approach to broadband policy in the United States—light-touch regulation of intermodal competition—is working well.<sup>5</sup> The fact that our broadband industry has achieved competitive speeds with other wealthy countries while also maintaining low entry-level pricing is remarkable considering the hurdles U.S. broadband providers face with sprawling suburbs, rural states, relatively low levels of computer ownership, and relatively high rates of poverty.<sup>6</sup> This is no reason to rest on our laurels; development and deployment of connectivity technologies requires constant effort. Developing an agenda for the next generation of technology and policy-guiding research is an important, long-term endeavor. We commend the administration for this inquiry.

## **BROADBAND TECHNOLOGY**

*1. What are the critical data and research needs in the areas of broadband technology and innovation? 2. What specific technology research proposals, and associated methodologies, should be prioritized to support the advancement of broadband technology? And why?*

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<sup>3</sup> For a general guide to spurring information and communications technology (ICT) adoption, see Robert D. Atkinson & Ben Miller, “A Policymaker’s Guide to Spurring ICT Adoption” (June, 2015), <http://www2.itif.org/2015-policy-maker-ict-adoption.pdf>.

<sup>4</sup> The White House, Presidential Memorandum, *Expanding Broadband Deployment and Adoption by Addressing Regulatory Barriers and Encouraging Investment and Training* (Mar. 23, 2015), available at <https://www.whitehouse.gov/the-press-office/2015/03/23/presidential-memorandum-expanding-broadband-deployment-and-adoption-addr>.

<sup>5</sup> See Richard Bennett, Luke A. Stewart, & Robert D. Atkinson, “The Whole Picture: Where America’s Broadband Networks Really Stand” (Feb. 12, 2013), <http://www.itif.org/publications/2013/02/12/whole-picture-where-america%E2%80%99s-broadband-networks-really-stand>.

<sup>6</sup> See *The Whole Picture*, *supra* note 5.

The federal government serves an important role in supporting basic research that fuels technological innovation. Broadband access technology is still evolving at a rapid pace. The government's role is not one of simply providing monetary support for deployment of existing technology, but of supporting a constant, dynamic unfolding of innovation.

As we gradually move into the 5G era, and the technologies that will undergird the next generation of mobile communication become concrete, examples of academic and government-supported research come to mind: the work of NYU Wireless in modeling millimeter wave spectrum, and proving out the feasibility of using these bands for mobile connectivity. Similarly, much of the early work around software defined networking came out of academic institutions like Berkeley and Stanford. NSF grants will continue to play an important role in fueling academic research that can be transferred into industry to be put to wider use.

Communications technology intersects with a wide array of research areas—NSF should continue to fund a diversity of basic research areas in mathematics and engineering.

Government-supported research should generally focus on high-risk projects that are costly to develop and do not have immediate avenues to monetization. This type of early stage research can be too risky or have too long a time-horizon for industry to undertake, but is needed to fuel continued innovation. That said, telecommunications is rife with technologies that would provide tremendous capacity at low cost—in theory. Several technologies, even ones well proven in the lab, face challenges when faced with a realistic deployment in the wild. For example, massive-multiple input, multiple output (MIMO) and distributed MIMO antenna systems, now popularly discussed as components of next-generation wireless networks, have long documented successes in research settings. But put an antenna array outside the lab, and wind, clutter, and other environmental effects, and the math becomes much more difficult. This to say, federal funding should not shy away from practical, goal-directed research either.

## **BROADBAND ACCESS AND ADOPTION**

*4. What are the critical data and research needs in the areas of broadband deployment and access? 5. What specific research proposals, and associated methodologies, regarding broadband access should be prioritized? And why?*

A rigorous analysis of the costs and economic benefits of different levels of broadband access would be tremendously valuable. There has been a recent push, even beyond America's borders, for so-called "gigabit" networks. There is certainly something to be said for bandwidth abundance, but to date the definition of an "abundance" has been based more on slogans ("gigabit now"), than analysis.

To help understand to what extent greater network capacity is actually needed, and the level of investment (of actual capital or the political variety) required to achieve that capacity, continued assessment of the level of broadband network speed that is reasonably necessary to see measurable productivity gains would be helpful. Having realistic expectations of the bandwidth requirements of applications that will drive demand for future networks is key to focusing policy objectives. In other words, given the applications and usage patterns expected to emerge in the next decade, what speeds are required?

Access network speed continues to be the primary metric by which we measure broadband performance, but in reality a whole host of different variables affect the experience, most notably latency and jitter. Understanding the importance other variables play in driving productivity through broadband would help prioritize speed versus other metrics in setting policy and identifying any bottlenecks in providing broadband that drives economic growth.

*6. What are specific areas for federally-supported research as related to key market trends that impact broadband deployment, including business models, public-private partnerships, sustainability drivers, the removal of regulatory barriers?*

Much of recent broadband policy has focused on opportunities for local municipalities to lower the cost of deploying broadband infrastructure by private parties. Google Fiber and Gig.U led the charge in developing a new paradigm of a more cooperative relationship between municipalities and private companies deploying or upgrading broadband facilities. These approaches rely on private investment and ownership of facilities, but companies work closely with city officials to streamline the deployment as much as possible.

There are many cost reduction methods that have been identified by a variety of actors. NTIA itself has produced a number of checklists and planning guides for effective public-private partnerships.<sup>7</sup> Google Fiber has its “Fiber Ready Checklist,” which outlines steps for cities to ease fiber deployment, with the general goal of providing information about existing infrastructure, ensuring access to infrastructure, and making construction quick and predictable.<sup>8</sup>

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<sup>7</sup> See, e.g., National Telecommunications and Information Administration, “Broadband USA: An Introduction to Effective Public-private Partnerships for Broadband Investments, (Jan. 2015) [http://www.ntia.doc.gov/files/ntia/publications/ntia\\_ppp\\_010515.pdf](http://www.ntia.doc.gov/files/ntia/publications/ntia_ppp_010515.pdf).

<sup>8</sup> Google Fiber, “Google Fiber City Checklist,” 2014, <https://fiber.storage.googleapis.com/legal/googlefibercitychecklist2-24-14.pdf>.

It is important to distinguish these collaborative cost-reduction strategies from municipal broadband, where local government takes a more prominent role. As a general matter, policymakers should be skeptical of the broader push towards local ownership of broadband infrastructure; municipal broadband in areas with existing networks are inefficient overbuilds that impose negative externalities outside their footprint and do not invest in innovation.<sup>9</sup> In areas that are legitimately unserved, of course the benefits of broadband access justify public involvement. In those cases, it is best for local governments to focus only on the lower layers of the Internet stack and provide dark fiber, addressing the largest sunk costs while leaving the fast-changing electronics to nimbler firms. Here research into the effect of additional facilities-based competitors on the time horizon over which investments in upgrading existing networks are recouped would be informative.

But the continuing identification of public-private collaborative tools, designed to clear red tape and ease the challenges of network deployment or upgrade, are an important policy development. Research that models this style of network deployment with an eye to measuring effectiveness of various cost-reduction efforts would be tremendously informative for policymakers. A sensitivity analysis on the variety of levers local government can pull to help spur wireless and wired network buildout would be of great value to identify and prioritize policy objectives. In addition, it would be valuable for the federal government to collect data regarding the extent to which counties and municipalities proactively support broadband deployment, along the lines of the checklists discussed above.

*7. What are the critical data and research needs in the areas of broadband adoption and utilization? 8. What specific research proposals, and associated methodologies, regarding broadband adoption and utilization should be prioritized? And why?*

The vast majority of U.S. citizens have access to multiple broadband networks, and yet the Pew Research Center measures only around 67 percent of adults subscribe to broadband at home—down from a peak of 70 percent in 2013.<sup>10</sup> Given the tremendous positive externalities of having a society that can reliably conduct basic affairs over digital networks rather than paper, Internet adoption should be the key policy question of the day. Research to understand adoption trends and impediments should be prioritized. Most of the existing research on this topic relies on survey research, which only provides broad and high-level reasons for non-

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<sup>9</sup> See Doug Brake, “Comments of ITIF in the Matter of Petitions of Electric Power Board and City of Wilson WCB Docket No. 14-115, 14-116” (August 2014), *available at* <http://www2.itif.org/2014-municipal-broadband-comments.pdf>.

<sup>10</sup> John B. Horrigan & Maeve Duggan, “Home Broadband 2015,” Pew Research Center Internet, Science & Tech (Dec. 2015), <http://www.pewinternet.org/2015/12/21/home-broadband-2015/>.

adoption (e.g., lack of interest, price, etc.) But what are the real, deeper reasons why almost one-third of Americans do not subscribe to broadband? What are the best intervention strategies to boost adoption?

In the same study cited above, Pew found a slight trend away from fixed broadband connections in the home towards mobile access. Beyond use of broadband in the abstract, the applications used are of key importance if we are to achieve welfare-enhancing outcomes. Understanding how different access technologies, such as mobile form factors, impact usage trends and productivity, would be useful. Is smart phone or tablet access an effective substitute for desktop or laptop broadband access, especially for tasks such as doing homework? Along similar lines, identifying key applications that rely on Internet connectivity to promote, such as the Internet of Things, should be an ongoing effort.

## **CONCLUSION**

NSF and NTIA should continue to provide the important research and grant support for basic research. Beyond that, research should look to inform policymakers with rigorous analysis on key policy questions. Providing the policy debate with a more realistic understanding of the costs involved in deploying networks of different characteristics, the performance needs of next-generation applications, and effectiveness of a variety of local cost-cutting tools would be a useful foundation to inform the next administration on how to prioritize policy efforts.

Sincerely,

Doug Brake

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