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THE MERGING OF TELECOMMUNICATIONS POLICY AND SCIENCE POLICY THROUGH BROADBAND STIMULUS FUNDING

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ABSTRACT

The Broadband Technologies Opportunities Program was seen as a historic attempt by the Obama administration to bring broadband access to the underserved or unserved communities of the US while also investing capital into many of the economically hard hit companies and regions that support such technological development. Expectations for the first Notification of Funding Availability were quite high. However, conflicting belief systems and viewpoints about the role of large scientific institutions in the aid public development led to disillusionment and conflict. The authors use policy and discourse analysis to break down the situation and highlight the key differences that caused it to arise. This paper analyzes these differences and their foundational roots in an attempt to understand the basis of this conflict and what could be done to correct the situation in future notifications.

INTRODUCTION

This research represents the first part of what will be a three-part analysis of the impact of the US Federal government's funding of Broadband Infrastructure through the American Reinvestment and Recovery Act (ARRA) on cyberinfrastructure. The overarching research question is, "Are there direct and/or indirect effects of the ARRA broadband stimulus funding on academia, eScience and large-scale computational science?" The intention of this first effort is to understand the basic policy environment in which the call for proposals has been released and responded to. In the last quarter of 2009 and the first half of 2010 we expect to conduct a textual analysis of the listed-as-funded Broadband Technologies Opportunities Program (BTOP) projects through the National Telecommunications and Information Administration (NTIA) as they are awarded and announced. Each organization and/or project will be analyzed as to its connection with academic and scientific endeavors.

In this first effort, before the first awards are made, we gathered data concerning (1) the language in the initial general stimulus Act, (2) language in the subsections focused on broadband stimulus, (3) the language as expressed by the Obama administration and members

of the NTIA administering this portion of the stimulus policy, and (4) the response of potential respondents from universities and those representing higher educational institution interests.

From this data we have established that the initial language used in, and surrounding, the Broadband stimulus funds, as well as the political climate, encouraged universities and other educational anchor institutions to believe they would play a much more central role in the call for proposals than how it has been interpreted by these potential applicants. In other words, educational institutions were led to believe that funding would be made available to them for large scale, very high-speed networking projects between institutions and this did not turn out to be the case in the Notification of Funding Availability (NOFA) as of July 14th 2009. This has led potential academic applicants to disengage from the application process, wait for later funding cycles hoping for a change in criteria, lobby for these changes to the NTIA, and in some cases, to alter their proposed project to meet the needs of the call by the mid August 2009 deadline.

The disconnect from the application process may have several implications for the continued success of both the NTIA stimulus act as well as for universities seeking to meet their technology and networking needs. The first is that a potential valuable player in reaching the communities targeted in the NOFA has become disinterested in participation. Universities have many systems in place that connect them to their local communities as well as a foothold in many of the communities targeted. They have the potential to act as intermediaries between companies, communities, and the government since they have the organization and ability to communicate and organize all three groups in ways that open channels of cooperation and communication. Since the success of this first NOFA will likely shape the content of the next two stages of funding, creating a successful and integrated first round of funding would be a goal for the universities that are currently looking at the next rounds of funding to meet their own cyberinfrastructure goals. Disengaging at this stage makes universities input and feedback for any additional stages of funding very difficult and may well increase the likelihood that universities will continue to be disappointed by the opportunities presented to them.

While the money for the broadband stimulus bill has already been allocated, successful public works projects require large community participation. By creating a disconnect between the NTIA and universities, the first NOFA has largely broken a potential partnership that could have created a successful outcome through leveraging the universities resources to encourage additional companies and institutions to engage with the problem of broadband access in underserved or unserved communities. Universities may act as important bridges between companies, communities, and the government. Having these bridges on board for such public work projects pressures others to join in the work as well as providing valuable skills and resources that are difficult or expensive to obtain otherwise.

CYBERINFRASTRUCTURE AND E-SCIENCE

eScience, or computational science, is defined as a rapidly growing multidisciplinary field that uses advanced computing capabilities to understand and solve complex problems. Computational science constitutes what many call the third pillar of the scientific enterprise, a peer alongside theory and physical experimentation. eScience is fundamentally collaborative, multi-disciplinary, multi-agency, multi-sector and multi-organizational. This form of scientific activity must be supported by what has come to be known as cyberinfrastructure. The term cyberinfrastructure describes the new research environments that support advanced data acquisition, data storage, data management, data integration, data mining, data visualization and other computing and information processing services over the Internet. According to Lazowska, Lee, Elliott and Smarr (2008)

> "Today we are at the dawn of a second revolution in discovery – a revolution that will have far more pervasive impact. The focus of this new approach to science – called *eScience* – is *data*; specifically: the ability to manage orders of magnitude more data than ever before possible; the ability to provide this data directly and immediately to a global community; the ability to use algorithmic approaches to extract meaning from huge volumes of data."

In the opening chapter of their book, Scientific Collaboration on the Internet, Olson, Bos and Zimmerman (2008) claim that the changing nature of much scientific research, including shifts from collocation to distributed collaboration and increasing size and complexity of data sets and requirements, has required the rise of technological and social systems that are capable of handling new research demands. Technology has been advancing rapidly by not only researching and developing new forms but by also exploring the synergistic opportunities that using technologies together in new ways produce. By expanding upon these capabilities technology had been able to cross

> "…thresholds that now make possible a comprehensive cyberinfrastructure on which to build new types of scientific and engineering knowledge environments and organizations and to pursue research in new ways and with increased efficacy. (pg. 1)" (Atkins 2003)

This crossing has resulted in increased ability to support the changing needs of scientific research. Grid computing has risen as an important focus of computational research since it helps researchers gain a handle on the problem of raw data storage and sharing across institutional boundaries (Avery 2007; Chervenak, Deelman et al. 2007). Grid computing is a network of computers across the participating research institutions that "[…] contribute compute cycles to enable data analysis of the vast data sets.(Olson et al, 2008, pg 67)" This sharing of the cost of computing data allows the many researchers involved in these projects to engage in the research without shutting down any single site completely.

Broad, (2008) stated,

> "infrastructure is an essential precursor to social and economic progress. Whether it is upgrading and expanding the electrical grids that power society or improving the roads and bridges that link people and commerce, infrastructure is essential to the future. Today, a new type of strategically important infrastructure may be less publicly visible but is, arguably, more essential to the future success of colleges and universities: cyberinfrastructure."
> (http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume43/RealizingthePromiseofCyberinfr/163063)

Research universities are the central engine of the innovation economy (Lazowska, Lee, Elliott and Smarr, 2008). This role depends critically on having state-of-the-art cyberinfrastructure as a foundation for eScience research and education activities. Like the physical infrastructure of roads, bridges, power grids, and water systems that support modern society, cyberinfrastructure refers to the distributed computer, information and communication technologies combined with the personnel and integrating components that provide a long-term platform to empower the modern scientific endeavor (NSF, 2003, http://www.nsf.gov/od/oci/reports/toc.jsp). In order for eScience to be enabled through cyberinfrastructure, the broadband connections between entities engaged in the research must secure, fast, reliable, and able to handle very large amounts of data in multiple forms.

While the basic goals of science have remained the same over the last few decades, the questions that many researchers are dealing with have become more complex. Data has gone

from being files that can be stored on a single computer and handled by a single lab of researchers to massive petabytes of information that are handled by many distributed groups (Newman, Ellisman et al. 2003; 2008). Projects such as the CERN Large Hadron Collider or the Sloan Digital Sky Survey are capable of producing more information in a short period of that can reasonable be stored in a single area, let alone analyzed by the single laboratory of older research model. The authors call this "imminent deluge of data" one of the main drivers for change in the next years as science adapts itself to handle the needs that projects of such scope demand (Hey and Trefethen 2003).

In addition to sheer volume, the nature of the data being collected by scientists in such large scale projects are also changing. While some remains fairly similar in their characteristics, other fields are dealing with data that are increasingly incongruent. This makes not only the storing the data difficult but also changes how scientists need to approach the process of analyzing the data. Hey and Trefethen (2005) point out that the field of bioinformatics is facing such a dilemma since the information they gather comes from many different sources as well as in many different formats that must be made compatible before analysis can begin or findings drawn.

A CONTEXT OF AGREEMENT AROUND THE STATE OF BROADBAND IN THE US

In the following sections, the authors will tell a story about the political climate in which the ARRA and BTOP and the eventual call for proposals came into being, the reaction of scientific institutions to these. This story is one of initial enthusiasm leading is disappointment and a strong disagreement. However, in order to tell the story accurately, the authors feel that it is essential to discuss the context of agreement in which the story begins.

Among those involved in the ARRA, and the BTOP more specifically, they fundamentally agree on three things. First, they agree on the significance of the problem of poor broadband availability, speed and quality found in the US in comparison with the rest of the developed world. Second, they agree that broadband Internet has the potential to significantly impact the quality of life of US citizens and encourage economic and social development. Third, they agree that the Federal government should take a direct role in addressing the problem.

The poor broadband penetration within the US is often blamed on unreliable and slow service, high prices, and a low-density, distributed population. While the US has made significant gains in broadband adoption, it still lags far behind other countries in terms of the average speeds available over broadband connections (Little, 2005). Broadband in the US is among the "slowest, most expensive, and least reliable in the developed world" (Bleha, 2005). The slower adoption of broadband service in this country is likely due, in part, to economic reasons. The price charged by telecommunications and cable operators is quite high and had steadily risen to a point out of the price range for many lower income households (Cooper 2004).

Secondly, those involved in the BTOP debate agree that access to information and communication technologies shapes users' life chances and capacity for civic engagement. In the US, ICT is seen as central to participation in the knowledge-based economy and thus wedded to wealth, power, and prestige. For instance, people who have access to and the skills to use the Internet are (1) more successful economically, with respect to education, jobs, earnings, (2) socially participate more in terms of political and civic engagement, and (3) receive more government services and other public goods than those who do not (Katz and Rice 2002; Kennard 2001; Oden 2004; Oden and Strover 2002; Tufekcioglu 2003; Robinson, Kestnbaum, Neustadtl and Alvarez 2000; Shah McLeod, and Yoon, 2001; Freeman 2002; Goss and Phillips

2002). Information technology (IT) skills and access are public goods because, like education and libraries, they are capable of providing positive externalities associated with economic growth and democratic governance (Mossberger, et. al, 2003: 5). In some cases, control over information is seen as an essential aspect of autonomy, social mobility and empowerment on par with human or social capital (Schiller, 1996; Oden, 2004; Foucault, 1980; Britz & Blignaut 2001; Norris 2001).

The lack of Internet access is viewed as a major barrier to the full exercise of citizenship rights in the US because it has become pervasive. The Internet is structurally integrated into contemporary life, making it difficult to operate in society without access. The global knowledge economy now comprises a social space where communication is increasingly mediated by electronic means, where access to the Internet is increasingly taken as a given, assumed for the conduct of many types of economic and social exchanges that underpin all three dimensions of public rights; civil, political and social. Thus access becomes viewed as indispensable, and exclusion from the global network becomes a political issue (Hoffman, Novak and Venkatesh, 2004).

Third, those discussing the BTOP agree that the US has a long history of telecommunications-related social policy aimed at providing universal service to communications services that were deemed social goods and necessary for a minimum quality of life. Despite the equally long history of private ownership of most telecommunications infrastructure in the US, there have been significant efforts to regulate these private industries with the intent of forcing providers to make universal, affordable, and adequate quality communications service available to all citizens. Claims such as these provide a strong case for federal government intervention to provide access to all citizens, not just those who are already advantaged.

In the early part of the 1990s the Clinton/Gore presidential administration began to frame the Internet as a public good and used the power of the federal government to encourage its growth (Kvasny and Truex, 2001). This administration continued the historic trend of universal service in the US. Universal service is an enabling policy tool for allowing citizens to participate in societal activities. The term “universal service” entails not only physical access to communication and computing devices, but also individual/domestic adoption and usage of these devices. It aims to ensure adequate facilities at reasonable charges, especially in rural areas, and to prevent discrimination on the basis of race, color, religion, national origin, or sex.

The Internet’s rapid diffusion in the US during the late 1990s was influenced by a wide range of federal policies: the privatization of the Internet early in the decade; the decision to exempt online sales from federal tax; Commerce Department grants for projects that brought new communication technologies to low-income communities; and the federal “E-rate” policy of subsidizing investments in Internet technology by public schools and libraries (DiMaggio, Celeste and Shafer 2004). Such efforts follow a long tradition of universal service policies that attempt to provide low cost telecommunication services both to low-income persons and those living in areas where it is costly to provide such services (i.e. rural areas).

It is from this point that the story begins. President Obama and his administration as well as those representing scientific and research institutions commonly agree that the state of broadband in the US is at a crisis point, that is it essential to address this problem and that government must play a role in that solution. Where this story becomes interesting is when the question of what role scientific institutions should play in that solution is asked and there are multiple answers.

METHODOLOGY

The research presented in this paper is the result of the first phase of three phases of a larger research project. The overall research question driving this work is, "Are there direct and/or indirect effects of the ARRA broadband stimulus funding on academia, eScience and large-scale computational science?"

The intention of this first effort is to understand the basic policy environment in which the call for proposals has been released. Before the first ARRA-BTOP awards are made, we gathered data concerning (1) the language in the initial general stimulus Act, (2) language in the subsections focused on broadband stimulus, (3) the language as expressed by the Obama administration and members of the NTIA administering this portion of the stimulus policy, and (4) the response of potential respondents from universities and those representing higher educational institution interests.

The data come in two forms, transcripts of interview data and textual documents found in the policy environment concerning the BTOP, the NTIA, the NOFA and the role universities might play in the funding process. To date six interviews have been conducted. Each interview lasted 60-75 minutes. These interviews are not to be seen as conducted at the individual level, but rather as representative of key institutional interests. Each interview was conducted with a representative from a stakeholder from an institution with significant vested interest in the BTOP funding process, specifically related to academic, scientific and research institutions. The institutions represented here are (1) a large national scientific funding agency, (2) A US government agency directly involved in the issue, (3) a state higher educational consortium, (4) a large state-sponsored university, (5) a national networking organization, (6) a law firm/consultancy group advising potential applicants. These interviews were recorded, transcribed, and coded using an open coding system. The documents were analyzed using the same codes as developed by the interviews as well as some open coding. The observations led to better quality coding of both the interviews and documents in that provided much-needed context.

Documents were gathered during the months between February 2009 and August 2009, after the signing of the ARRA into law, during the pre-proposal phase, and during the submission phase. Documents were gathered manually from the Internet using key terms such as BTOP, cyberinfrastructure, eScience, NTIA, anchor institutions, science, among many others.

The method of analysis was to conduct a discourse analysis of the interview transcripts and documents. Discourse analysis enables access to the ontological and epistemological statements behind a project, an assumption, a method of research, or - to provide an example from the field of Library and Information Science - a system of classification (Budd and Raber, 1996). In other words, discourse analysis enables us to reveal the hidden motivations behind a text or behind the choice of a particular method of research to interpret that text.

Discourse is therefore a complex and arguable term with a history in many different disciplines. However, Van Dijk's (1985) approach to discourse as "language usage" and discourse analysis as the examination of "text and talk in context" is helpful in encapsulating what is perhaps the main feature of discourse analysis: a significance in how social context works together with the use of language. Researchers from both the social and linguistic framework traditions share this belief. As a result, they perceive discourse as a type of social action. For both traditions, the goal of discourse analysis is to understand how the use of language has social content/effects.

They ask key questions about how language is used, why it is used, by whom, to what and in what circumstances (Hasting, 2000).

It is important to understand that within the bounds of this case study we conduct policy analysis. Policy analysis is defined by Nagel as associated with determining the nature, causes, and effects of government decisions or policies designed to cope with specific social problems (Nagel, 1980, p.3). Policy analysis often is speculative in nature, using available data and likely outcomes from similar policies in other situations to anticipate the outcomes of a policy in any given situation.

PRO-SCIENCE POLICY ENVIRONMENT

Since 2007 President Barack Obama and his staff, and later his administration, have been wooing the American scientific community. Part of this courtship has been in the form of public rhetoric around the importance and value of science and part has been in the form of government stimulus funding going directly or indirectly to scientific institutions. In this climate scientists and academic and research institutions have received more rhetorical and financial support from the federal levels of administration than in several decades. During his candidacy for President, Barack Obama stated,

> Ensuring that the US continues to lead the world in science and technology will be a central priority for my administration….I'll change the posture of our federal government from being one of the most anti-science administrations in American history to one that embraces science and technology…My administration will increase funding for basic research in physical and life sciences, mathematics, and engineering at a rate that would double basic research budgets over the next decade. We will increase research grants for early-career researchers to keep young scientists entering these fields. We will increase support for high-risk, high-payoff research portfolios at our science agencies." (30 August 2008 Science Debate 2008, http://www.sciencedebate2008.com/www/index.php?id=40)

To back up these claims, in 2009 President Obama signed the American Recovery and Reinvestment Bill (ARRA) into law for $787 billion dollars. This included $21.5 billion for research and development, of which $18 billion will go directly to researchers. The remaining $3.5 billion is allocated for facilities and equipment. These monies provided a much-needed boost to the support of science and research that had been reduced, limited, or removed during the previous decade. While many in the government spoke about increasing funding for scientific research, many scientists had remained skeptical. The creation and signing into law of the ARRA was the first step by the new presidential administration to show support for the rhetoric of the election and underlined the actual support within the federal government for the work of science. This change led to a general climate of scientific enthusiasm.

Continuing this trend, on April 27, 2009 at the National Academy of Sciences, President Obama proposed an ambitious plan to invigorate science in the United States. He stated,

> "I believe it is not in our character, the American character, to follow. It's our character to lead. And it is time for us to lead once again. So I'm here today to set this goal: We will devote more than 3 percent of our GDP to research and development. We will not just meet, but we will exceed the level achieved at the height of the space race, through policies that invest in basic and applied research, create new incentives for private

> innovation, promote breakthroughs in energy and medicine, and improve education in math and science. This represents the largest commitment to scientific research and innovation in American history. Next, we are restoring science to its rightful place. On March 9th, I signed an executive memorandum with a clear message: Under my administration, the days of science taking a back seat to ideology are over. Our progress as a nation –- and our values as a nation –- are rooted in free and open inquiry. To undermine scientific integrity is to undermine our democracy. It is contrary to our way of life."

The various pro-science announcements made by the White House, following so closely on the heels of the ARRA further increased universities hope for an increase in funding flow into their badly wanting coffers. As the costs of doing scientific research and development increased and the US economy continued to worsen, many universities saw such pro-science rhetoric as an encouraging hope. Drawing from our interviews with potential applicants for the broadband stimulus funding we found that this feeling of hope, enthusiasm and expectation around e-science and the stimulus funding was widely experienced and interpreted as applying directly to their interests. One applicant from a university networking group stated,

> "The Obama campaign started talking about broadband, started talking about science and technology so people were getting a little excited and giddy and so on and he got elected and the transition started very rapidly and all of a sudden we got – we were pointed to a document that had appeared on the computing research association's Web page about e-science…and we're told it was well received and we were told that at least in the Obama administration's version of what the stimulus should look like it was in there and it was a billion dollars for cyberinfrastructure for e-science."

While the general political climate seemed to be favorable to the American scientific community, it also became clear that for some in the Obama administration that there was a direct link between the enhanced scientific climate and the need for enhanced broadband Internet. On April 2nd, 2009, Mark Seifert, the Senior Advisor to the Assistant Secretary of the National Telecommunications and Information Administration (NTIA) spoke to the Subcommittee on Communications, Technology, and the Internet Committee on Energy and Commerce of the U.S. House of Representatives. He said,

> "Our scientists, universities, and researchers will need better broadband connections to continue our great tradition of innovation…We want to start taking steps to ensure that our schools, universities, libraries, community centers, job training centers, hospitals, and public safety personnel have high-speed access. We have been asked by Congress to focus on funding high-speed connections to these community anchor institutions…We want applications that will provide researchers and scientists at universities and other institutions the broadband connectivity they need to compete with the rest of the world. Schools, universities, libraries, community centers, job training centers and hospitals are all community anchor institutions that need broadband connectivity. We view these grants as a test-bed or proof of concept for sustainable, viable, and scalable projects…With access to broadband and the skills to use it effectively, Americans will be better able to compete, succeed, and lead in the 21st century's knowledge-based economy."

Both the overall climate of scientific enthusiasm and the specific encouragement by the NTIA toward academic anchor institutions led to a belief that the funding allocated for broadband

stimulus was intended, at least in part, for cyberinfrastructure plans and projects. Such comments highlighted that this was a federal level of support for developing the infrastructure for performing scientific research. In addition, such comments highlighted the acknowledgment of the role of universities acting, as centers for not only research, but also as sources of community interaction and knowledge dissemination. Drawing from our interviews with officials representing potential applicants, we attest that this public rhetoric was perceived by the community and internalized in their planning for future broadband projects. A representative from a university networking institution stated,

> "So they told us to go after it. We were watching the TV before the actual notice of funding availability came out as to what things were being said. Public statements made by a guy named Mark Siefert over at NTIA in a Congressional hearing – and op-ed piece by Commerce Secretary Gary Locke, a couple of comments made by Susan Crawford in some speeches and so on – all seemed to indicate that they were thinking in terms of focusing this money on an anchor institution strategy."

A general environment of support for anchor institutions, such as universities, as well as a focus on developing and supporting the high cost, high payoff work of science encouraged many institutions that they would be recipients of support and funding from the national government. Many institutions began to prepare for the announcement that funding will be made available as they drafted initial arguments.

OFFICIAL LANGUAGE AND EXPRESSED GOALS

On February 17, 2009, President Obama signed the American Recovery and Reinvestment Act of 2009 into law. The essential goal of the ARRA is to provide a ''direct fiscal boost to help lift our Nation from the greatest economic crisis in our lifetimes and lay the foundation for future growth.'' Accordingly, the ARRA identifies five overall purposes:

A. To preserve and create jobs and promote economic recovery;
B. To assist those most impacted by the recession;
C. To provide investments needed to increase economic efficiency by spurring *technological advances in science* and health;
D. To invest in transportation, environmental protection, and other *infrastructure* that will provide long-term economic benefits; and
E. To stabilize state and local government budgets. (Federal Register/Vol. 74, No. 130/Thursday, July 9, 2009/Notices)

There is a total of $7.2 billion appropriated for broadband funding in the American Recovery and Reinvestment Act of 2009, Title VI (Recovery Act, Public Law 111-5): (1) $4.7 billion will go to the "Broadband Technology Opportunities Program" that will be administered by The Commerce Department's National Telecommunications and Information Administration (NTIA); (2) $2.5 billion to a broadband deployment program administered by The Agriculture Department's Rural Utilities Service (RUS). The BTOP intends to provide consumers in unserved and underserved areas of the United States with broadband access, and ultimately stimulate economic growth by facilitating supply and demand for broadband services, creating related jobs, and narrowing gaps in broadband deployment and adoption.

Besides the purpose of enhancing overall broadband access, a maximum $350 million out of $7.2 billion will be allocated for the NTIA to create and maintain a nationwide broadband inventory map pursuant to the Broadband Data Improvement Act (Pub. L. No. 110-385) and to develop a national broadband plan through the Federal Communications Committee (FCC).

The NTIA and RUS have cooperatively developed a grant application process. The NTIA has developed the guidelines and procedures for the BTOP, and published the Notice of Funds Availability and Solicitation of Applications (Notice) on July 8, 2009 that establishes eligibility criteria and funding conditions pursuant to the ARRA. On August 7, 2009, the NTIA released the Federal Register Notice clarifying the information requirements for the Program awardees. The Notice provides that applications must be accepted by August 14, 2009, at 11:59 p.m. Eastern Time (ET). The NTIA intends to make initial grant awards in the fourth quarter of 2009 and complete the whole grant awards by September 30, 2010. A separate NOFA regarding the broadband map will be published.

The RUS has also developed grant application procedures. Unlike the BTOP program, a hard deadline for use of RUS funds is not stipulated by the ARRA, but timing will still be a factor in evaluating grant applications to the extent that those projects that "can commence promptly following approval" will be prioritized.

The rationales or rules of broadband stimulus funding reflected in the BTOP and RUS funding are: (1) Utilitarianism; (2) Competitiveness; (3) Expeditiousness; and (4) Completeness.

The ARRA intends to upgrade the nation's competitiveness by achieving the balanced improvement in both the accessibility and quality of national infrastructures in the shortest possible duration of time. For this purpose, the Act places a priority to the applicants and projects which pursue the public interest in unserved and underserved areas of the nation and which would be undertaken promptly upon granting and completed with the fund granted in the designated timeframe that the Program pursues. The projects and technologies that would provide or improve the broadband life for as many people as possible and as efficiently as possible as long as those projects and technologies do not conflict with technological neutrality. As a part of this purpose, the same project is prohibited to be funded by both the NTIA and RUS.

During the first half of 2009, potential academic institutional applicants for the stimulus dollars directed at broadband initiatives (Section 6001 of the ARRA) believed that points 3 and 4 below, would be the purposes through which much of the broadband stimulus dollars would be channeled. They interpreted the focus as one on technological advances and building infrastructure as the mechanisms by which the economy would be stimulated.

Section 6001 of the ARRA establishes a national broadband service development and expansion program to promote five core purposes:

1. To provide access to broadband service to consumers residing in unserved areas of the country;
2. To provide improved access to broadband service to consumers residing in underserved areas of the country;
3. To provide broadband access, education, awareness, training, equipment, and *support to community broadband capacity at entities, such as community colleges* and public libraries, that permit the public to use these computing centers.
4. To improve access to, and use of, broadband service by public safety agencies; and
5. To stimulate the demand for broadband, economic growth, and job creation. (Federal Register/Vol. 74, No. 130/Thursday, July 9, 2009/Notices)

Again, the potential academic institutional applicants for the broadband stimulus funding interpreted this language as focused on funneling dollars through institutions such as

universities, colleges and libraries to meet the goals of the overall ARRA and ensure better broadband coverage.

The BTOP comprises three categories of projects: Broadband Infrastructure, Public Computer Centers, and Sustainable Broadband Adoption. The Broadband Infrastructure category, which consists of two components—Last Mile and Middle Mile— will focus on delivering broadband access to unserved and underserved areas. The Public Computer Center category will dedicate funds to enhancing both the quantity and quality of public access to broadband service by increasing the broadband capacity of public entities such as community colleges and public libraries. The Sustainable Broadband Adoption category will be focused on promoting broadband awareness and demand among vulnerable population groups who have underutilized broadband technologies through broadband education, training, support, etc. (Federal Register/Vol. 74, No. 130/Thursday, July 9, 2009/Notices)

After President Obama signed the ARRA into law, many institutions felt their earlier optimism was well founded since the core purposes of the law included several areas where their needs could fit with the requirements of the law. However, despite the signing of the bill into law the first round of funding had yet to be announced and many institutions searched for more information as they drafted their initial proposals and groundwork based off of what they saw as the connection between the focus of the new law and their own role in it.

INITIAL INTERPRETATION OF THE LANGUAGE AS FAVORABLE TO UNIVERSITIES, RESEARCH AND SCIENTIFIC COMMUNITIES

From our interview data, it is clear that the period of time between the initial signing of the ARRA bill into law in February 2009 and the release of the NOFA on July 1, 2009 was a time of hopeful speculation as to the role the academic, research and scientific communities would play. Most of our respondents believed that the scientific community and the anchor institutions which supported them, would be the key applicants for the BTOP funding. A representative from a university networking institution said,

> "Look, the sort of dream of getting an NSF program didn't happen in the stimulus bill, but there was this $7.2 billion in broadband money that was put into the broadband culture at NTIA. It's for networking and there's enough in the language that makes it ambiguous as to where the money is gonna go."

Another potential applicant from a State level educational institution stated,

> "Given the leading role of higher education as pulling the network forward for 30 years now--from the first DARPANET stuff to NSFNET to every state of Internet evolution—it has been pulled by the academic community. We think you guys should go in and try to get a piece of that. We can't tell you how to do it and we can't – we're just giving you sort of council and advice."

The ambiguous nature of the wording associated with the ARRA allowed many to read meaning into the law that would allow them to take advantage of their placement in the community to receive funding from the ARRA to support their cyberinfrastructure needs. As one commenter pointed out the government has turned to the university system to do the development of cutting edge communications research in the past. Given this fact along side the general rhetoric of the administration, a strong case for broadband funding being distributed through the institutional anchor system could be made. Considering the financial state of many of these anchors, as well

as some initial disappoint that many of the federal funding initiatives were cut, could have lead many institutions to seek out hope for support for their cyberinfrastructure projects.

Several of our potential applicants had direct interactions with representatives from the NTIA, and other members of the Obama Administration around this issue. The feedback they received encouraged them. One member of an academic networking group said,

> "You're gonna have to compete like everyone else in the broad general program. But we think that as anchor institutions and institutions that lead in the communities that you're located, you should be well-positioned to do well."

It was common across all interview subjects that they believed universities had a special role in creating networks, technological innovation and as economic drivers. This belief was further fed by comments from funding agencies during feedback sessions, reinforcing the idea that the role of anchor institutions and the meeting of their needs remained an important issue for the administration when distributing funding. This special role led them to believe that they would also have a special role to fill in the BTOP program. A representative of a law consultancy firm working with a potential applicant stated,

> "Now, with regard to universities, universities have really always been among the leaders in connectivity. The Internet was invented by them. They usually have pretty cutting edge connectivity on campus relative to anywhere else, practically anywhere else you could think of…So I'm not sure that the intention of the act was so much to improve the connectivity for universities, per se, as it was to have them be an anchor, or one of the anchors, for the deployment of more private sector competition in a community, or a public sector, or competition, competition by any sort of broadband in a community."

The interviewees interpreted the language of the ARRA as anchor institutions, like universities, would play a key role in drawing high-speed access to communities. One interview subject stated, "The act seemed to look to those community anchor institutions as having enough demand to make it worthwhile for more providers to come into a community where they need it…the end wasn't to provide more connectivity necessarily for those places. They were a means to the end of increasing connectivity to the area generally."

Ambiguous language as well as a general government support for science and scientific endeavors by the university system encouraged many early interests in the funds allocated to the NTIA. Many of these early hopefuls understood that they would need to compete with others for access to the funding. Many universities believed that their roles in network development in the past as well as their function as community anchors placed them in a unique position to be able to develop the broadband of the future while still acting as funding funnels to the local community. However, with the release of further information many of these communities were forced to re-evaluate their initial optimism.

NOTIFICATION OF FUNDING AVAILABILITY BRINGS CONFUSION AND DISSAPOINTMENT

On July 2 the NTIA and the RUS released their initial "Notice of Funds Availability" (NOFA) with respect to two broadband-related programs funded through the ARRA of 2009.

Surprising many of the potential applicants, the first NOFA emphasized the first two purposes of the BTOP program, rather than the remaining three.

1. To provide access to broadband service to consumers residing in *unserved areas* of the country;
2. To provide improved access to broadband service to consumers residing in *underserved areas* of the country;

According to NTIA and RUS, an "unserved" area is defined as the area where terrestrial (fixed or mobile) broadband of which the minimum downstream is 768 kbps and upstream 200 kbps is not available to 90% or more of the households.

An "underserved" area features any of the following three characteristics: "(1) no more than 50% of the households have access to facilities-based, terrestrial (fixed or mobile) broadband service (minimum advertised speeds of at least 768 kbps down and 200 kbps up); (2) no fixed or mobile broadband service provider advertises downlink speeds of three megabits per second (Mbps) or more for the area; or (3) 40% or fewer of the households in the area subscribe to broadband service." (http://www.ntia.doc.gov/frnotices/2009/FR_BBNOFA_090709.pdf)

BTOP has been effectively reinterpreted by NTIA as a rural-focused program, and further limited to only those rural areas where no basic DSL or cable modem service is advertised, contrary to the statutory language and legislative history (Meinrath and Hovis, 2009). According to interview data, the potential applicants for BTOP funding have interpreted this in similar ways. A representative from a legal consultancy advising an applicant said,

> "It was a total surprise, just the very tight focus on this first round toward truly rural and really underserved areas. You're absolutely right. It makes it very difficult to justify serving these community anchor institutions because, by and large, these places are in population centers, which makes it very difficult given the restricted definition of underserved to qualify. So it's real tough."

Although the BTOP is supposed to put an equal emphasis on each of the five purposes by the ARRA, the NOFA effectively prioritizes the first two purposes (serving "unserved" and "underserved" areas), creating prerequisites for projects that address the other three purposes (community anchor institutions/vulnerable populations; public safety; and job creation/economic development). This has resulted in community anchor institutions and middle mile projects in non-underserved areas become ineligible for the BTOP. For instance, specific groups (e.g., first responders) and institutions (e.g., schools, libraries, and health care facilities) which require higher quality broadband of 100 Mbps or gigabits speed would not be eligible to apply for the BTOP funds because they are located in served areas where hundred Kbps broadband services are already available. (Meinrath and Hovis; New America Foundation, July 2009). According to the Ed-Tech Action Network,

> " …the rules governing this first of a projected three rounds of funding are extremely complicated and appear to target residential areas that are unserved or underserved by broadband. Schools, libraries and health care facilities – so-called "anchor institutions" on which ARRA appeared to place a premium for broadband connectivity – received relatively short shrift in the 121 pages of funding program rules released on July 1st." http://www.edtechactionnetwork.org/uploads/Information_regarding_NOFA_Grants.pdf

The problem with this focus on the underserved and unserved is that it focuses the program on delivering broadband service to individual, residential consumers, not institutions. According to the New America Foundation,

> "The NOFA provides for funding of last-mile projects (to residences and community

> anchor institutions) and middle-mile projects (that deliver capacity for other entities to bridge the last mile). To our surprise, however, the NOFA effectively makes the first two purposes of BTOP (serving unserved and underserved residences) prerequisites for addressing the three other statutory purposes by requiring that both last-mile and middle-mile projects demonstrate that they will serve areas that meet the definition for unserved or underserved *residential* service." (Meinrath and Hovis; New America Foundation, July 2009)

John Windhausen, representing the Schools, Health and Libraries Coalition stated,

> "The NOFA applies the terms "unserved" and "underserved" to anchor institutions, even though the statutory language does not. (In the statute, these terms only apply to residential consumers.) The result is that thousands of libraries, K-12 schools, colleges and universities, hospitals, health clinics, and other anchor institutions in urban and suburban areas that provide critical services to the public will not be eligible for BTOP funding. We respectfully ask that notions of "unserved" or "underserved" not be applied to anchor institutions." (Windhausen, Schools, Health and Libraries Broadband Coalition, July 2009)

Again from interview data, a potential applicant from a university system stated,

> "There's a few things that were kind of strange. After reading the NOFA, I have to say that I didn't see a place for higher education or science or even large institutions in any kind of urban area in it."

While the NOFA is clear that these two criteria should be emphasized in all applications, what is not clear is the method by which the applicant can determine how unserved or underserved an area is. It is recognized that it is difficult to determine with any accuracy who is receiving service in an area already served by at least one broadband provider. It is possible that most telecom providers will not disclose how many subscribers they have, especially if it means helping a government-subsidized competitor come into the market. Those companies will also have the right to challenge applicants' claims about service or the lack thereof.

Many of the respondents to this work expressed their opinions of the NOFA with frustration and disenchantment. Another interviewee representing a university networking institution stated,

> "Focus on rural. Anchor institutions were mentioned but they weren't mentioned in any special way. There was no mentioned of a higher standard for serving them so 786 kilobits is apparently good enough to connect a library, which is a joke. And so now the higher ed is having a hard time trying to figure out where they fit in to the NTIA."

According to the Ed-Tech Action Network,

> "…overall the NOFA appears to be focused on using funds to provide services to residential areas rather than to anchor institutions like schools. Sadly, the NOFA takes little notice of the statute's focus on serving key community institutions, like schools, libraries and health care facilities, and provides little incentive for providers to serve or partner with such institutions. For instance, when prioritizing applications for funding, the NOFA gives no additional points in its scoring of applications that are focused on serving anchor institutions."
> http://www.edtechactionnetwork.org/uploads/Information_regarding_NOFA_Grants.pdf

The result of this disconnect is that the subjects of this research viewed the NOFA and initially saw no place in it for academic and scientific institutions. One research subject stated,

> "The bottom line is that I don't think the NTIA broadband program meets the needs of the high-end research community for an ever-improving advanced networking environment that would enable e-science. I think that the federal government needs to relook at this issue."

This initial change in the focus and requirements to apply for the first round of funds from NTIA changed the first views that many institutions had regarding their ability to access these funds for the creation and implementation of cyberinfrastructure projects. The change in policy wording, created a great amount of reflection among many anchor institutions as to whether they fulfill the requirements of this policy. The views of many potential participants changed dramatically after the release of the NOFA as they re-evaluated their current proposals and made decisions about how to handle the seemingly sudden change in goals during the one month period left before proposals were due.

IMPLICATIONS FOR POTENTIAL APPLICANTS

Many potential applicants representing university, research and scientific institutions were surprised by the underserved and residential focus of the NOFA. This has led potential academic applicants to disengage from the application process, wait for later funding cycles hoping for a change in criteria, lobby for these changes to the NTIA, and in some cases, to alter their proposed project to meet the needs of the call by the mid August 2009 deadline. The criteria of "unserved" and "underserved" have effectively been made prerequisites for all infrastructure projects. This suggests that potential applicants will need to refocus or limit proposals to such areas. For example, the service area for both last-mile and middle-mile projects must be defined carefully to ensure meeting two of the restrictive criteria for the definition of "underserved." When asked how potential applicants from universities were responding, one interview subject stated,

> "Enormous frustration. Enormous amount of – I'm still trying to figure out whether they can take their ideas because they have spent months thinking of their ideas about getting ready for proposals and so on and whether or not they can fit their square pegs in round holes of the NTIA NOFA or not. Many of them come to the conclusion that they cannot. Particularly campuses. Campuses are particularly frustrated and feeling this program isn't for them."

A representative from a State Higher Education Organization found his hopes diminished. He stated,

> "We had some private discussions both before the NOFA came out and right after the NOFA came out we had a couple of conversations with people saying this doesn't make sense; this is not what we expected, this is not gonna make it easy for us to participate…So it seems to be to me that we're out of sync with that program and unless the program gets revised in the second or third rounds it isn't clear how well that program can meet the needs of e-science and cyberinfrastructure on campuses."

Another interviewee discussed the Regional Optical Networks (RONs), which were anticipating applying for the first round of funding. He said,

> "Some of the RONS, some of the national networks are still trying to figure out whether or not it's worth a shot. I mean literally [omitted] hasn't decided yet whether we're applying but we're still on the table. We have three weeks to get it done. We've done some work but it's very frustrating because it doesn't fit very well. And it's led us to the conclusion that while we may or may not take a shot at it the chances of success are low…And I know that even the RONS are having a hard time figuring out how they can meet the specifics of the NTIA. And they were – they all have upgrade plans and extension plans so they can reach 30 miles down that road to get to that institution."

A representative from a law consultancy firm representing several academic potential applicants stated,

> "I think it's really – what's gonna happen is that the responses in the first round are going to be – there will be much fewer responses than they expect in the first round. Then Round 2 will be overloaded because a lot of people are holding off by just the function of time, the time crunch and also just maybe to see if the terms change for Round 2."

Across all interview subjects it was clear that they experienced some frustration and uncertainty around the release of the NOFA. This was best expressed by one subject who said,

> "They all have plans; they also all were working with their state governments to try to integrate into a state plan and now many of them are just sort of scratching their heads. They haven't all given up but they're scratching their heads about whether or not it's going to work."

The initial response after the first round NOFA was disappointment and many potential applicants felt that simply withholding their application would be the best response given the restrictive nature of the call. Overall, the feeling was one of disappointment at the disconnect in reasoning between the initial atmosphere of support for large science and the focus on unserved and underserved residential communities that almost explicitly exclude many larger universities and other community anchors. Many others, however, focused on identifying the problem which lead to this disconnect and examining how institutions like large universities act as community anchors for fulfilling the original goals of meeting community broadband needs.

MISUNDERSTANDING

The universities, research and scholarly institutions, which are the subject of this research were surprised by the focus on residential, rural and underserved individuals. Underlying this misunderstanding is a fundamental disconnect between views on how to best stimulate the economy. Those who represented the institutional viewpoint believe that institutions are best able to increase broadband coverage, speeds and quality to the citizens of the US at the best price. According to the Computing Research Association,

> "America's colleges and universities and their partners have the knowledge, the experience, the foundation network infrastructure, and the track record to jump-start a national broadband vision and strategy, leveraging federal ARRA investments in ways that will spread broadband, create jobs, improve health, push the frontiers of science, and educate young people." (Lazowska, Smarr, Lee, Elliot, West, Lassner, Houweling, Bachula, Fox and Lance, http://www.cra.org/ccc/docs/init/Unleashing.pdf)

These institutions believe that by channeling the broadband stimulus dollars through large anchor institutions will have a greater positive effect on the status of broadband in the US than giving access directly to residential consumers. According to Internet2,

> "Our nation's research and Education networks have a proven track record of innovating in networking and its application, of deploying and continually upgrading advanced networks, and of extending those networks to the unserved and underserved across our nation… We may be the only group in the country that has the experience, the collaborative capabilities, the networks, and the users to effectively launch new mechanisms on a national scale for ensuring access, achieving affordability, evaluating progress and advancing the Federal Policy goals. " (Catalyst, http://www.internet2.edu/government/files/Call-for-Participation.pdf)

According to the Computing Research Association in their article published in April of 2009, "Unleashing Waves of Innovation: Transformative Broadband for America's Future" There are seven reasons why academic institutions should play a central role in the construction of broadband infrastructure for the US.

1. Colleges and universities are innovation incubators.
2. College and university applications drive advances in networking.
3. Colleges and universities have a four-decade proven track record in deploying, managing, operating, and continually upgrading advanced networks.
4. Colleges and universities also have a proven track record, working in concert with state, regional, and national research and education networks that they created, of reaching unserved and underserved communities with connectivity and content.
5. Colleges and universities today are preparing tomorrow's innovators, workers, and consumers – tomorrow's doctors, nurses, police, firefighters, managers, government leaders, and technologists.
6. Colleges and universities serve as neutral territory for open, non-proprietary, unclassified advances, fostering close partnerships with and among industry and government and across all sectors ranging from education to health care.
7. Colleges and universities are catalysts for local, regional, and national economic growth. (Lazowska, Smarr, Lee, Elliot, West, Lassner, Houweling, Bachula, Fox and Lance, http://www.cra.org/ccc/docs/init/Unleashing.pdf)

Part of the frustration expressed at the NOFA was actually a frustration with a lack of understanding of the role of universities and the scientific communities as an engine of the economy, especially the knowledge economy. One of the research subjects stated,

> "They all seem to not understand the historical role of the university networking communities who are pulling everybody else. That's where the applications are developed, that's where the Web came from, that's where Google research came from. I mean everything came out of the academic community and then spilled over into the commercial world. "

When asked directly how broadband stimulus dollars, if given to anchor institutions like universities, would stimulate the local economy and bring broadband to local communities all respondents stated that it emphatically would, but not necessarily directly. A representative of a university networking group expressed some reservations,

> "But it is true on the other side of it if you invest a significant amount of money in a very advanced cyberinfrastructure it doesn't automatically mean that the community around that campus is going to be improved unless there's some conscious decision to work with that community and some partnerships and some other kinds of things that can be done."

Most subjects stated that there were several mechanisms that would increase broadband access, use, speeds and quality in the local community. Some believed that as employees and students became accustomed to using high speed, high quality ubiquitous broadband connections at the university they would then demand similar speeds at home and in future employment arrangements. Still others believed that universities provided innovations and content that would drive local business and consumers to seek better speeds and quality. A representative of a higher educational state organization had a very clear idea of how the university's access might more directly impact the local community. He stated,

> "They [the Universities] pay for very, very fat pipes to leave their campuses and hit the Internet and so on--the backhaul, as they would call it, to get outside. Well, if a local ISP could access that backhaul, and maybe access it at a very favorable rate, then its investments could concentrate on what it takes to go down the street to a new neighborhood. And all that it would take is an interconnection between the local ISP and the campus ISP which might be across the street somewhere. Right now they don't do that. Right now the campus backhaul goes out to the Internet and the local ISP has to go out the commercial route to the Internet. They may each travel 35 miles to go somewhere and all you'd have to do is connect it."

For the Computing Research Association, the link between increased access, speeds and quality to the university and the same to the local community is far clearer.

> "A set of coordinated investments that begin with research universities can expand to engage thousands of additional college and university campuses across the nation as anchor partners in restoring the nation's leadership in broadband deployment, utilization, and innovation for all Americans… There is a long and highly successful tradition of major research universities partnering with smaller institutions in unserved and underserved regions of the nation to provide advanced connectivity, making these smaller institutions and regions more competitive… Universities will require their regional and national networks to partner with efforts (federal and state) to reach out and connect their medical facilities with rural and underserved populations." (Lazowska, Smarr, Lee, Elliot, West, Lassner, Houweling, Bachula, Fox and Lance, http://www.cra.org/ccc/docs/init/Unleashing.pdf)

Universities recognize the historical role that they have played in the development and implementation of newer Internet technologies and feel that their role as innovators has placed them front and center as sources of new technologies and consumer demand in both the local and national levels. Many argue that universities act as centers that drive demand for better network connections through the demands by university workers and partners in the local community. Many representatives acknowledge the needs of their community and focus on the importance of helping unserved and underserved communities connect to and engage in the developing networked world and knowledge economy.

DISCUSSION

At its core, this is a story of misperception and misunderstanding. The story began with a sense of common purpose in several areas. Those involved in creating the BTOP as part of the ARRA, as well as those potential applicant all commonly agreed that the US has poor broadband availability, speed and quality in comparison with the rest of the developed world. Second, they agreed that broadband Internet has the potential to significantly impact the quality of life of US citizens and encourage economic and social development. Third, they agreed that the Federal government should take a direct role in addressing the problem.

Taking off from this point of agreement, the scientific and research communities also believed they were to play a significant role in addressing the problem of insufficient broadband in the US. These institutions believed this for several reasons. First, they believed that the political climate in the US was favorable to science and research in general. Second, they believed that science played a large role in the language used in the ARRA. Third, they believed that the BTOP language, which referred to anchor institutions was referring to universities and research institutions. Fourth, they believed that there exists a significant and irrefutable track record of universities playing a role in both telecommunications and economic development. Lastly, drawing from public comments made by President Obama and his administration, they wove all of these items together to create the belief that growing science and growing broadband went hand in hand.

When the NOFA was released, the scientific and research institutions were met with prerequisites, restrictions and policy that did not favor scientific institutional involvement in solving the broadband problem in the US. At this point the differences in beliefs between the funding agencies and the scientific institutions came into conflict. The story changed from on of agreement to one of misunderstanding and disagreement. The central question is from where did this disagreement stem?

The source of the disagreement could be traced to fundamental differences in opinion about the role of broadband connectivity for individuals within the United States. There are two possible views for this role: individual rights and social benefits. Going back to the original problem of providing high quality, high-speed, ubiquitous broadband one must draw upon the concept of universal service. Universal service is an enabling policy tool for allowing citizens to participate in societal activities. The term “universal service” entails not only physical access to communication and computing devices, but also individual/domestic adoption and usage of these devices (Schement & Forbes, 1999). According to Sawhney (1994), universal service policy for regulating the Internet tends to focus on either the rights of individuals or the social benefits to society. The individual rights argument asserts that every American has a right to access to modern telecommunication service by the mere virtue of being a citizen. In the social benefits argument, the overall benefit of the system is seen as an economic justification for pouring resources into universal service. This principle has been applied to telecommunications, education, fire and police service, and other important public services. It is in the interest of society that every member contributes to the cost of providing universal services. It is only by examining the differences between these two views that we begin to see the fundamental disagreement between the stakeholders around the BTOP issue.

On the one side, there are those that believe that the federal dollars should go to programs that directly provide access to rural, underserved individuals. This viewpoint asserts the individual rights argument that broadband Internet is a public good that must be made available to ever citizen directly. This also can be seen as a form of “trickle up” economics. The trickle up effect

states that benefiting the poor directly will boost the productivity of the society as a whole and thus those benefits will, in effect, "trickle up" to benefits for the wealthy. Proponents of the trickle up effect believe that if the lower and lower-middle classes are given benefits, such as tax breaks or subsidies, the increased funds would be spent at a much higher rate than would the upper class, given similar fund increases. In addition, one could frame this side of the argument as one of empowering the individual directly, encouraging individual agency in society.

On the other side of this issue is the social benefits argument in which the proponents believe the BTOP dollars should go to established institutions, such as universities, who will through the nature of serving the public, will spread broadband Internet indirectly. This side of the argument can be illuminated by the concept of trickle-down economics, the policy of providing tax cuts or other benefits to businesses and rich individuals in the belief that this will indirectly benefit the broad population. Proponents of these policies claim that if the top income earners invest more into the business infrastructure and equity markets, it will in turn lead to more goods at lower prices, and create more jobs for middle and lower class individuals. It is here we see the focus on investing in infrastructure, rather than in individuals. This side of the argument is informed by structure, rather than agency. These supporters believe that anchor institutions are in the best position in society, due to their structure, to have the most impact on the structure as a whole.

This result is the conclusion that the intervention of the federal government in the provision of broadband Internet infrastructure is necessary, and the BTOP is one form of such an intervention. However, the form of that intervention, the recipients of that intervention and the mechanism by which the government provides funding is hotly debated. It is clear that the universities and research institutions involved in this debate espouse this second side of the debate and that the Obama administration and the NTIA, have espoused the first side in the language of the NOFA.

It is a fundamental difference in opinion as to what form of intervention is likely to produce the greatest effect. On the one side, individuals are privileged, taking off from the belief that individual agency will help to grow the system the fastest and in the areas in which it is most needed. By providing broadband access directly to the rural, impoverished and underserved, there can be no question as to whether the federal dollars are going to where the broadband network is the most inadequate. However, the fault with this belief is that often access is not enough. It may be the case that in some of these rural and underserved areas that the population has not been motivated to use the Internet, sees no immediate social or economic value in connections, sees no appropriate content online that might draw them and worse, may not own any divide through which they can connect. Bringing broadband Internet to their homes may not, indeed, be what they seek to solve their economic problems. In this way this direct intervention would have to be accompanied with services, which provided more than access, education, training, devices and support. Metaphorically, this side of the debate is building a paved road to every rural home that connects with all other roads. The problem is that often the owners of the homes have no car with which to drive on the new road and nowhere they wish to go, even if they had a car.

On the other side of the debate, the institutions believe that providing scientific and academic organizations with the ability to create a more powerful and robust basic broadband infrastructure that links institutions will stimulate the economy and thus will motivate more people who are currently not online to get online. The argument is that if the broadband infrastructure has a very strong core (backbone) and passes close to many rural and impoverished areas, local communities and ISPs will make the effort to connect themselves to this core. They also argue that these rural communities and individuals will be motivated to do

so because of the services, technologies and opportunities created by universities as an output of research. The problem with this argument is that there is no direct link to the rural and underserved populations and these same populations will be expected to serve themselves, at least to make the final connection. To carry the metaphor even further, this institutional argument wants to cover the US with superhighways that pass near many small towns. They also claim to build the super fast cars that travel on the highway. They also plan to develop the desirable destinations alongside the highway. They hope that when underserved populations see what is happening on the highway that the individuals, their communities, or local providers will build their own small on ramps.

The differences between these two viewpoints and their underlying belief structures acts as the supporting cause for the story of the BTOP's NOFA and the resulting disappoint and conflict that it created. By carrying additional belief systems derived from outside information about the presidential administration, as well as assumptions about their role in the transference of knowledge and wealth, scientific institutions operated under a conflicting viewpoint to that of the federal government when initially drafting their ideas regarding the broadband funding. These differences in views resulted in a period of disillusionment and conflict for both parties as they felt their expectations were not met. However, there remain several important lessons to be learned from this case, as well as several ways that scientific institutions can still participate in the NOFA as it is currently established.

IMPLICATIONS AND CONCLUSIONS

The initial build up of enthusiasm for the support of science by the Obama administration and the signing of the ARRA into law encouraged many universities to believe that they would have access to government funding for the sponsorship of cyberinfrastructure projects. However, after the release of the first NOFA, for many universities disappointment was felt given the focus on residential connections and many institutions considered dropping the proposals on which they had been working. However, Universities interested in obtaining support from the BTOP still have several options available to them to increase their success in obtaining some funding. There are a number of existing plans for organization that these universities can turn to as a format to structure their proposals in response this first NOFA. By making use of these formats universities still have a chance to overcome what they see as limitations on their participation and fulfill both the requirements of the grant as well as meeting their own needs.

Universities can co-opt existing structures within their organization to serve as new connection and integration centers as per the requirements of the NOFA**.** Many large universities already have some form of outreach or cooperation programs in place to disseminate knowledge and technology from the universities research centers to the state and local areas. For large universities their access and impact can be vast. For example, Graham Spanier estimates that Penn State University has employees "in every county in Pennsylvania, all 50 of the United States, and 80 countries around the world." and that "One in every two households in Pennsylvania has someone participating in a Penn State program." (Spanier, 1999). Penn State is just one among many large universities within the nation who have such a reach and impact. Several such universities working together have the potential to leverage their individual influences to reach many of the underserved communities that are the target of the NOFA proposals. These universities can argue that they are more adequately position to reach a large number of residential households and create demand for as well as supply of high-speed connections distributed throughout the country.

It is possible that many of the universities may propose leveraging or reorganizing along the lines of the grant-based universities (eg. land-grant, sea-grant, sun-grant, or space-grant universities) in acting as regional centers of research as well as dissemination points meant to spread knowledge into the local regions through increasing training and access to technology (Spoth et al, 2004; Spainer, 1999; Schoenecker, Meyers, Schmidt, 1989). Universities may leverage this system in two ways. The first is through an already established support and outreach structure with existing community organizations that encourages, guides, and supports community based response projects meant to address local unmet community needs (Spoth et al., 2004). The second is through bringing to bear the diversity of disciplines and viewpoints that are unique to a university setting to establish and support community programs and teams (Rubin, 2000). Often these teams can be difficult for local communities and businesses to assemble on their own, making the contributions and input from as diverse a community as a university invaluable. Universities can position themselves as intermediaries between local organizations and the government, able to "speak both languages" of the local and governmental (Etzkowitz et al., 2000).

The second way universities may leverage their existing systems is through ties that universities have made with business leaders at the local, state, and national levels. These business ties have often been used to create and disseminate new technologies and other advances so that they can reach the wider public. As Feldman and Droschers (2003) describe the research developments of large universities often spill over into the localized context as researchers and businesses work together on public support projects. Universities can spin their researchers as both consultants and support centers for businesses seeking to make use of university based research (Schoenecker, Meyers, Schmidt, 1989). Many large universities are also participants of large-scale research networks meant to supplement the standard connections they already have. These research networks, such as Internet 2, have already created connections between networking companies and research universities as they work together to create and support these networks.

Should universities choose to pursue an application to NOFA they will likely engage the systems that they already have in place for community outreach. As outlined previously universities will be likely to use their current outreach system or, if lacking one, adopt a system for outreach similar to those found in the grant-based universities that already exist. These universities can act with local organizations and companies to determine the needs of the community and translate those needs to the federal government. The universities may leverage their different disciplines and connections to strengthen the understanding of the community and provide advice and support to local organizations. They may also take advantage of existing relationships to large networking and communication companies to transfer the ties created during the development of university based research networks to the rollout of broadband to the underserved communities. Given their past history of outreach and cooperation meant to enhance the local community many large universities are well placed to take advantage of the first NOFA funding to act as intermediaries and repositories of knowledge to aid in the development of broadband to rural, underserved, or unserved communities across the nation. However, for this to occur many universities will need to see past their initial disappointment with the terms of the NOFA and act to position themselves as unique institutions capable of reaching a wide percentage of the population in the desired communities and able to achieve the goals of residential broadband rollout while still meeting their own needs for an integrated high speed network.

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