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The National Broadband Map:

A Case Study on
Open Innovation
for National Policy

by **Zachary Bastian**,
Woodrow Wilson Center
and **Michael Byrne**, Federal
Communications Commission

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FOR NATIONAL POLICY

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Foreword

Three years ago, Interim Federal Communications Commission (FCC) Chair Michael Copps asked me to return to the FCC to help develop the National Broadband Plan. Congress had mandated that the Commission write a plan to analyze policy options for extending the benefits of broadband to all parts, and all residents, of the United States.

We completed the task about 9 months later. It was an enormous undertaking made possible by the contributions of more than 300 people and a number of agencies, companies, and nonprofit organizations that provided policy insight and massive amounts of data. The intention was to lay out—particularly for the stakeholders—an agenda for action. It detailed policy targets to aim for—in the sense of policies to adopt, examine, and replace with better alternatives, if appropriate. A clear agenda, with specific policy targets, sets the stage for a better policy debate. Every successful enterprise operates pursuant to a plan. As we said many times in the throes of internal debates, “Plan beats no plan.”

I am enormously proud of the work that the team—hundreds of FCC staffers

(including one of the authors) working 80-hour weeks (including a day in which a blizzard shut down the rest of Washington, D.C.)—accomplished. The process of developing the Plan was the largest, most exhaustive, and most participatory process in FCC history. We held more than 30 workshops and issued 31 public notices inviting input on specific questions with which we were grappling. This input produced a vision and a set of policy options that today shape every communications debate in the United States.

We were not perfect, but there were a few things we did very well. One was the real—almost compulsive—effort to gather and analyze data. Much of the debate in communications up until this time had not been based in actual data, and we aimed for and succeeded in making data-driven recommendations and igniting an ongoing thirst for more data. The September 2009 meeting of the FCC—in which the Plan team presented data to the Commissioners for 4 hours, often bursting bubbles in certain strongly held beliefs—set records for delivering data that, sadly, may never be broken.

The National Broadband Map is a codification of the desire to drive policy with data rather than spin. The National Telecommunications and Information Administration, in collaboration with the FCC and in partnership with 50 states, five territories, and the District of Columbia accomplished a feat of policy innovation in service of that goal. In the short time that the Map has been available, it has informed policy and shaped the national understanding of our communications future. With this unprecedented tool and the collaboration, innovation, and vision underlying it, we begin to insure communications policy against another “Dark Age” where data are an afterthought.

The team that built the Broadband Map, like the team that wrote the Broadband Plan, can be proud. Both teams were motivated by the true spirit of public service and acted with energy and intelligence. They provided a gift to the nation that has already paid enormous dividends and will continue to do so in

the future. However, while plan beats no plan and data beat belief, it is still up to policymakers, in a constant dialogue with citizens, to set the vision for our future progress. The Map is an essential tool that can guide us, but like our iconic American pioneers, we need courage and leadership to build our shining city on the hill.

Blair Levin
Communications & Society Fellow,
Aspen Institute
Executive Director, Gig.U: The University
Community Next Generation Innovation
Project

Executive Summary

In the Broadband Data Improvement Act of 2008, Congress directed the National Telecommunications and Information Administration (NTIA) to produce an interactive and searchable map detailing broadband availability nationwide. This mandate was part of a comprehensive effort toward utilizing broadband to drive economic growth and improve social welfare. The American Recovery and Reinvestment Act of 2009 and the National Broadband Plan, proposed in 2010, were also part of this effort. The former authorized funding to provide focused broadband investments to reinvigorate an economy that had faced numerous challenges. The latter identified broadband as a vital ingredient in lasting infrastructure improvement. Through these actions, Congress clearly recognized that Internet connectivity has become a vital part of our society for all members. To ensure that no one is left behind, it is necessary to pinpoint the gaps in Internet availability across the United States and to identify priorities for action.

The National Broadband Map, the first step toward achieving these goals, was developed in an innovative way. Agencies face numerous regulatory burdens, and those that spearheaded the project, the NTIA and the Federal Communications Commission (FCC), are no exception. However, the National Broadband Map was up and running in a relatively short period of time, and it has already had a tangible impact on policy. This is due to a series of deliberate decisions by the team that built the National Broadband Map.

The project team utilized a diverse set of “open innovation” inputs. They incorporated data from numerous sources and encouraged citizen input and feedback in multiple ways and on a national scale. They built the Map by transparent means with the use of open-source software. The building blocks are freely available software programs, not proprietary products chained off by licensing fees. Breaking away from the traditional way in which government software is developed, the team took cues from the private sector’s operations. This method prioritized regular communication with programmers, allowing the

agency to have a better understanding of the process as it happens—a remarkable break from the traditional method of government procurement. This novel approach also tapped into the enormous power of Geographic Information Systems, shifting away from dry, tabular representations of data toward dynamic visualizations of community needs. This groundbreaking project has already influenced congressional budget appropriations through the Connect America Fund, now offering grants to communities that lack robust high-speed broadband service.

Different agencies have different priorities, and it will not be possible simply to apply this approach to other problems across the government. But the NTIA and the FCC were saddled with a large goal and given a small window of time in which to achieve it. They succeeded because of their creative approach, which included the development of innovative methods to overcome procedural hurdles, such as those outlined in the Paperwork Reduction Act. Other agencies with big goals, limited resources, and similar administrative challenges can examine this case study and, it is hoped, see lessons worth applying.

Introduction

One of the challenges of government is maintaining a sense of realism without becoming too cynical. The most experienced policy-makers can be the most skeptical at the possibility of real change. Although legislation can point in the right direction, true progress requires a shift in organizational culture. It is impossible to create

the government required for the 21st century while maintaining the infrastructure and procedures of the 20th century.

Government relies on the stability and predictability of the bureaucracy, but more and more voices are eager to improve processes and outcomes. The Federal Communications Commission

Figure 1. The National Broadband Map's Entry Website

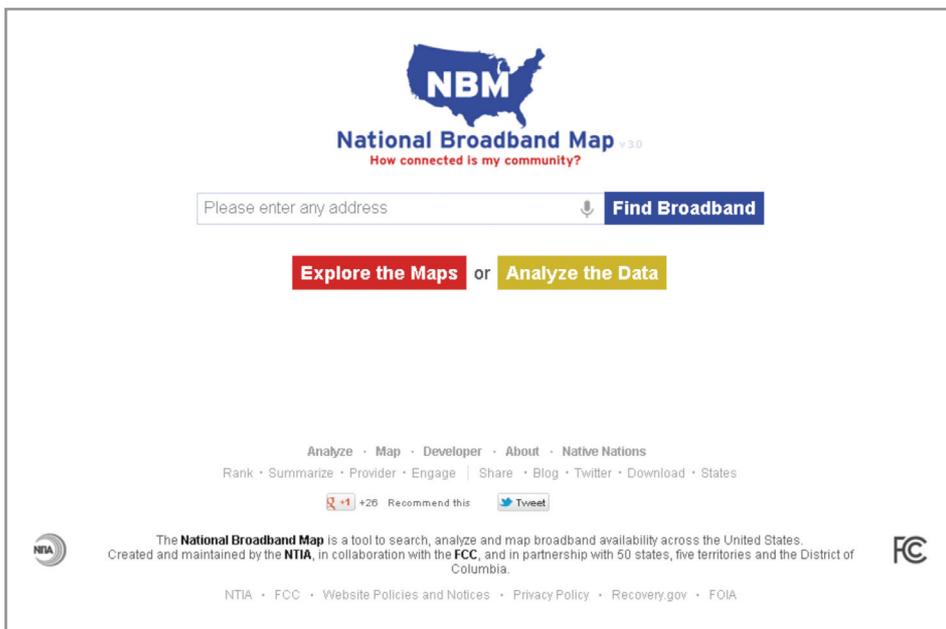
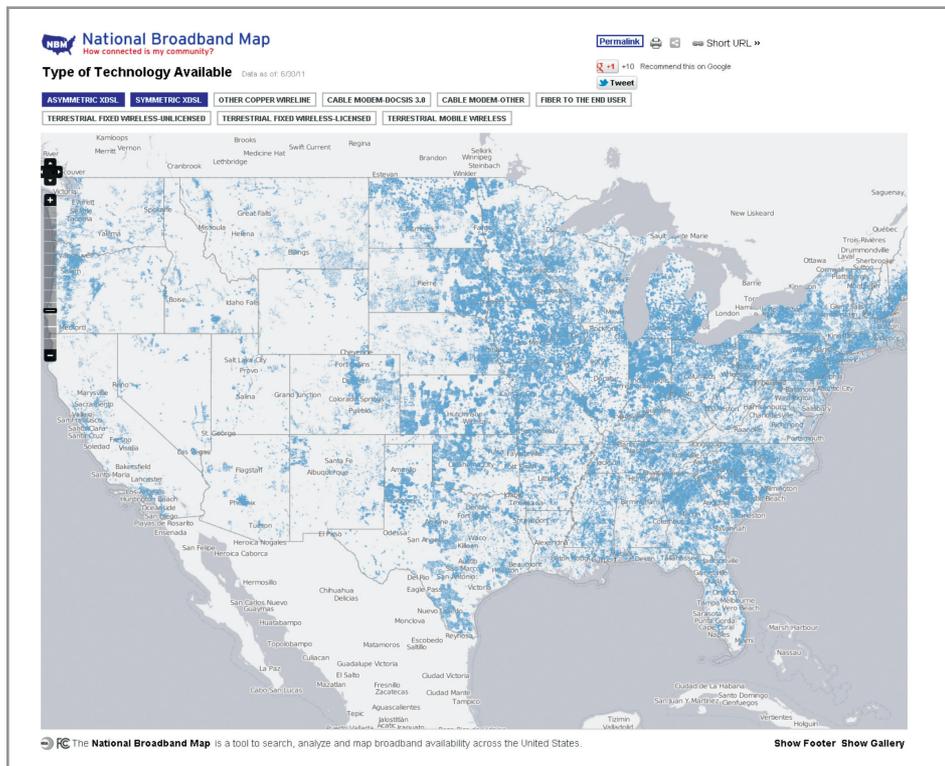
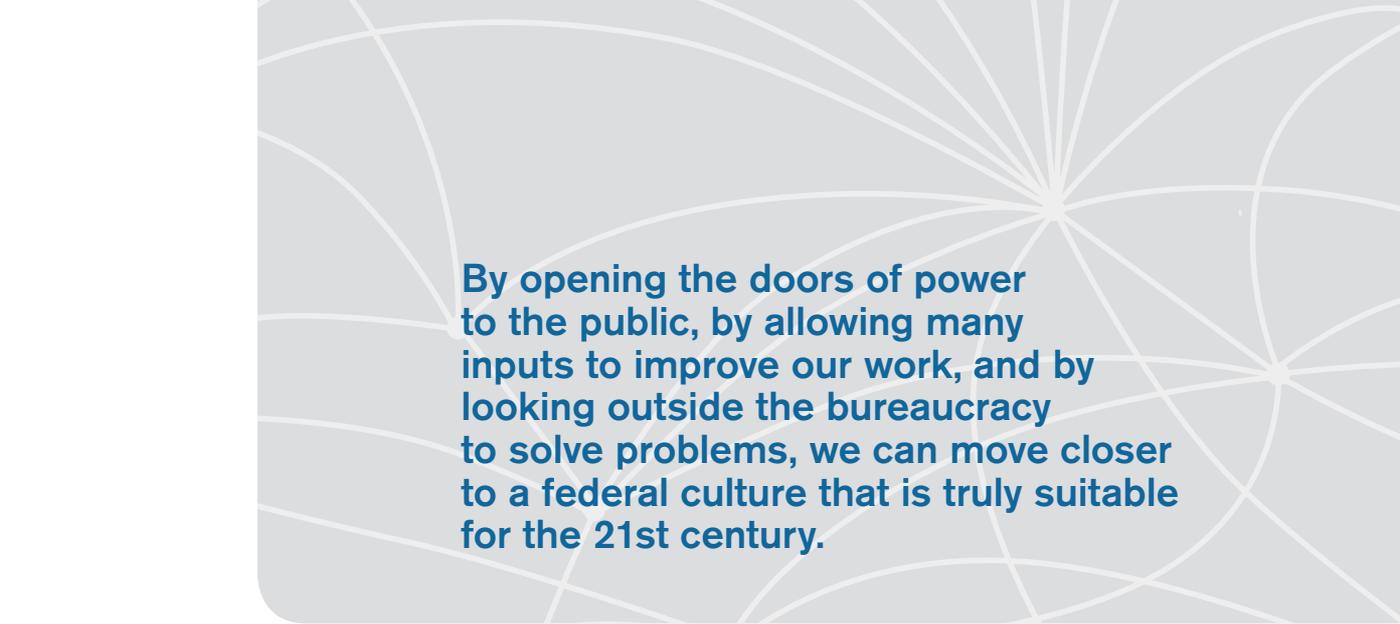


Figure 2. An example of the National Broadband Map, displaying broadband technology options



(FCC) has adopted three approaches to establish an agency culture of innovation and modernization. First, the Obama Administration's Open Government Initiative aims to decode the byzantine nature of policy for citizens by increasing transparency while maintaining security. Second, crowdsourcing¹ engages citizens, combining official intelligence with a web of inputs from the public at large on the principle that the higher volume of data, with context and interpretation, can improve outcomes. Third, by incorporating proven successful methods from the private sector, the federal government can gain efficiencies at a time when resources are spread thin.

The National Broadband Map stands as a vibrant example of what can result when these ideas move from consideration into reality (figures 1 and 2). The Map displays comprehensive statistics about Internet download and upload speeds in an interactive, transparent, and accessible manner. Conceptualized in the National Broadband Plan² and the Broadband Data Improvement Act (BDIA),³ it was built using diverse citizen inputs, but took its methods of construction from the private sector. The American Recovery and Reinvestment Act of 2009 (ARRA) authorized participants nationwide to collect detailed data,⁴ a massive cooperative undertaking that was spearheaded by the National Telecommunications and Information



By opening the doors of power to the public, by allowing many inputs to improve our work, and by looking outside the bureaucracy to solve problems, we can move closer to a federal culture that is truly suitable for the 21st century.

Administration (NTIA) and the FCC. The project required intergovernmental collaboration and cooperation that would have been impossible with the stereotypical government agency culture of fiefdom and control. It applied lessons from the business community.

Agencies interested in modernizing their processes can look to this example and see that reform, while difficult, is possible. The developmental process used for the National Broadband Map does not offer a foolproof blueprint for national policy. Government faces different issues at different levels, and there are no one-size-fits-all solutions. However, the intellectual approach guiding this project provides a valuable lesson applicable anywhere. The method by which numerous procedural hurdles, such as the Paperwork Reduction Act, were overcome demonstrates that there is room to incorporate

new, technology-driven methodologies into the achievement of government's goals. Our nation faces numerous challenges, and our ability to rise to meet them will depend on our capacity to engineer creative solutions. By opening the doors of power to the public, by allowing many inputs to improve our work, and by looking outside the bureaucracy to solve problems, we can move closer to a federal culture that is truly suitable for the 21st century.

The development of the National Broadband Map indicates a drive to modernize federal government through collaboration, transparency, citizen engagement, crowdsourcing, and best practices driven by the private sector. The project is one step in the wider push for organizational culture change and modernization, as government at all levels seeks increased efficiency and effectiveness through technology.

Purpose of the National Broadband Plan

1

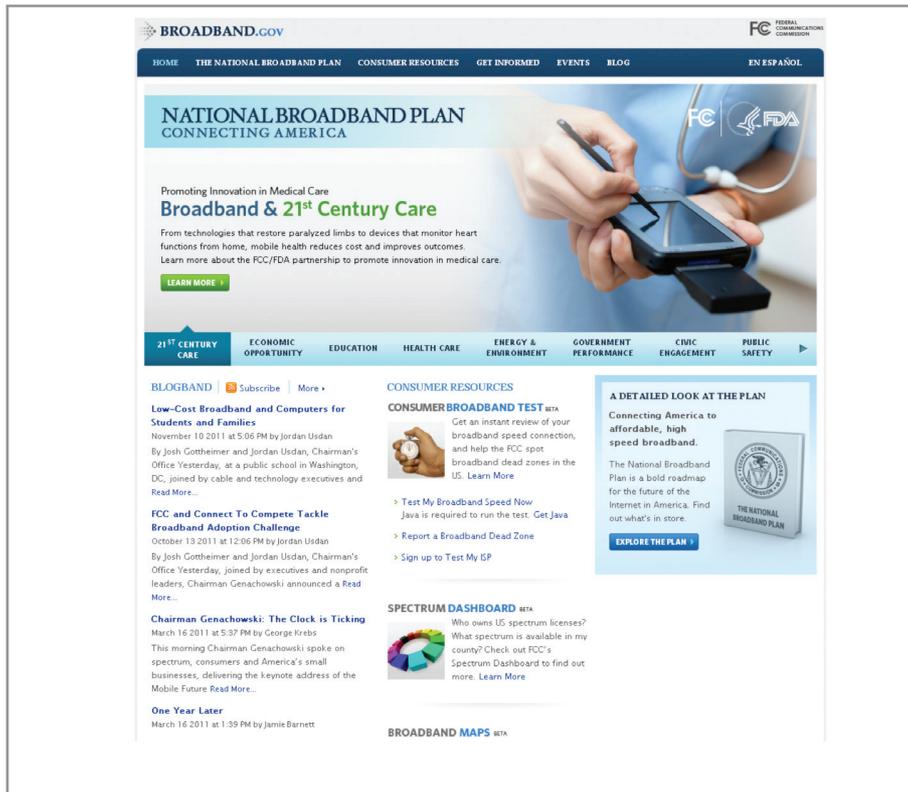
Broadband has fundamentally altered education, health care, energy management, public safety, government engagement, and the manner in which we access, organize, and disseminate knowledge. In 2009, Congress directed the FCC to produce the National Broadband Plan to enhance American competitiveness through broadband, enabling entrepreneurship, job creation, and general economic growth.⁵ Published on March 16, 2010, the FCC's National Broadband Plan identifies the creation of durable, widespread, and easily accessible high-speed Internet connectivity as the early 21st century's great infrastructural challenge (figure 3).⁶ It declares that "broadband is a foundation for economic growth, job creation, global competitiveness and a better way of life."⁷

The Plan details the modern economy's escalating dependence on strong Internet connectivity. Within the home, broadband use has grown exponentially: from 1 hour a month in 1995 to 15 hours in 2000 to almost 29 hours

at publication.⁸ As use increases and applications become more bandwidth-intensive, the total data consumption has grown approximately 30 percent per fixed residential connection annually.⁹ The networking company Cisco forecasts that online video consumption will expand 40 percent in 2012 and 120 percent in 2013.¹⁰

The mobile market has exploded as well, with 850 different certified mobile products available to consumers in 2009.¹¹ Of those products, 27 percent were Internet-capable, and analysts predict that the use of Web-ready "smartphones" will soon overtake the use of traditional cellular phones.¹² More and more, employment opportunities require Internet savvy. The number of working Americans who were using broadband at their jobs grew 50 percent from 2003 to 2007, and hiring in the information technology and communication sectors has expanded more quickly than that in other industries.¹³ All of these indicators point to broadband as a transformative general purpose technology—investments in these types of technologies give not only the benefit of that direct investment, but

Figure 3. The National Broadband Plan Website

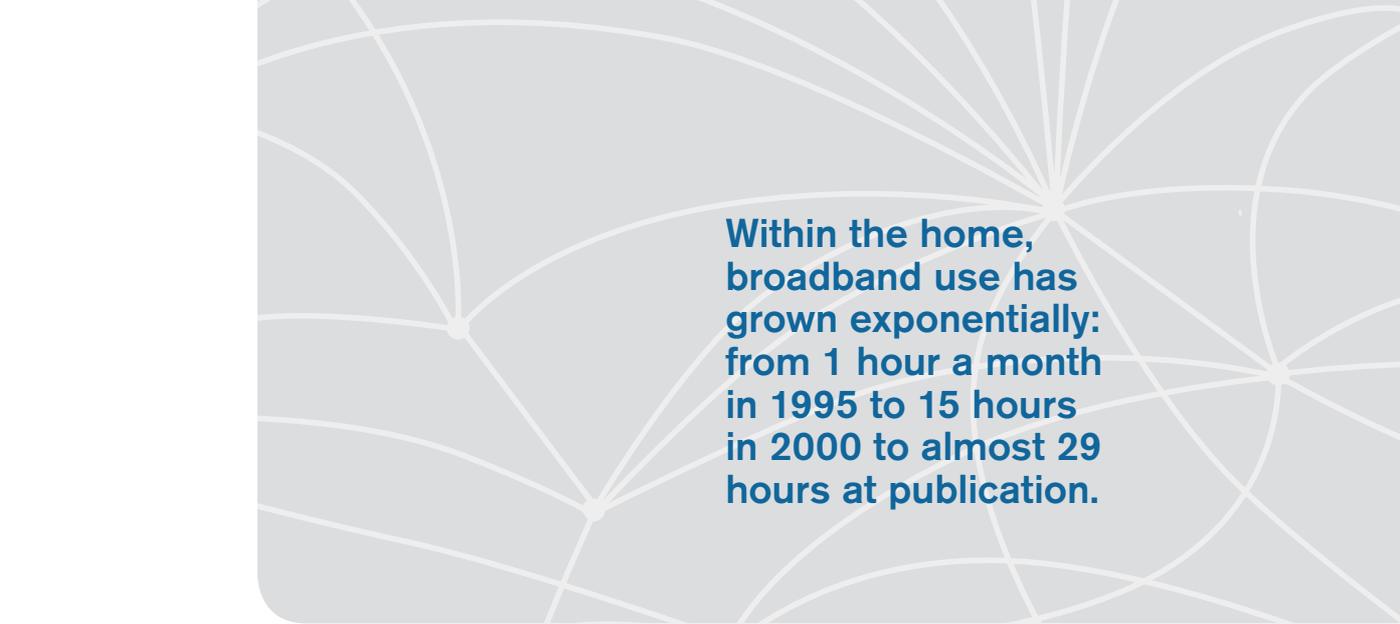


also wider spillover benefits throughout the economy.¹⁴

The Plan identifies the broadband availability gap as the core challenge. Many statistics about broadband proliferation are encouraging. The vast majority of businesses have access to broadband services, as do health care facilities and schools.¹⁵ But gaps remain. More than half of educators say that slow or unreliable Internet connectivity is a barrier to robust use of the Web in the classroom.¹⁶ Only 71 percent of health care clinics in rural areas can receive mass market broadband service.¹⁷ This, the Plan argues, is an issue of “equality of

opportunity”—when geography determines the citizens’ access to resources, the Plan says, “We can predict the outcome of children’s lives by the ZIP code in which they live.”¹⁸ To combat this problem, the Plan sets the national broadband availability target:

Every household and business location in America should have access to affordable broadband service with the following characteristics: *actual* download speeds of at least 4 Megabits per second (Mbps) and *actual* upload speeds of at least 1 Mbps, along with an acceptable quality of service for the most common interactive applications.¹⁹



Within the home, broadband use has grown exponentially: from 1 hour a month in 1995 to 15 hours in 2000 to almost 29 hours at publication.

To allow this benchmark to adjust to changing conditions, the Plan directs the FCC to review and reset this target every 4 years.²⁰

After describing the landscape of broadband and setting benchmark goals, the Plan then sets an agenda for achievement. Any meaningful development in broadband policy requires robust,

in-depth data on the Internet landscape. Thus, the Plan states that “the FCC needs to collect more detailed and accurate data on actual broadband availability, penetration, pricing, and network performance in order to accurately benchmark progress toward plan goals.”²¹ It recommends multiple metrics—usage surveys pricing portals, broadband quality of service measurements, and broadband mapping.²²

Relevant Regulations and Legislation

It is impossible to understand how the Broadband Map came to be without first examining the framework upon which it was built. The NTIA and FCC took into account all the regulatory and legislative considerations: collecting the needed data, financing the project, and engaging the public—thus complying with the requirements of the Broadband Data Improvement Act, the American Recovery and Reinvestment Act of 2009, the Administrative Procedures Act, the Paperwork Reduction Act, and the Freedom of Information Act.

Broadband Data Improvement Act of 2008

The BDIA declares that, although there has been progress, robust and comprehensive data are essential to discover where improvements are needed.²³ These metrics are to include the types of technology used to provide broadband, the cost to consum-

ers for the service, the actual speeds of the connections, the Internet-based applications that consumers use, and so on.²⁴ In order to weave this assessment into the broader landscape of federal policy, the BDIA directs that broadband data be incorporated into the U.S. Census.²⁵

The BDIA reflects a concern that, without in-depth metrics, it is impossible to know whether broadband consumers are receiving the level of service for which they pay.²⁶ To begin harvesting this information, the BDIA establishes the parameters of the grant program for state-level data collection.²⁷ Grantees must return a baseline assessment of broadband service deployment,²⁸ including areas of low-level service,²⁹ the rates of broadband adoption,³⁰ and the suppliers of high-speed service.³¹ The Act also creates a reporting requirement for grantees, directing them to detail how they used the funds³² and to transparently provide the public with the results of their assessment.³³

Figure 4. Recovery.gov, where American Recovery and Reinvestment Act funding is tracked



American Recovery and Reinvestment Act of 2009

Passed in the wake of the 2008 economic downturn, the ARRA legislated a series of investments and reforms designed to energize the national economy (figure 4). In the "Purposes and Principles" section, the law emphasizes that government needs an infusion of better technology to move forward.³⁴ To finance this progress, the Act appropriates \$4.7 billion to the Broadband Technology Opportunities Program and sets aside a portion for building a broadband map.³⁵ This program was intended to address the broadband availability gap by providing access

to broadband service for consumers residing in underserved areas of the United States³⁶ and improving Internet capability to consumers in underserved areas.³⁷ The ARRA emphasizes the need for meaningful transparency in the grant process to finance the data collection³⁸ and sets requirements for the upcoming broadband map.³⁹

Administrative Considerations

All federal agencies must obey a series of laws and directives in the performance of their duties. Government action frequently involves administrative tasks that must be completed to stay in compliance with the law. Although this creates

a degree of predictability and familiarity, it can also increase project expenses and time to market. A series of specific adaptations made by the planners of the National Broadband Map allowed these burdens to be reduced and the project to be completed in a remarkably quick timeframe. Other government agencies can look to this example and see that barriers to incorporating new technologies into their processes are not prohibitively high.

Administrative Procedure Act

The method by which government agencies complete significant actions such as the National Broadband Map is controlled by the Administrative Procedure Act (APA),⁴⁰ which sets strict requirements for agency actions and the promulgation of regulations, including those of the FCC.⁴¹ The APA applies to many agency functions, including those related to rules,⁴² rulemakings,⁴³ orders,⁴⁴ proceedings,⁴⁵ and actions.⁴⁶ It also establishes a wide scope of information that agencies must provide to the public,⁴⁷ such as descriptions of the agency and its employees,⁴⁸ statements clarifying its internal and external procedures,⁴⁹ clearly defined rules of procedure,⁵⁰ rules of general application authorized by law,⁵¹ and any changes in this type of information.⁵² Oriented around transparency, the Act commands that many agency materials be made “available for public inspection and copying.”⁵³

Paperwork Reduction Act

A legislative response to the information burden on both the federal government

and the public, the Paperwork Reduction Act (PRA) mandates limits on the information that the federal government can collect and creates disincentives to new collections.⁵⁴ Specifically, before beginning to collect any new information (e.g., the volumes of data on Internet usage required for the National Broadband Map), a government agency must obtain the approval of the Office of Management and Budget (OMB) by completing Form 83-1, Paperwork Reduction Act Submission.⁵⁵ Conceptually, this step requires the agency to build a cost-benefit analysis into the process: Why is the information needed, and what burden will be on the public to provide the information? The Act has been amended to reflect the growth of digital tools in federal operations and requires agencies to respect public concerns with privacy and confidentiality,⁵⁶ security,⁵⁷ and public access to information.⁵⁸ The law is intertwined with the APA, mandating a period of public notice and comment to allow citizens and affected agencies to voice their concerns.⁵⁹

Freedom of Information Act

Under the Freedom of Information Act (FOIA),⁶⁰ the government must unlock its records and allow public access to information. To comply, agency information must be published in the *Federal Register*, and agencies must respond to applications from citizens for additional disclosure.⁶¹ Like the PRA, the FOIA acknowledges the convenience and widespread use of computers, requiring “reasonable efforts” to place the requested information in an electronic format.⁶² President Barack Obama issued a pair of memoranda strongly endorsing

With its new policies, the OMB has encouraged agencies to expand public engagement through social media, the myriad of Web-based opportunities for personal interaction such as Weblogs, Twitter, Facebook, YouTube, and so on, without creating new regulatory burdens.

the ideals behind the FOIA and directing agencies to make compliance a high priority. The first memorandum ordered a clear effort toward transparency and urged disclosure even when information might be embarrassing.⁶³ The second directed the chief technology officer of the United States, coordinating with the director of OMB and the head of the General Services Administration (GSA), to develop an Open Government Directive instructing “executive departments and agencies to take specific actions implementing the principles set forth in this memorandum.”⁶⁴ Published on December 8, 2009, the resulting directive has four key recommendations—agencies are (1) to publish government information on the Internet, (2) to improve its quality, (3) to create and institutionalize a culture of open government, and (4) to ensure the policy framework enables transparency.⁶⁵

OMB Memorandum on Social Media

On April 7, 2010, the OMB responded to the Open Government Directive’s request to evaluate the application of the PRA to agency use of new technologies to engage the public.⁶⁶ As mentioned earlier, the PRA requires that a cost-benefit analy-

sis be done and OMB approval be obtained before any agency activity deemed to be a “collection of information” takes place. With its new policies, the OMB has encouraged agencies to expand public engagement through social media,⁶⁷ the myriad of Web-based opportunities for personal interaction such as Weblogs, Twitter, Facebook, YouTube, and so on, without creating new regulatory burdens.

The OMB has carved out a series of exceptions that allow agencies to interface with their constituencies without invoking the need for PRA procedures, and the memorandum identified parallel Web-based activities that agencies can safely continue.⁶⁸ First, the PRA does not apply to “general solicitations,” defined as “facts or opinions submitted in response to general solicitations of comments from the public, provided that no one person is required to supply specific information... other than necessary for self-identification.”⁶⁹ The OMB found this to be parallel to open questions posed by agencies with unstructured responses on places such as social media Websites, blogs, microblogs, content-sharing sites, or message boards.⁷⁰ The memorandum also states that an online suggestion box, along with

brainstorming or idea-generating applications, would not activate the PRA.⁷¹

Also exempted from PRA review are electronic subscriptions to agency notifications or publications—this could include emailed newsletters, mobile phone lists for text message updates, or addresses for RSS feeds, which allow users to customize and subscribe to updates to Websites.⁷² The OMB has also advised that public meetings,⁷³ already excluded from the PRA's requirements, include virtual or electronic meeting tools like public conference calls, webinars, blogs, discussion boards, forums, message boards, chat sessions, and so on.⁷⁴ The OMB retains authority to carve out additional exemptions from the PRA through its ability to identify "like items" that are not considered "information."⁷⁵ According to the memorandum, the "like items" principle applies to Web-based applications such as collecting data that allow users to establish an agency account, to rate or rank items on an agency Website, to perform a voluntary commercial transaction, and to participate in agency Web contests.⁷⁶ In addition, agencies can collect information that allows them to customize their Website for individual users.⁷⁷

In short, the memorandum provides strong encouragement to agencies that have been seeking opportunities to engage the public through new technology. Although a wide variety of Web-based activities do not require PRA procedures, the OMB memorandum details what does constitute "information" and, therefore, creates a regulatory burden on agencies, requiring them to submit paperwork to justify the

burden on the public. A general prompt that will elicit an unstructured response is fine, but a poll or customer satisfaction survey, because of the higher level of specificity, is considered information.⁷⁸ Similarly, a general public meeting where citizens can comment however they like is fine, but a focus group requires compliance with PRA procedures.⁷⁹ Feedback requests require no PRA administrative burden, but once they require information beyond what is needed to self-identify the commenter, the PRA comes into play.⁸⁰ As a general principle, the OMB sees any information identifying the user more than necessary as a trigger for the PRA. Such data could include information about age, sex, race, employment status, or citizenship.⁸¹ Any agency wondering whether its practices will create a PRA burden can consult the White House's Office of Information and Regulatory Affairs.⁸²

The federal government is highly concerned with public engagement in the 21st century. As technology has evolved, its benefits are not just available to the private sector. Ideally, new opportunities for the public to give feedback and commentary on government policy means that the end result will better reflect the priorities of those whom the legislation intends to serve. Electronic tools can allow all citizens to better understand the governmental processes that impact their lives. The creation of the National Broadband Map embodied this spirit. Other agencies can look to this example and see that barriers to public engagement are not prohibitively high, provided they learn from this innovative approach.

The Road to the Map—Data Collection, Assembly, and Crowdsourcing

The step-by-step process leading to the National Broadband Map involved a nationwide collection of broadband data, an open call to the public at large to contribute their concerns and participate in speed tests, and finally a cooperative assembly and release of the finished product.

Desktop, Mobile, and In-Home Speed Tests

The FCC wanted not only the state-level BDIA grantees,⁸³ but also many other parties feeding them broadband data. To that end, they employed multiple mechanisms to independently assess consumer Internet use and the strength of their connections. One way they accomplished this was by using desktop and mobile Internet speed tests. As the FCC emphasized, the concern was consumer protection—the vast majority of users do not know the type of broadband for which they are paying.⁸⁴

The FCC mobile software application, or “app,” was free to download. It was an off-the-shelf third-party product that sends a data packet (a tiny bit of

generic information that any computer can process); measures upload speed, download speed, latency (also known as delay), and jitter (hiccups in the Internet connection); and then returns that information to the FCC.⁸⁵ Because of the limited information collected by the app, it did not require PRA procedures or OMB approval, reducing the administrative burden.⁸⁶ This approach provided the data that the project needed and brought traffic to the FCC Website, increasing national attention on the agency’s concern with tracking Internet speeds. These types of tools have existed for some time, but distributing one branded by the FCC demonstrated the importance of the project to the public.⁸⁷ Easily accessible Internet-based apps like these allowed the FCC to engage the public and learn from it.

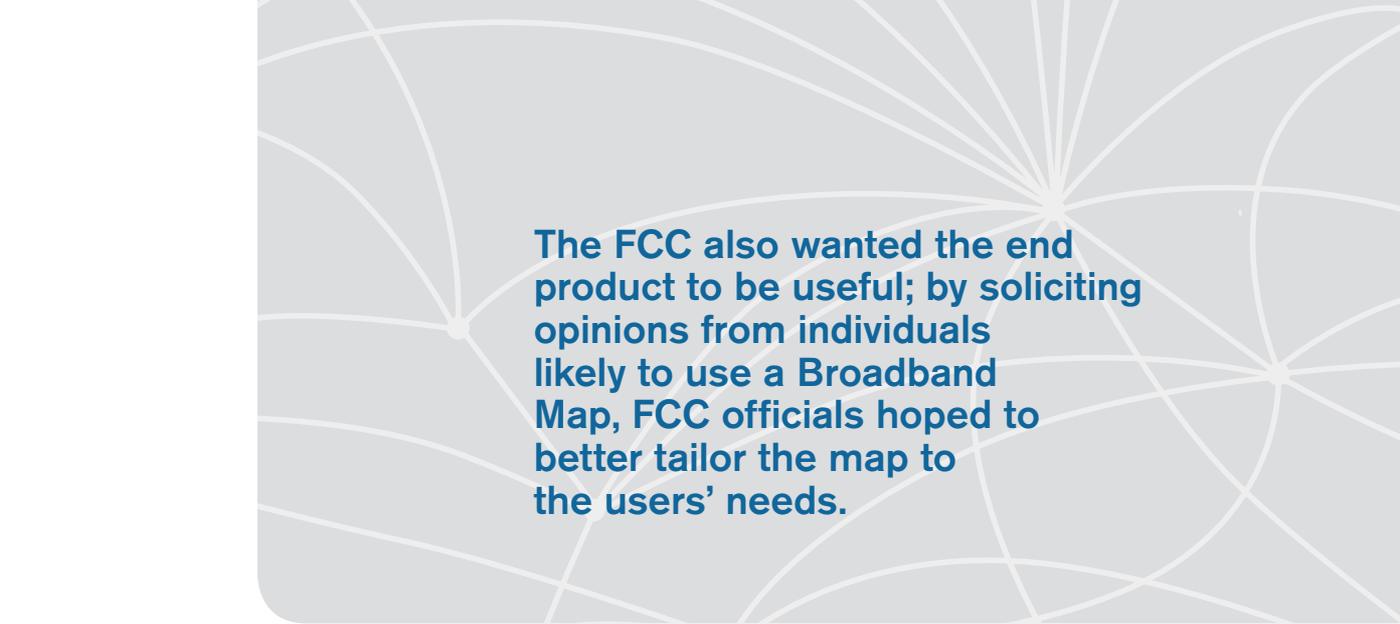
The execution was efficient. In November of 2009, FCC officials decided the testing software was needed, and the app was available four months later in early March of 2010.⁸⁸ Typically, this type of information would be collected through Form 477, Resources for Filers,⁸⁹ the standard agency paperwork that every provider must file. But that approach

relies on the participation of broadband providers, not consumers. By going directly to the public and giving them familiar tools, the agency was able to collect independent data, reduce administrative costs, and increase the volume of inputs.⁹⁰ With the mobile app, the FCC rapidly had millions of smartphones sending them the results of speed tests and the geographic locations of the tests.⁹¹ With the help of geographic information systems (GIS),⁹² computer software used to visualize and analyze data in layers on a digital map, the team began to analyze the spatial patterns from the speed tests. The geographically distributed mobile data of Internet upload and download speeds could then be layered on top of a digital map of the United States, and the FCC could start looking for patterns.⁹³

GIS allows for flexibility in the way that data are combined, analyzed, and visualized, enabling various types of spatial analysis. By making adjustments in the settings of an interactive and dynamic GIS map, the FCC could show consumers their chance of finding a connection above a certain speed threshold in different geographic locations.⁹⁴ Because transportation networks such as highways were already layered onto the map, the FCC was also able to tie the download speeds submitted by the public to those roads, allowing visual representation of where consumers might find faster Internet service on a car trip.⁹⁵ The larger the amount of data, the more confident the project managers about the patterns on the map. Based on shading, users could compare the sample size in one with that on another.⁹⁶

The FCC gained another stream of data by using in-home testing units. SamKnows,⁹⁷ a company that had previously provided broadband testing services for the United Kingdom's communications regulator Ofcom,⁹⁸ provided the needed equipment.⁹⁹ Distributing units to users nationwide was obviously more expensive than releasing a mobile app. However, the agency believed that the robust data obtained by the in-home long-term tests made the investment worthwhile. Mobile or desktop speed testing applications neglect an important piece of information—what type of Internet did the user actually purchase?¹⁰⁰ Also, a SamKnows unit provided a “pure” test—the unit was plugged in directly to the broadband port, showing exactly how the connection behaved, uninfluenced by computer hardware or software.¹⁰¹

To receive a SamKnows unit, users were directed to the TestMyISP.com Website. This FCC Website solicited participants and explained that the purpose of the project was “to provide US consumers with reliable and accurate statistics of their broadband connections.”¹⁰² The site provided the required PRA notice (meaning that it had to be approved by the OMB),¹⁰³ estimating the time burden on those who received a unit as roughly an hour. To join the project, the FCC asked that participants have several characteristics.¹⁰⁴ Their connection needed to be from a fixed line, which had to be stable and their only method of connecting to the Internet. Frequent downloaders of large files could not participate on the rationale that excluding this group would promote a focus on the needs of the average Internet user. In addition, par-



The FCC also wanted the end product to be useful; by soliciting opinions from individuals likely to use a Broadband Map, FCC officials hoped to better tailor the map to the users' needs.

ticipants needed a spare power socket, and their Internet service provider (ISP) was required to be on a list provided by the FCC. Also, a participant could not be an employee or the family member of an employee of a monitored ISP.

Those selected to receive a SamKnows unit agreed to additional conditions. They were asked not to unplug it unless they were leaving home for an extended period. To keep the data from being corrupted, users agreed not to reverse engineer or alter the unit. The FCC also requested that users notify the FCC if they chose to change providers and that users return the unit if they decided to no longer participate. The testing mechanism was simple and put little burden on the user.¹⁰⁵ After being set up, the SamKnows unit functioned like a normal router, allowing access to a wi-fi signal and guest networks. Every night, the unit would run a series of tests, recording speeds of upload and download and noting any network problems. The users also received a monthly report explaining the data and pointing out patterns.¹⁰⁶ These different avenues gave the FCC a significant body of data to work with and helped make the map a reality.

FCC Developer Day

November 8, 2010 brought clear evidence that the FCC was serious about finding opportunities to engage people outside the agency. According to the planners of this FCC Developer Day, it was partially motivated by curiosity. This type of event, in which computer programmers are invited for a day to write code for and experiment with app development,¹⁰⁷ has been used in the technology world for some time; FCC staff wondered how such an event would function at the agency.¹⁰⁸

Once some of the map applications had been partially built, the FCC believed that developer input would be useful by providing a fresh perspective on the work. The FCC also wanted the end product to be useful; by soliciting opinions from individuals likely to use a Broadband Map, FCC officials hoped to better tailor the map to the users' needs. Planners also hoped the event would enhance the agency's comfort level with the format, allowing for an ongoing series of similar events.¹⁰⁹

Bringing people to the FCC was not a challenge, because the agency regularly hosts a wide variety of stakeholder meetings. As this was a public meeting, it did not invoke the administrative burden of the PRA.¹¹⁰ This event allowed developers to peek ahead before a product was released, and the planners wanted to make sure everyone within the FCC was comfortable.¹¹¹ They reached out not only to FCC leadership, but also to agency employees at all levels to make sure they were aware of what would be taking place.

The event staff also discussed the Developer Day rules with the FCC's Office of General Counsel—they found that the FCC's legal advisors were comfortable with the idea because of the similarity with the Notice and Comment process under the APA.¹¹² Additionally, a separate temporary network to address agency cybersecurity concerns was set up for developers and programmers to use during the event, and a physical space was set aside and provided with equipment.¹¹³

Once the event had been planned and approved, the FCC announced it on their blog.¹¹⁴ Calling it “Open Developer Day,” the agency trumpeted it as an opportunity to collaborate with Web developers in the private and public sectors. The blog post also let interested parties know that Yahoo! engineers would be on hand to provide instruction for some of the tools involved. Anyone was welcome, provided that they registered, brought their own laptop, and agreed to follow security guidelines.¹¹⁵

Reaction to the event among the programming community was positive. One commentator said that the FCC needed this type of event, because the agency had “to do more than just publish open data sets in machine readable formats online: it [would] have to develop a community of software developers that benefits from creating such applications,”¹¹⁶ which the agency addressed by deploying multiple application programming interfaces (APIs). Another expressed excitement over the potential for the Broadband Map—believing that it would go beyond being a flashy, eye-catching Website and create a framework for other agencies to provide the public with a graphic representation of their data.¹¹⁷

Reaction to Developer Day within the FCC was mixed. Many staff members support open process management, allowing more constant feedback from parties outside the agency, but there was also understandable skepticism on whether this event really signaled change. Some were concerned that without real benefits to the frontline workers in agencies, this type of outreach will not be repeated in a meaningful way.¹¹⁸ However, FCC programmers did see benefits—for example, some groundwork coding was done on the mobile version of the Broadband Map that continues to prove useful. The Yahoo! engineers also provided some helpful assistance with coding style, consistency best practices, and API framework guidelines that are easily transferable to organizations. FCC is just beginning to take advantage of these.¹¹⁹

One lesson that the Developer Day planners took away was the need to

better engage programmers with policy and social media professionals. These staffers attended and were enthusiastic; however, Developer Day was geared to those with a computer science skill set, so participation of the policy and media experts was limited. The planners noted that there can be a disconnect between decision-makers and coders, as the two groups do not typically interact. If planners of future events could work to identify shared priorities, a wider population could walk away feeling needed and heard.¹²⁰ Enhancing communication between the two camps not only could lead to better completed projects, but also could allow both sides to understand the limitations of policy and technology, respectively.

The greatest yield from these events comes when they focus on a specific application, like the National Broadband Map.¹²¹ Other agencies have also engaged programmers to improve their work. The Department of Health and Human Services (HHS) invited programmers to help build an application that would enable citizens to browse their data on community-based health.¹²² When this type of programmer outreach happens in the private sector, it is often done to encourage the use of a particular platform. The FCC's logic was similar, as the agency wanted to create a product that people would use.¹²³ Outreach into professional communities is a sound investment for a federal agency eager to build public interest in its work: The Developer Day provided practical benefits and promotion for the National Broadband Map. Questions remain on the place of such events in agency activ-

ity, but it is encouraging to see this type of outreach.

Notice and Comment Procedure

The APA requires federal agencies to provide notice to the public and an opportunity for them to comment on any action—the National Broadband Map was no different. The ways the FCC engaged with the public and sought their feedback on this project reflected the open and inclusive nature of the work. Traditionally, interested parties can make a comment via the Internet using the Electronic Comment Filing System.¹²⁴

Rather than restrict the public to the Electronic Comment Filing System, the FCC gave the public additional options. One was the IdeaScale engine—this application offers a crowdsourced approach by soliciting ideas from the public and then allowing anyone to agree or disagree with the contributed suggestions (figure 5). The FCC constructed an IdeaScale site on the broadband issue and learned more about public priorities.¹²⁵ Comments on the FCC's Broadband blog were also incorporated in the official record.¹²⁶ Both of these sources, as they clearly fall within the OMB's exemptions from the PRA, allowed the agency to collect important information without increasing the administrative workload.¹²⁷

With the cooperation of the FCC's Office of General Counsel, the public were presented with myriad opportunities to express their opinions about the project. For the staff, it was both a challenge and an opportunity. Because

Figure 5. Broadband.gov's IdeaScale Forum

The screenshot shows the Broadband.gov IdeaScale Forum interface. At the top, there are three main action buttons: 'Contribute' (Share your ideas on the National Broadband Plan), 'Discuss' (Brainstorm Ideas with other to make them even better), and 'Vote' (Check out other people's ideas, and vote on the ones you like best). Below these is a 'Browse Popular Ideas' section with three tabs: 'RECENT (279)', 'POPULAR (279)', and 'HOT (0)'. The 'POPULAR' tab is selected, showing three ideas:

- WIRELESS BROADBAND -**
Bring the United States mobile broadband pricing in line with the rest of the world.
The United States has the highest pricing for broadband access in the world. It also has the most confusing set of mobile broadband plans found anywhere. Don't let carriers confuse consumers with extra charges and small print. Simplify contracts with plain language and simplify plans with plain terms. Serve the consumer, not the carrier.
131 votes, 1 disagree, 15 comments. Submitted by Unsubscribed User 2 years ago.
- DEPLOYMENT -**
Net Neutrality Is Vitrally Needed, even in Cities
Simply this: do NOT hand the future of a healthy internet to private telecommunications companies to run as they see fit. They have already proven themselves to be only concerned with profit maximization, pure and simple. They want to stifle growth and competition, and have already tried to do so. Lobby money is no way to administer the largest global communication network ever. I live a mere 10 miles from San Jose ... more >
117 votes, 1 disagree, 10 comments. Submitted by Unsubscribed User 2 years ago.
- BENCHMARKS -**
Move from "advertised" to "actual" speeds
I recommend that we move from measuring broadband performance (download and upload speeds) from "advertised" performance an ISP provides an end-user to "actual" performance at PEAK times that an ISP provides an end-user. While the end-users' true performance will vary based on a number of other issues (back-end connections, devices, etc) there are methods today to accurately track and measure the "actual" performance, ... more >
102 votes, 1 disagree.

On the left side, there is a 'Campaigns' menu with items like All Ideas, Broadband Framework, E-Gov & Citizen Engagement, International Lessons, Opportunities for Small & Disadvantaged Businesses, Adoption/Utilization, Accessibility for People with Disabilities, Education, Public Safety & Homeland Security, Smart Grid, Deployment, Fixed Broadband, Wireless Broadband, Benchmarks, Best Practices (Big Ideas), Broadband Consumer Context, Health Care, and Off Topic. Below that is 'Social Web' with a 'Like' button and '16 people like this. Be the first of your friends.' At the top right, the 'FEDERAL COMMUNICATIONS COMMISSION' logo is visible.

there were more options, there were more comments that agency employees had to read and transfer into the official record. However, some at the FCC believed the additional data justified this workload,¹²⁸ and the agency continues to perform this type of outreach for other actions. As the FCC.gov site is modernized, the agency has encouraged users to report bugs so that programmers can fix them.¹²⁹ There is also a page available to collect input from those concerned with Internet neutrality, the continuing debate over whether Internet providers can and should prioritize certain types of consumer traffic.¹³⁰ Some believe this type of prototyping and experimentation is important; it remains to be seen if this

option continues to be available over the long term.¹³¹

Data Collection and Map Assembly

As discussed earlier, the BDIA created a network of state-level grantees to collect data on broadband providers, and their data formed the backbone of the Broadband Map. This process was a unique collaboration between federal agencies, state governments, and the private sector. The purposes of the ARRA and the BDIA were interwoven: to facilitate the deep integration of broadband and information technology into the economy nationwide.¹³²

The demands of the project placed execution on a tight timetable. In July 2009, less than five months after the passage of the ARRA, the NTIA published the program rules for grant applicants via a Notice of Funds Availability and stated that there would be one award per state.¹³³ The grant recipients were announced in October 2009, and most received funding by the end of January 2010. That gave them 13 months to complete work before the statutory deadline for completion of the National Broadband Map.¹³⁴

Within nine months, states had completed two rounds of data collection, gathering information from approximately 3,400 providers representing 1,650 unique broadband companies. The grantees developed relationships with companies to explain the aims of the program, a resource-intensive, but meaningful opportunity to engage with the private sector. Often, broadband providers and grant recipients reached mutually beneficial agreements on data disclosure, meaning that much of the information was provided voluntarily.¹³⁵ Upon receipt, the data were checked by various methods. For example, some grantees drove down major highways testing the signal for wireless broadband service. Having established a relationship with providers, many grantees shared the data they had collected so the companies could confirm or suggest an alternative interpretation.¹³⁶

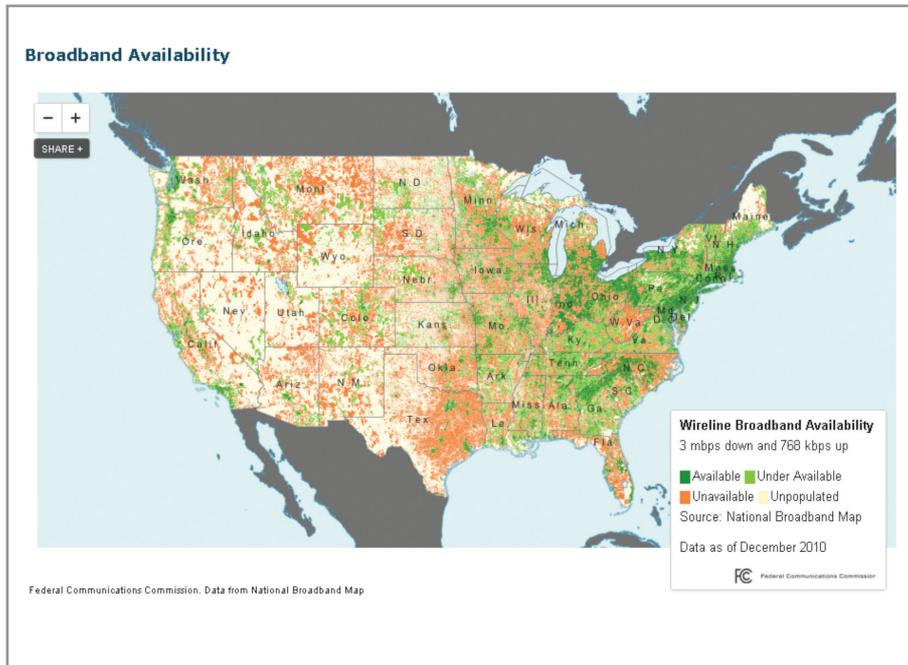
The data sets were delivered to the NTIA by October 1, 2010, leaving roughly five months before the deadline for the Broadband Map's completion. With the information in hand, the project

now relied on cooperation between the NTIA and the FCC. The agencies developed common standards for the intake, review, and publication of data nationwide. The FCC then awarded funds to three contractors to build the National Broadband Map.¹³⁷

During this process, cooperation and group assistance were the rule. The federal government supported state-level grantees with technical assistance and ideas, and grantees supported one another by developing group best practices. They evaluated changes in participating broadband providers, determined the best ways to organize the different broadband providers, and assessed satellite coverage.¹³⁸ The data model for the Broadband Map was developed by members of the National States Geographic Information Council (NSGIC), a national organization of senior state geographic information managers and coordinators, who then incorporated feedback from the grant recipients. The NSGIC was comfortable with this level of interaction, as they regularly share work and support one another.¹³⁹

The result of this hard work and sustained group commitment is the National Broadband Map (figures 6 and 7). It meets the core requirements detailed in the ARRA's mandate, the White House initiatives, and the needs of users. The comprehensive, interactive Broadband Map not only displays broadband service capability and availability, but also incorporates the values of transparency, participation, and collaboration.¹⁴⁰ Stakeholder feedback was instrumental; policymakers, consumers, and small

Figure 6. An image of Wireline Broadband Availability for 3 megabits per second download speed, using National Broadband Map data collected as of December 2010



businesses are all unique constituencies with unique needs, and without their input the project would not have been completed.¹⁴¹ The open and transparent process that built the Map was meant to hold the FCC and Internet providers accountable, synchronized with the White House's Open Government Initiative. It was anticipated that creative people would find creative ways to use the map. Thus, the National Broadband Map was released in 37 different APIs¹⁴² on the FCC Website so that anyone could leverage and analyze the data in a variety of ways.¹⁴³

But building an application with an API is only one step. The project team considered several things when designing the system to promote significant returns. First, they purposely chose low

barriers to entry when developing the APIs. There are no "keys" required (used with many applications to tie a user to standard agreements and policies) and no restrictions on use other than citation. In addition, there are clearly written developer pages describing how to use the resources. Thus, anyone with coding ability is free to write new applications using these APIs.

Second, the development team developed a usage-tracking system that monitors API statistics with little overhead and maintenance. They then constructed a live viewing application so they could personally observe how users leveraged the APIs. As a result, no data are "hidden" from the public: The collected, integrated, and displayed records are unchanged and freely avail-

Figure 7. Examples of different views available for the National Broadband Map

Maps

Sort By
Maps Per Page
Apply



Wireline Maximum Advertised Download Speed

This map shows the maximum advertised download speed by any wireline broadband provider for each US Census block less than 2 square miles. Source: National Broadband Map as of June 2011.



Mobility Fund Phase 1 Eligible Areas

This map shows the areas identified as eligible for Mobility Fund Phase 1 support as of May 2012. These areas are US Census blocks that lack 3G or better mobile coverage at the centroid of the block and contain road miles in any of six road categories. These blocks were identified by analyzing ...



800 MHz Cellular – B Block CGSAs

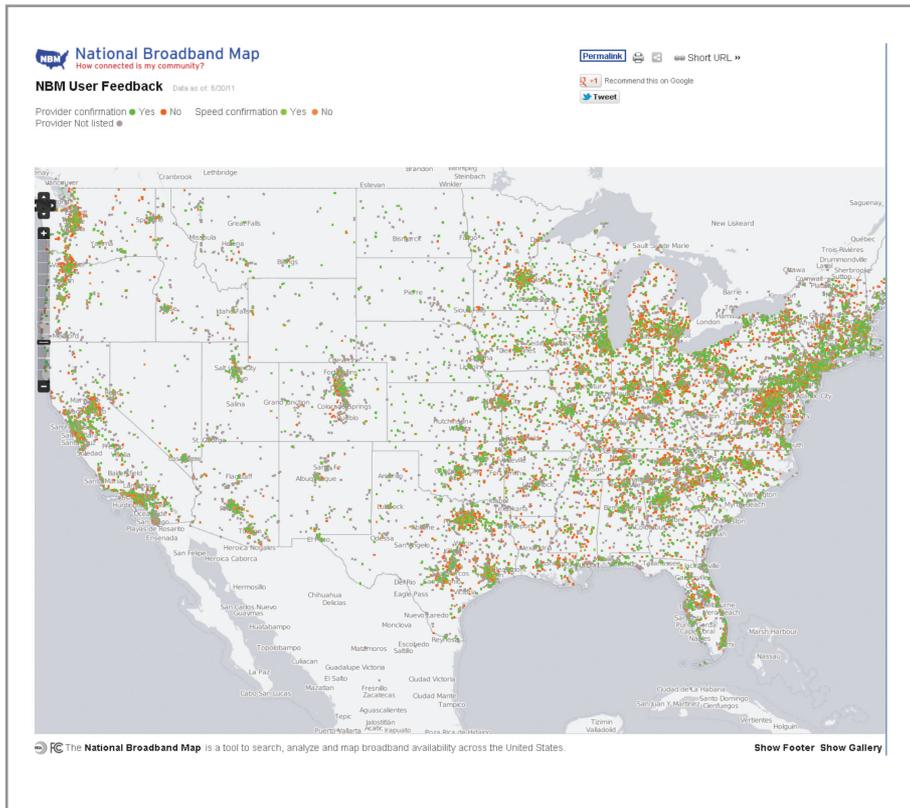
This map shows the Cellular Geographic Service Area (CGSA) boundaries overlaid on top of Cellular Market Areas (CMAs) for the B Block 800 MHz cellular licenses. The purpose of this map is to depict the licensed CGSAs in each CMA (as of January 11, 2012) as the FCC considers a rulemaking to revise the licensing ...

able. Finally, the team built the National Broadband Map on these very same APIs. The very same data set used by the FCC for the Map is accessible to the public.

The reception of the Broadband Map has created hope for its future potential. In the first few months, the Broadband Map saw more than 500,000 unique visitors,

most staying on the site for more than 10 minutes. Many federal and private sector groups are also experimenting with the APIs offered, and the data have been downloaded more than 1,000 times. In September 2011, the NTIA and the FCC updated the Broadband Map with data from each state, territory, and the District of Columbia.¹⁴⁴

Figure 8. The National Broadband Map, with dots indicating points of user feedback



Broadband Map's Crowdsourcing Utility

Clearly, the National Broadband Map was not an isolated project built by a single team. It required multiple stakeholders to share their work, compare ideas, and reach solutions in the best interests of the group. It is especially appropriate therefore that the Map itself has a unique crowdsourcing function. A user who visits the Map can, but is not required to, answer three questions. First, does a listed Internet provider serve the geographic area of the user? Second, if not, which providers operating in that area are not currently listed? Third, does the provider offer the speed

tiers listed on the Map?¹⁴⁵ Once a user searches for speed statistics and answers the questions, a single dot appears on the Map to show the address entered for the search. As this information falls within the OMB's detailed exemptions to the PRA, the crowdsourcing utility allows for additional data collection without the administrative burden.¹⁴⁶ Figure 8 shows the results of every crowdsourcing user feedback as a point on the Map. The utility helps the FCC to gauge where visitors are using the Map to learn about broadband service.¹⁴⁷

However, as the FCC staff point out, these "dots" are not updated automatically. Instead, the data are passed

back to the state-level grantees, who in turn can use them in their next round of data collection. Some grantees have used these data to help focus additional validation steps, increasing confidence in existing data or sharing information with providers about their availability. Not all grantees have taken advantage of the additional data, and

staff have expressed a desire to ensure that these data are more widely used. The Broadband Map itself is updated twice a year—a condition of the NTIA grants. The staff admits this cycle is slower than they would prefer. Users have an expectation of instant updates. They hope to adjust this time to market in the future.¹⁴⁸

Analysis—What Can We Learn Going Forward?

4

The National Broadband Map's efficient time to market and creative development process make it a strong example for policymakers. But agencies face unique challenges in their responsibilities. What lessons can others take from this project for use with applications outside of the FCC's sphere?

Better Government Fueled by Private Sector Experience

The NTIA and the FCC decided that a map about broadband needed to embody the spirit of the Internet. This ethos required architecture built on open standards and constructed by means of collaborative methods. In the Scope of Work released for contract, the team never defined a specific technology for serving the map, but rather described nearly thirty “Platform Specifications” on which a contractor was expected to implement the National Broadband Map. The winning bid was not a technology-specific contract, but one that focused on two critical pieces of architecture. First, the winning bid used an “open-source technology stack,” meaning it was programmed with freely available

resources that use common private sector standards. Second, it focused on an agile software development cycle, which prioritizes regular communication between programmers and end users, a shift from the traditional model of government software procurement.

Open Source

Computer software whose core software code has been published and is freely available to the public is considered an open source. The terms of an open-source licensing agreement permit any user to change, enhance, and modify it. Open-source software is developed in a public collaborative manner and is often free of charge to end users. In many cases, the business models for using open-source software come in support or customization, making the barrier to entry extremely small or at zero cost.¹⁴⁹

The Broadband Map is entirely based on open-source software. There are three distinct layers, and all are built using open-source software. The first tier is the application tier, developed using what is commonly called a LAMP (Linux, Apache, MySQL, and PHP) stack; its four compo-

nents are all open-source software and provide the foundation.¹⁵⁰ In addition to this stack, the team employed a content management system to serve the pages known as WordPress, another open-source software program.¹⁵¹ In the second tier, geospatial data and maps are served via the OpenGeo stack, also open-source software.¹⁵² Finally, the database tier is built on Postgress, an open-source database program.¹⁵³

Each part of the architecture had careful consideration before its selection. The WordPress environment was chosen because of the ease of implementing the content management system and the extensibility of the software. Once that option was chosen, the LAMP stack was designated because it is the predominant architecture for delivering WordPress systems. The contractor proposed using the OpenGeo environment because it best conforms to the complete Open Geospatial Consortium standards and provides the most flexibility in delivering the data within the time budgets articulated in the Scope of Work.

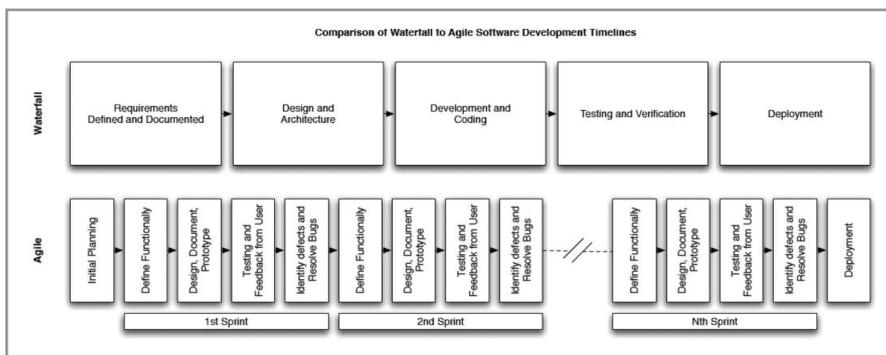
The contractor originally proposed using a proprietary back-end database. However, once the team realized the application could be built on open-source technologies, they carefully weighed alternatives with respect to project costs, delivery schedule, and purpose of the project and decided to switch to Postgress. In the end, the application truly embodies the spirit of the Internet, down to the open APIs upon which it has been constructed. The system is entirely open and repeatable, so software licenses or use restrictions will not present a barrier to further development

of the National Broadband Map or any repeat process.

Agile Development

Another area of reform is agile development,¹⁵⁴ which addresses problems in the federal information technology procurement process by looking to strategies developed in the private sector. Traditionally, federal applications have been procured through “waterfall development.” This approach breaks program creation into two stages—analysis and coding. During analysis, the agency buying the application must outline all conceivable requirements before giving formal documentation to the development team. The development team begins work, and when they have finished, the buyers and developers meet to discuss the project.¹⁵⁵ The advantages of this approach center mainly around its similarity to the usual workflow in the federal government—it mirrors current procurement models, allows for easier budgeting as requirements are front-loaded, provides objective standards for evaluation, and leaves a large record of documentation.¹⁵⁶

But waterfall development has disadvantages. First, it assumes accurate forecasting of a project’s requirements in advance. Such accuracy is frequently difficult in information technology, however, as both hardware and software can shift rapidly. Second, it demands specificity tailored to funding, planning, and acquisition. Again, this type of predictive precision does not always mesh with the rapid changes taking place.¹⁵⁷ This incongruity could explain proliferating inefficiency in federal information technology. In Fiscal

Figure 9 Waterfall vs. agile development

Year 2011, \$77.1 billion of the federal budget was spent on information technology, a figure that grew 70 percent in the preceding decade.¹⁵⁸ Less than one-tenth of all federal information technology projects are completed on time and within budget. End users report that only one-third of the features in procured applications are regularly used.¹⁵⁹

Agile development seeks to sidestep these problems by approaching information technology procurement in creative ways (figure 9). Instead of a two-step waterfall process, it is broken into smaller iterations, where developers and customers regularly interact. It emerged in the private sector in the mid-1990s as a response to heavy cost overruns.¹⁶⁰ Coding is done in multiple “sprints,” where a user selects needed tasks and the developers quickly construct a prototype that users can test. This approach promotes an in-depth understanding of project purposes in both parties and encourages progress.¹⁶¹

Despite these technical and budgetary benefits, agile development is incompatible with much of the structure underlying federal information technology. It forgoes

the traditional documentation and reporting requirements widespread throughout the federal government.¹⁶² Government officials also have a higher comfort level with the risk avoidance created when all project requirements are laid out at the beginning.¹⁶³ Government contracts are not structured for agile’s “develop-as-you-go” method.¹⁶⁴ Additionally, not all developers support this reform, either because it does not suit their skill set or because it is thoroughly unfamiliar to them.¹⁶⁵ A bureaucracy and workforce constructed around a certain approach can resist pressure to adapt.

But barriers should not be seen as a reason to avoid change. With executive and staff education on the benefits of this approach, applications could better meet the government’s needs.¹⁶⁶ Federal acquisition regulations could be adjusted, expanding the procurement exemptions currently available for architects and engineers to developers, meaning that project requirements would not have to be outlined beforehand and progress could be more gradual.¹⁶⁷

In terms of implementation, the National Broadband Map team required the

development team to pursue an agile approach in development of the Broadband Map. The primary reason for this approach was a short timeline from development to publication (less than 5 months from contract signing to application launch). In fact, the winning bidder took the agile development process a couple of steps further and implemented the standard agile approaches, such as daily team meetings, shorter sprints to code, and application development with real outputs for the clients to see. In addition, the contractor proposed several alternatives that made development even faster. For example, the contractor built the application in a cloud environment, which allowed clients to log in and see the working components as they were being developed. Daily team meetings took place in this same environment, making it possible to demonstrate the components and actively experiment as the programmers worked. As a result, there was no behind the scenes work. Also, the contractors deployed “live” builds with their code in a code storage site, so there was not a lengthy time to deploy the application or to roll it to an entirely different user acceptance testing environment. What the team saw in the cloud was the application’s most recent code, which was refreshed every minute. The combination of these factors led to a successful project completion within difficult time constraints.¹⁶⁸

Challenge of Cultural Change

Beyond any specific governmental reforms that incorporate transparency, collaboration, and new technology, there is the broader challenge of the federal workforce culture. Without changes in

the way that both leadership and staff approach technical projects, it is unrealistic to expect any real lasting change. The National Broadband Map was an important example of the improved outcomes possible when agencies work to better engage the public as a contributor of information and expertise. Others within the government are interested in cultural change to allow reform to truly take root.

Reform by the Federal Chief Information Officer

The Federal Chief Information Officer (CIO), Steven VanRoekel, has demonstrated a grasp of the tools available to promote smarter, leaner government. In October of 2011, VanRoekel expressed the urgent need to build on positive work done so far, allowing “technology to improve government productivity and lower barriers to citizen and business interaction.”¹⁶⁹ Responsible for the largest information technology bureaucracy in the United States, VanRoekel identified three goals: eliminating inefficiency, reaping cost savings, and enhancing collaboration by discouraging a fiefdom-based federal culture.¹⁷⁰

VanRoekel’s agenda—called “Future First”—looks to the private sector for process improvement in federal workflows. For example, a program similar to the “entrepreneur-in-residence” programs common in Silicon Valley would allow agencies to bring in subject matter experts to look at specific issues without going through a lengthy federal hiring process.¹⁷¹ VanRoekel also seeks to move infrastructural agency applications toward cloud computing. For



Beyond any specific governmental reforms that incorporate transparency, collaboration, and new technology, there is the broader challenge of the federal workforce culture.

example, the Department of Agriculture consolidated 21 different email systems into one under the cloud, dropping per mailbox costs from \$24 to \$8.¹⁷² “Future First” will also look to crowdsourcing to solicit public opinion on federal reform. As VanRoekel said, “I would love to start a dialogue on this...about what should be included and what shouldn’t be.”¹⁷³

In fact, the CIO’s new Federal Government Digital Strategy formally applies across all federal government the basic playbook used in the development of the National Broadband Map: decoupling data from container, open APIs, citizen engagement and novel uses of technology.¹⁷⁴

OMB’s Social Media Memorandum and the Potential for Engagement

The process that led to the National Broadband Map involved the FCC repeatedly reaching out to the public. This outreach came in many forms. There were blog posts,¹⁷⁵ the IdeaScale application,¹⁷⁶ events such as the FCC Developer Day,¹⁷⁷ the desktop and mobile speed tests,¹⁷⁸ and the crowdsourcing utility.¹⁷⁹ All of these provided

valuable information and helped brand the FCC as truly invested and concerned in the future of our national broadband infrastructure.

As noted earlier, the PRA creates a series of procedural barriers to agency collections of “information,” requiring agencies to perform a cost-benefit analysis and to obtain OMB approval before they can collect particular data.¹⁸⁰ The OMB had named a series of exemptions where data that an agency collects will not be considered “information” for the purposes of the PRA, however, and recently identified parallel exemptions within the field of new technologies and social media.¹⁸¹ By following these guidelines closely, the FCC gained the benefit of the data that the public provided without the administrative burden that would add both time and cost. Agencies interested in expanding their options in public engagement should carefully consult the memorandum while planning their interactions.

The difficulty in implementing changes in the way government operates is not a reason to avoid adjustment. Rather, the overstretched budgets and economic

Figure 10 FCC's application programming interface offerings, allowing programmers to experiment with and manipulate the Map

The screenshot displays the FCC's 'Developers' page. The main content area is titled 'Data Transparency' and lists several APIs:

- Accessibility Clearinghouse API:** The 21st Century Communications and Video Accessibility Act put into motion new requirements to ensure that everyone has access to communications as well as the ability to send and receive emergency information and services.
- FCC Census Block Conversions:** Like politics, all data is local. Unlock the US Census Block number of any geographic coordinate using the FCC Census Block Search. This API also returns the associated US State and County name, with more layers coming soon.
- FCC Content API:** Content is data and the content of FCC.gov is made accessible by the FCC Content API.
- FCC Consumer Broadband Test:** Over 1 million user speed tests were generated from FCC Consumer Broadband Test. This API delivers data on the number of tests, average user download/upload speeds, and more.
- FCC Form 499 Filer Database API:** The FCC Form 499 Filer Database is an identification system for all interstate telecommunications carriers, all interconnected VoIP providers, and certain other providers of interstate telecommunications. This API returns the FCC Form 499 information that matches any of several parameters including Filer ID, FRN Number, State, and Primary Communications Type.

On the right side of the page, there are three sections:

- Developer Mailing List:** Includes an email input field, a zip code input field, and a 'SIGN UP' button.
- Code Repository:** Promotes checking out FCC's code repository on GitHub and SourceForge.
- Other Agency Hubs:** Lists various agencies with expandable options: Department of Education, Department of Labor, Centers for Medicare & Medicaid Services, Commerce - Automated Export System, and Consumer Product Safety Commission.

instability shows these deeper changes are urgently needed. Without hard choices and creative thinking, we will lose our chance to develop a government built for the demands of the 21st century.

Continued FCC Commitment to Transparency and Engagement

Staff at the FCC have continued to build off their positive experiences with the Broadband Map and look for opportunities to make publicly available their vast amounts of data. In early 2012, the FCC released a new map depicting “dead zones” in mobile broadband—the publication showed that there remain large areas of Alabama, Nevada, Idaho,

Arizona, and Texas with service gaps.¹⁸² The information was previously available in a spreadsheet or database format, but the FCC chose to go further by providing it in three standard formats—all used by the private sector, all open, and all quick.¹⁸³ Therefore, geographers, developers, and information analysts can now carry out additional analyses of the gaps. The FCC seeks to “enable use of our data by the widest possible audience so that everyone understands the issues we are addressing in our actions.”¹⁸⁴ The areas with reduced service are eligible for grants through the FCC's Connect America Fund, which seeks to complete “our nation's wired and wireless infrastructure.”¹⁸⁵

The National Broadband Map continues to be leveraged by its users in innovative ways. Because it was built with open APIs, people began building on it as soon as it was released (figure 10). A geospatial firm based in Boston completely changed the graphics of the Map to demonstrate what could be done for a state broadband-mapping exercise.¹⁸⁶ Another company, called broadband.com, integrated the speed test results that API used on the National Broadband Map to enhance the value of the speed test data that the company had already assembled. Usage metrics have indicated that many have taken advantage of the APIs available and sought to tweak the map to their needs, just as the programmers had hoped.

The FCC has also been engaged in a sustained effort to modernize and improve its Website by rebuilding the structure and allowing more agency data to be available for scrutiny. This work has merited notice by the Department of Justice's Office of Information Policy (OIP), which invited the FOIA Officer of the FCC to a "Sunshine Week" event to highlight the agency's "exemplary" work on transparency and accessibility. According to the invitation, the OIP wants details on how the FCC Website is used "to promote public engagement with FCC data and records."¹⁸⁷

On April 16, 2012, the FCC hosted its second developer event.¹⁸⁸ Called the .Gov Developer Meet-up, it was promoted as part of the agency's continued drive to transparently offer its data and was intended to create "a more informal atmosphere for the developer community to share ideas." It featured recorded re-

marks from FCC and OMB leadership.¹⁸⁹ The event was not only a call for collaboration from the public, but involved 13 federal agencies eager to present their work with APIs.¹⁹⁰ Each gave a short presentation on their use of APIs to leverage their assets, and the event was broadcast online for those who could not physically attend.¹⁹¹ Many federal agencies are eager to interact with the public, and these developer events give them new opportunities to do so.

National Broadband Map As Place-Based Policy

Congress directed the NTIA to develop and maintain a National Broadband Map that is searchable and interactive: That was the limit of the command in the BDIA. By using a fully geography-based analytic approach, the team developed a visualization of the data that serves as an example of what can be done with GIS. If the status quo approach had been used, where data are collected and tables of results are presented, then few if any correlations to other data could have been made. The approach the National Broadband Map team took was to harness the real power of geography at its lowest common denominator. When data are presented at the same unit they are collected (in this case, the U.S. Census Block level), then not only do external users have access to the same data as policymakers, but also they have the ability to combine those data with data of the same high-resolution geography. This is important not just in relation to broadband, as researchers, the public, and policy teams often want to investigate any number of place combinations, aggregate regions, and different socioeco-

nomic indicators. Data presented in this lowest common denominator level meet that objective and set the bar for other federal entities to not aggregate data for presentation sake.

Although the National Broadband Map was completed before the release of the White House's place-based policy memorandum,¹⁹² it mirrors the methods and goals that the memorandum espoused. Rather than offering a one-size-fits-all solution to problems, place-based policy seeks to focus resources in specific places and draw on the combined effects of coordinated action. This concept acknowledges that the needs of urban and rural communities can be vastly different. For example, home ownership in urban areas might be encouraged via a neighborhood-based approach of financing and redevelopment.¹⁹³

The power of GIS is to connect disparate data simply by their relationship of location, the point of place-based policy. If the team had not taken this approach, we would not know any of the population and demographic estimations; we would have only record counts of availability. We would not know any of the speed test data at any location. We would not be able to return summary statistics or rank geographies by cross-cutting aggregates. We would not be able to compare Universal Service Study areas, which receive billions of dollars of annual federal funding for telephone universal service, by broadband availability. Moreover, we would not be able to compare one company with another as we can with the provider analysis pages. In short, we would not know the *context* of the data. The geographic approach implemented here is the fundamental reason why the project is so revolutionary.¹⁹⁴

Conclusions

The United States is confronting an increasingly competitive world, creating a great incentive to modernize. The private sector acts as a laboratory, adopting new technologies, and the fast-paced business environment naturally favors quick and nimble companies that can incorporate change. Those who cannot adjust risk becoming irrelevant.

Government has the stability and presence to delay adapting, but this cannot last forever. Economic turmoil, overstressed budgets, and a frustrated public have made adaptation essential. Without meaningful change, policymakers risk losing the trust and confidence of citizens. In an effort to acknowledge the problem, many within government have urged that the system become more cooperative, collaborative, and transparent. However, rhetoric is cheap; action is not.

The development of the National Broadband Map and all supporting activities represent an exemplary actionable approach to current needs. The team identified actionable steps to meet a daunting goal and then implemented

each step. Those steps existed across a spectrum of areas, not just in information technology acquisition or program implementation. Secrets to the success did not lie in understanding any one ingredient, but in understanding the combination of the legal landscape (e.g., BDIA, ARRA, PRA, etc.), policy landscape (e.g., administration and policy drivers), public landscape (e.g., need for crowd sourcing), information landscape (e.g., the content of the data collected), and technology landscape (e.g., API, open architecture and open-source software).

Although this paper does not provide a comprehensive contrast to other federal geospatial activities, its in-depth analysis brings clarity to the recipe for success here and perhaps suggests room for improvement in the existing environment. Success necessitates a deep understanding of a single content area combined with equally deep understandings of the legal, policy, public, and technology drivers affecting the content.

Mired in bureaucracy, the National Spatial Data Infrastructure (NSDI),¹⁹⁵ the ideal of a comprehensive U.S. geospatial library, has provoked a great deal of con-

versation about a federal framework for geospatial data with limited applications to show for it. Critics of the NSDI have noted little action on the initiative. The National Broadband Map, on the other hand, was implemented on time, within budget, and with positive policy outcomes. The NSDI is not about any single legal, policy, public, or technology issue. Perhaps this lack of a tangible focus contributes to its current state. If leadership in the NSDI took a single focused policy framework (e.g., economic recovery in the housing market, health care reform, or national security) and applied legal, public, and information technology approaches similar to those described in this paper, the geospatial infrastructure would be further advanced.

The NTIA and FCC both need to understand the broadband landscape; therefore, both had incentives to have the project done correctly. For too long, the NSDI has conceptually been the single point of entry for spatial data policy. This mode fails in today's landscape. Maps in and of themselves are not the end goal. The true target is policy about something, like the National Broadband Map is for advancing public Internet connectivity.

If the NSDI tied spatial data to policy decisions, geospatial advancement could occur much more quickly. The impetus of the National Broadband Map was a singular directive, and the team met the goal, producing an interactive and searchable map of broadband availability. The NSDI, on the other hand, has attempted to produce one map, but the one-map paradigm does not have focus and does not reach a single policy goal. Rather, openness around maps and data

about addresses and land parcels would help to clarify home ownership policy; openness around maps and data about public school metrics would help to clarify education policy; openness around maps and data about labor statistics would help to clarify economic policy.

A key outcome of any information product is the measurement of the way in which the information is used. This measurement is often glossed over, because it is difficult to measure policy outcomes. Information technology experts may turn to simple use metrics to try to justify their applications (e.g., the National Broadband Map received 500,000 visits in the first ten hours). However, these metrics fall short, simply because they are not a real outcome. In the Broadband Map's case, though, several real outcomes exist.

In October 2011, the FCC voted to create the Connect America Fund.¹⁹⁶ In its issuing order, the Commission noted that the Universal Service Fund will be maintained at its current rate of about \$7 billion a year and that a portion of the High Cost Fund, normally designated for universal telephony service, will be redirected to ensure the 4-Mbps download, 1-Mbps upload speed goal articulated in the National Broadband Plan. The use of the National Broadband Map, which makes it possible to visualize where there is availability and where there is none, is not simply a formal nod to a data source as authoritative. It is a real, measurable metric pinned to a constant set of decisions in the allocation of hundreds of millions of dollars, resulting in additional people having broadband service. In short, the National

Broadband Map is a decision tree for ensuring that more citizens have access to the same basic services that many already take for granted.

Moreover, it stands as proof that careful planning and savvy management can permit the achievement of big goals with limited resources and limited time. Despite the extensive regulatory burdens that they faced in creating the National Broadband Map, the NTIA and the FCC completed the project on time, and the project has already had tangible and identifiable impacts on

policy. Different agencies have different responsibilities and goals, but they can look to this project as proof that the hurdles can be overcome.

The development and deployment of the National Broadband Map is an interactive and informational example of the drive to modernize federal government through collaboration, transparency, citizen engagement, crowdsourcing, and private sector-driven best practices. The project is a step in a wider push for cultural change, as government at all levels seeks increased efficiency and effectiveness through technology.

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