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**Local Government Stimulation of Broadband:
Effectiveness, E-Government, and Economic
Development**

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**Local Government Stimulation of Broadband:
Effectiveness, E-Government, and Economic Development**

A White Paper Prepared from
A Proposal to the U.S. National Science Foundation
Program on Digital Government
Division of Experimental and Integrative Activities
Directorate for Computer & Information Science & Engineering

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1. PROJECT SUMMARY

Access to broadband is widely recognized as a prerequisite for a community's economic welfare and the delivery of government services. In communities where the private sector is perceived as having failed to deliver adequate and affordable broadband services, municipal and county governments face pressures to stimulate broadband deployment. However, no systematic data documents the nature and status of municipal broadband initiatives, the comparative effectiveness of alternative policies for promoting broadband access, or their implications for local economic development, private provisioning of infrastructure, and the operation of local government. As a result, hundreds of communities are proceeding independently to develop their own strategy, without the benefit of the accumulated experience of those that have gone before, and with no assurance of success. The objectives of this project are to collect, analyze, and disseminate data about the nature and effectiveness of local government initiatives to stimulate broadband deployment, adoption and use, as well as the effects of such initiatives on local e-government and economic development.

No database exists of local government broadband initiatives. Therefore, the project will create one using a combination of primary and secondary sources, telephone interviews, and survey methods. Data gathering will be facilitated by access to the local government membership of the National Association of Telecommunications Operators and Advisors, a project partner. An innovative multi-dimensional classification scheme will be developed to characterize the range of initiatives along institutional, technical, economic, and organizational lines. This cross-cutting research design integrates across disciplines represented by the project's investigators (computer science and engineering, political science, economics, and public policy) and will use feedback from government managers serving on the project's advisory board. Combined with contextual data about communities, the classification scheme is an essential input to statistical analysis of the characteristics of initiatives that will lead to one part of the project's results. This analysis is designed to answer questions such as: What factors lead a community to undertake or decline to undertake a local broadband initiative? What types of broadband initiatives are undertaken? What characteristics of a community determine the type of initiative taken and its outcomes?

The project will also carry out at least three detailed case studies of local governments in the early stages of problem-solving and decision-making with respect to broadband access. Analysis of these case studies will complement statistical data gathering and analysis and will explain "Class II" (as identified in the program solicitation) aspects of decision-making and effects of initiatives, in particular on economic and governmental development, that cannot be easily measured, particularly within the project's 3-year time horizon.

The intellectual merit of this research is embodied in: (1) its application of existing analytic and theoretical constructs from telecommunications engineering, business economics, and political science to the empirical analysis of local broadband policy; and (2) anticipated theoretical developments addressing the conditions under which public investment in communications infrastructure may be desirable and successful, and illuminating the decision processes leading to such outcomes. This integrative approach will prove valuable to practitioners seeking to understand or formulate local infrastructure policies and to researchers investigating the role of organizational and institutional variables on the development and use of technical infrastructure.

This work will have the following broader impacts. First, it will elucidate models to help government make the best use of scarce resources when partnering with the private sector,

especially in cases that involve rapidly changing technology. Second, identification and dissemination of effective local government strategies will reduce the effort and time required for action, thereby stimulating broadband availability, increasing competition and encouraging ongoing innovation in network infrastructure. Finally, the working hypotheses and empirical findings that will result concerning the relation of broadband to economic development and e-government can guide communities as to what communications infrastructure investments to make—and not to make—in order to maximize the benefit for these core functions.

Communities that traditionally have been underserved by commercial telecommunications providers tend to be rural, low-income, and without a substantial business base. In several regions of the country (for example, the Mississippi Delta), these attributes correlate closely with above-average percentages of minority population. Providing guidance to underserved communities as to how best to achieve the benefits of broadband will disproportionately benefit these historically disadvantaged groups.

In addition to training graduate students, we expect the results of this work to be incorporated into graduate coursework. Moreover, we will develop materials suitable for educating local, state and federal government officials regarding our findings. Further, we hope that the academic-local government partnerships we have established for this project can serve as a model for translating and diffusing research results to a broader public.

2. PROJECT DESCRIPTION

2.1. Objectives and Significance

The importance of broadband

Access to high quality telecommunications and data networking by a community is, in today's economy, a prerequisite for the community's economic welfare and for the delivery of local government services. Where once "telecommunications" meant only plain old telephony, today it encompasses services that go well beyond voice, such as broadband Internet access and even digital television. Over the last decade, the Internet has emerged from the confines of academia to become a mass-market service used by over 54 percent of the population.¹

As the U.S. Department of Commerce (2002) recently noted, "Broadband – high-speed, always-on Internet connectivity – represents the next phase in the evolution of the Internet. Most experts predict broadband will enable applications and services that transform our economy...and usage of broadband will significantly impact the global competitiveness of nations and businesses in the future."

Early Internet use relied on dial-up connections that offer limited capacity (56Kbps or less) and intermittent connectivity. The first generation of advanced services offering "always on" connectivity and expanded capacity (200Kbps to 1Mbps) began to be deployed in the latter half of the 1990s. These include DSL services offered over telephone company copper loops, cable modem services offered over cable television facilities, and a small but growing number of wireless services (satellite and terrestrial). However, there are still significant portions of the

¹ See page 1, National Telecommunications and Information Administration (NTIA) (2002). This includes almost all of the households that have personal computers at home.

population who do not have access to these services. As of April 2001, 87% of large businesses and 85% of medium businesses, but only 56% of small businesses had access to broadband. For households in 2002, some 71% had access to cable modem services, while only 60-70% of households had access to DSL.² However, less than 10% of all households – or 20% of Internet households – were subscribing to these services.³

Moreover, whether many of these services should even be classified as “broadband” has been questioned. The FCC (2002a) defines “advanced services” as capable of providing more than 200 kbps in both directions.⁴ By that definition, many cable and DSL systems do not qualify, as they are constrained to upstream bandwidths of 128 kbps or less. At a mere four times the bit rate, 200 kbps represents only an incremental step up from a dial-up modem. Much higher capacity access networks offering services in the 10s to 100s of Mbps per household (or more) will be needed to fully unleash the potential of advanced communications infrastructure.⁵

Delivering these services will require investment in new facilities and technologies in both backbone networks -- and importantly -- local access infrastructure. The magnitude of the required investment is likely to exceed \$100 billion. In light of the financial problems faced by the telecommunications sector -- including the bankruptcy of many competitive local exchange providers over the last two years and the declining profitability of the incumbent local exchange carriers-- the private sector's ability and incentives to undertake this investment is in doubt.

Pressure on communities to act

In those communities where the private sector is perceived as having failed to deliver adequate and affordable broadband services, municipal and county governments increasingly face pressure to stimulate broadband deployment within their geographic jurisdictions. Pressures arise from current and prospective residents who perceive broadband Internet access as essential to their quality of life; from local economic development organizations who link the availability and affordability of broadband with the ability to attract and retain businesses; and internally as e-government⁶ systems and processes are developed at the local level. Local governments in

² U.S. Department of Commerce (2002), p. 5-6. A recent FCC report (2002a), which notes that zip codes representing 98% of all households have at least one broadband provider, overstates availability as not all households within a zip code may be able to receive service. See also Strover (2001) for further explanation of how geographically aggregated reporting of availability particularly overstates the case for rural areas.

³ See Tables 3 and 4 of FCC (2002a). This overstates household penetration of broadband services because it attributes all 11 million residential and small business lines-in-service to residential households (which number 105 million, as of 2000 Census).

⁴ U.S. Federal Communications Commission (2002b). The State of Pennsylvania, by contrast, defines broadband as at least 1.5 Mbps full duplex (Act 30).

⁵ For example, Senator Lieberman (D-CT) introduced the "National Broadband Strategy Act of 2002" on June 6, 2002, calling for "making affordable, high speed broadband Internet connections of 10 Mbps-100 Mbps available to all American homes and small businesses has the potential to restore structural productivity and employment growth" (see <http://www.techlawjournal.com/cong107/lieberman/20020605.asp>). This goal is also endorsed by a number of the leading firms in the high-technology industry, see Technet (2002).

⁶ By e-government, we mean government's use of information and communications technology for both internal and external structures and functions. At the local level, this includes: Internet-based delivery of local government services to the community (for which ubiquitous residential access is essential to satisfying equity concerns); government's use of Internet access for its own managerial efficiency (e.g. electronic procurement, links with other communities, etc. – for which access to town buildings is essential); and government-provided access to local public schools and libraries. See National Research Council (2002a).

communities with one or more broadband providers may also face pressure to act, if they determine that limited competition provides insufficient incentives for affordable service, innovation, or redundancy for emergency preparedness. Recognizing that the private sector may not adequately invest in broadband capability in many communities, the 2002 National Research Council (NRC) study *Broadband: Bringing Home the Bits* recently identified as a priority the articulation and evaluation of public sector initiatives, particularly at the local level of government, to foster market entry into broadband Internet access.⁷

Notwithstanding these pressures to act, however, local governments lack clear, publicly available guidance on the range of feasible approaches, their applicability to specific local situations, and their effects on core government concerns including economic development and e-government. Indeed, there is no systematic data documenting the current status of municipal broadband initiatives, and even less on the comparative effectiveness of alternative policies for promoting broadband access, or the implications of these policies and broadband access itself for local economic development, private provisioning of infrastructure, and the operation of municipal and county government.⁸ Indeed, some have challenged the advisability of any form of municipal broadband initiative,⁹ and incumbent service providers have lobbied state governments to pass laws limiting the ability of local governments to act. The result is that literally hundreds of communities are proceeding independently to develop their own strategy, without the benefit of the accumulated experience of those that have gone before, and with no assurance of success.

Communities can learn from each others' experience

The goal of this research project is to conduct a systematic, rigorous and multidisciplinary examination of local government initiatives to promote broadband access, with the aim of providing objective information for the benefit of other communities who may be considering their own initiatives. We understand "local government initiative" to incorporate a wide range of activities¹⁰ including: efforts to remove roadblocks to private investment;¹¹ demand aggregation with local government as an anchor consumer as in Chicago CivicNet; joint public/private partnerships, and even municipally constructed networks as in Bristol, Virginia OptiNet. The multi-disciplinary nature of the project, drawing on experts in political science, economics, and engineering, is needed to address the complex inter-relationships between technology choice, the structure of local government institutions, institutional arrangements adopted for the initiative,

⁷ Recommendation 4.2, found on p. 35 of this report, states: "Explore public sector initiatives that foster market entry. Initiatives involving public sector actors may provide an alternative to imposing unbundling requirements on incumbents in order to provide increased competition in type 0 [no providers], 1 [monopoly], and 2 [duopoly] circumstances. *These initiatives should be articulated, researched, and evaluated* with a focus specifically on reducing barriers to entering competitors by building or facilitating enabling infrastructure." (Italics added.) See also pp. 206-215 for further discussion of the appropriateness of a local role in stimulating broadband deployment, and the heterogeneity of local approaches.

⁸ This last question has been addressed internationally: data from 75 countries, as reported in Geoffrey Kirkman, Peter Cornelius, Jeffrey Sachs, and Klaus Schwab (2002), demonstrates a positive correlation between broadband availability and an index of e-government services. However, a 2000 survey of U.S. county government offices indicated surprisingly low availability of broadband Internet access. See NACO (2002) for details.

⁹ See Eisenach (2001) and Kelly (2001).

¹⁰ Carnegie Mellon University and 3 Rivers Connect (2002)

¹¹ Michigan SB 880 limits Right-of-Way fees and reduces permitting delays for broadband providers. See Michigan.gov (2002)

and the dynamics of private-sector broadband service competition. We intend to achieve both comprehensiveness and rigor by combining statistical analysis of a large number of local experiences with a series of in-depth case studies of the entire process.¹²

The expected contributions of this project are oriented toward both research and practice. We anticipate generating new knowledge that describes and explains the antecedents and consequences of local government decision-making in the formulation of broadband strategies. We expect to systematize and organize this knowledge to help local governments formulate broadband strategies more effectively, rapidly, and at less expense than they can today, by digesting the lessons from communities that have gone before, and placing them in appropriate context.

Broader Impacts

Finally, we expect this work to have the following broader impacts for society. First, it will illuminate models that help government make the best use of its scarce resources when partnering with the private sector, especially in cases that involve rapidly changing technology. Assuming we can identify effective local government strategies, by reducing the effort required for action, application of these “best practice” models will stimulate broadband availability, increase competition and encourage ongoing innovation in network infrastructure. Finally, the study will develop working hypotheses and empirical findings concerning the relation of broadband to economic development and e-government, helping to guide communities as to what communications infrastructure investments to make—and not to make—in order to maximize the benefit for these core functions.

The communities that have traditionally been underserved by commercial telecommunications providers tend to be rural, low-income, and without a substantial business base. In several regions of the country (for example, the Mississippi Delta), these attributes correlate closely with above-average percentages of minority population. Providing guidance to underserved communities as to how best to achieve the benefits of broadband will disproportionately benefit these historically disadvantaged groups.

In addition to training graduate students, we expect the results of this work to be incorporated into graduate coursework, and we will develop materials suitable for educating local, state and federal government officials regarding our findings. Further, we hope that the academic/local government partnerships we have established for this project can serve as a model for diffusing research results to a broader public.

2.2. Research Questions

The questions we intend to address in this project can be divided into two sets. The first set of questions focuses on what kind of local broadband initiatives are being undertaken and why. The second set of questions deals with the consequences or outcomes of these initiatives.

¹² To our knowledge, no such systematic investigations have been undertaken. Strover and Berquist (1999), Laudeman (1999), NRRI (2000), Render (2002), and a few others have compiled lists of projects and in some cases made limited efforts at systematically characterizing them. Sawhney (2001) examines the decision processes used through case studies of state-level initiatives taken in North Carolina and Iowa. But the kind of detailed, multidisciplinary analysis we are proposing has yet to be attempted.

Local broadband initiatives: what and why?

The obvious motivation for a local broadband initiative is the perception that the private sector is not proceeding at a satisfactory pace to supply affordable access to broadband services. FCC and Commerce Department statistics cited above provide ample evidence that broadband availability is far from universal. Studies of the so-called “Digital Divide” abound.¹³ Yet the literature on public investment theory is riddled with conflicting arguments regarding when and how governments should take action to directly influence or supply infrastructure versus relying on private initiatives.¹⁴ While the FCC asserts that “Advanced Services” are being made available by the private sector at satisfactory rates, politicians continue to introduce legislation to accelerate the rollout.¹⁵ Without entering the normative debate on the *when* of government action, we are interested, in the first part of the study, in understanding positively why some communities choose to act and others do not, and the correlates of that decision. Later, as we evaluate the impacts of local broadband initiatives, we may be able to comment more concretely on the costs and benefits of various types of initiatives that have been undertaken, and thus shed light on the normative question.

More particularly, we want to know: What factors lead a community to undertake or decline to undertake a local broadband initiative? What types of broadband initiatives are taken? What characteristics of the community determine the type of initiative? How is the choice of administrative structure for the initiative related to the choice of what to do? How and where does the community draw the appropriate boundary line between activities to be undertaken by the government and those to be left to the private sector?¹⁶

From Jacques Elul (1964) a generation ago to Lessig (1999), Blumenthal and Clark (2001), and Lemley and Lessig (2001) more recently, there has been continuous debate on the extent to which technology choices constrain economic, social and political outcomes. In choosing a technology approach for a broadband initiative, local authorities may determine in part the scope of competition in complementary services, and the flexibility of the investment as a platform for further innovation. We hope to shed light on the relationship between technologies chosen, the political and organizational context of the decision, and the resulting outcomes. In particular, we expect to build on Sirbu and Banerjee (2001) to clarify for communities the kinds of tradeoffs involved between minimizing costs in the short term, and fostering competition and innovation in the longer term.

Actions have consequences

The second set of questions deals with the consequences or outcomes of an initiative. These outcomes can themselves be subdivided into three areas: success or failure in making broadband services available economically; impact on e-government; and impact on economic development.

First, we are interested in the economic consequences of the initiative itself. Did it meet its stated goals, financially and technically? What is the penetration or reach of the initiative? What was

¹³ U.S. Department of Commerce (1999), U.S. Department of Agriculture, (2000), Civile, Gurstein, and Pigg (2001)

¹⁴ Stiglitz, J., Orszag, P. and Orszag, J. (2000), and Eisenach (2001) and Kelly (2001).

¹⁵ See U.S. FCC (2002b) and U.S. Senate (2002)

¹⁶ Donahue (1989) and Savas (2000) address some of these questions from a general perspective, and applications from different services and industries.

the impact on broadband investment and entry by private sector firms? To what extent did the investment promote or inhibit competition either in broadband transport or in services?

An important aspect of the public investment debate has been the effect of public action on levels of private investment (Lehr, Willig, Bigelow and Levinson, 2002). Does public investment discourage private investment, or does it stimulate investment in both competitive and complementary goods and services? A key issue for this project, therefore, will be to assess the extent of such investment by the private sector in response to governmental action. We expect that the extent to which the initiative promotes competition will be key; there is a growing literature on the benefits of competition on infrastructure investment.¹⁷ Our research would supplement this work, and would seek to address the impact of local policy, if any, on the progress of competition and infrastructure investment. In the private sector, telecommunication service providers have historically been vertically integrated, both building facilities and providing retail services. Since the passage of the 1996 Telecommunications Act, we are engaged in a public policy experiment in the U.S. testing the viability of vertical de-integration, for example through leasing of unbundled network elements. Local governments are also experimenting with novel models such as providing wholesale-only services to multiple competing service providers.¹⁸ Pricing wholesale services in a converged network environment is a poorly understood problem (Wang, Peha and Sirbu, 1997). We are thus particularly interested in analyzing, both theoretically and empirically, the viability of the various economic models advanced in the different local initiatives.

Second, we are interested in the impact of the initiative on government activities, or e-government. There are no in-depth, large-scale studies of the relationship between the development of broadband access by a local government and its impact on e-government. We hypothesize that the consequences of broadband deployment for local government can emerge in a number of different ways.

For example, local broadband deployment may be associated with greater utilization by local governments of networked communications for governmental operations. Simple economics argues that ready availability, or alternatively, affordability of broadband, by lowering the cost of use, should increase consumption. More indirectly, communities that develop broadband infrastructure amass a critical mass of employees who are knowledgeable about the broadband technology, and thus act as a conduit for more rapid absorption of ideas for making use of the technology. Similarly, to the extent that the local broadband initiative succeeds in its economic development objectives and attracts high-tech companies, technology knowledgeable employees of these companies will act as advocates of increased use of networked communications by the municipality.

Typically, it is assumed that the availability of infrastructure will lead to its effective use, however Fountain (2001) has shown in a small number of illustrative cases that the relationship between the availability of information technologies and their effective use is mediated by organizational and institutional variables. Thus, availability of infrastructure is a necessary but not a sufficient condition for greater effectiveness in government. The present study would

¹⁷ See Sappington and Chunrong (2001); Boyland and Nicoletti (2000); Ros (1999); and Greenstein, McMaster and Spiller (1995).

¹⁸ Such as Tseng (2001) describes for Grant County, WA, and as is proposed by the UTOPIA project, <http://www.utopianet.org>.

continue to illuminate the role of these mediating variables by focusing on the institutional contexts in which infrastructure is developed and the effects of that context on development.

An alternative hypothesis might suggest that a community that becomes greatly enmeshed in *deploying* a broadband network will neglect the collateral investment in applications development needed for successful utilization. We can test this by examining how utilization varies as a function of the extent of local government involvement in the actual deployment.

Another important area for investigation will be how the structure of a broadband initiative affects the use of the advanced communication capabilities by local government. For example, the decision to facilitate competition in broadband services delivery by promoting a neutrally administered infrastructure may enhance eGovernment utilization compared to the case where the municipality provides services delivery itself. The reasoning here is that competitive service providers will be motivated to market new applications to the local government and thus prompt higher levels of deployment of these applications. An alternative view might be that a municipality that uses a closed architecture to provide a full-range of services may utilize these capabilities in eGovernment more extensively because the municipal provider may have greater expertise as to government needs.¹⁹

At this early stage in the development of eGovernment and broadband, it is premature to fully assess the relationship of eGovernment to broadband initiatives. However, the current efforts should provide valuable insight into local government processes that will prove crucial in both understanding the dynamics of eGovernment and in measuring performance outcomes. Our research will help capture the decision processes and the decisions themselves currently being made that will influence longer-term effects. We propose to collect these data while communities are in the process of making decisions regarding broadband access rather than trying to examine decision-making after the fact when it will be far more difficult to collect first-hand data.

Third and finally, we are interested in the impact of the initiative on economic development. The role of telecommunications in promoting economic development has been well studied (Hudson, 1988). The economic impact of increased broadband availability may operate directly by attracting firms that rely on sophisticated telecommunications, or more indirectly by first attracting or promoting the development of residents who are technologically sophisticated, which in turn leads to firms locating in order to take advantage of the labor pool. Many local governments may be induced to adopt a broadband initiative to seek a competitive advantage over neighboring communities. However, it is unclear whether such early mover strategies convey lasting economic benefits. Early movers may have been burdened with higher costs, and have faced greater risks than municipalities that act later; therefore, generalizing from these first movers may be misleading. Further, while early providers of broadband infrastructure may gain competitive advantage in attracting firms to a region, as more locales make broadband available, it may shift from being a competitive advantage to a competitive necessity (Clemons and Kimbrough, 1986).

Again, because of the early stage of deployment, it is unlikely that we will be able to fully measure the economic outcome effects of broadband. Nevertheless, careful data collection at this

¹⁹ The perspective is analogous to the view during the early days of both radio and cable, that the infrastructure owner needed to be actively engaged in stimulating services (content) that made use of the infrastructure, rather than rely on third parties. See de Sola Pool (1983) pp. 169-170

stage will provide a firm foundation for future research, and perhaps some preliminary indications.

2.3. Research Methods

We propose to address the research questions discussed above with two empirical approaches: creation and analysis of a cross-sectional database of local government initiatives, and in-depth case studies of communities grappling with these issues. The two approaches will overlap in time, and each effort will inform the other.

Creation and analysis of cross-sectional database of local government initiatives

The first empirical method will involve statistical analysis of a cross-community panel dataset documenting what local governments have done. The analysis will focus initially on identifying the key factors and their relationships that influence the type of initiative undertaken. To analyze the effectiveness of different approaches in different contexts, we will need to combine data about initiatives with relevant data about the communities themselves, and with the type of information about outcomes that can be readily measured.²⁰

This analysis will allow us to test hypotheses about the clustering of initiatives, community types, and some aspects of outcomes. Because of the preliminary nature of current data about initiatives and outcomes, we will need to refine the specific hypotheses to be tested as the research progresses. Examples of the types of questions we expect to be able to address through hypothesis-testing include: Are towns with municipal electric systems more likely to focus on, and/or effectively execute, supply-side initiatives such as deployment of a municipal broadband network? Are demand-side initiatives, such as using the local government's buying power to induce private-sector investment, more likely to succeed in communities above or below a particular size threshold? Does the choice of initiative correlate with measures of deployment and adoption? Do supply-side initiatives correlate with less private sector investment, or more? Are college or university towns more likely to have a broadband initiative than towns that are otherwise comparable? Are communities that start later in time more or less likely to succeed? Does a strong prior local government commitment to e-government make the presence of a broadband initiative more likely or more successful? The common theme is that we expect broadband strategies to reflect local community circumstances, and do not expect to see a single strategy emerge as optimal for all communities.

- Significant data gathering, consolidation and synthesis work is needed to enable this analysis, which is based on three types of data: the nature of initiatives, their consequences, and community context. Context variables are available from government and other public data. For example, the U.S. Census provides data about community demographics, types of businesses and employment. Publicly available engineering cost models (used by state public utility commissions to implement provisions of the Telecommunications Act of 1996) provide data about the cost of deploying communications infrastructure in a community. We will use the resources of the Harvard Data Center, an NSF-funded data repository for research on government, as well as the resources of the Municipal Research Bureau and its equivalent organizations. We anticipate classifying municipalities based on type of government, e.g., city

²⁰ The case studies, described below, will complement this analysis by gathering the kinds of information about outcomes and consequences that cannot be easily quantified.

versus town, and level or degree of professional expertise relevant to broadband. The selection of relevant context variables for inclusion in the database will be based on a series of structured telephone interviews we will conduct of communities that have undertaken a range of initiatives. Because context variables are likely to fall across the domains of multiple academic disciplines, selection of context variables from interview results, and identification of data sources, will draw on the cross-disciplinary and cross-institutional strengths of the project investigators.

Despite the broad search that we have conducted of the sources and experts listed below, we have been unable to locate the existence of consistent and codified data about the nature and outcomes of local government broadband initiatives. We therefore propose to gather and synthesize these data into a database of consistent and comparable entries that we will then make publicly available. This effort represents an important step towards remedying the current dearth of empirical information.

To date, we have collected secondary source information on local broadband initiatives from a variety of sources, including:

- Communications, economics, and policy literature.
- Government reports on infrastructure development, including the FCC's Section 706 studies on the progress of advanced telecommunications services and various state-level and local reports on the status of broadband development.
- Federal, state, and local government broadband experts, including the Federal Communications Commission; the Department of Commerce (both the National Telecommunications and Information Administration and the Technology Administration); the National Association of Regulatory Utility Commissioners (NARUC) and its research arm, the National Regulatory Research Institute (NRRI); the Massachusetts Technology Collaborative (a quasi-public economic development corporation); the National Association of Telecommunications Officers and Advisors (NATOA, an offshoot of the National League of Cities, or NLC); as well as academic colleagues and several consultants and attorneys who specialize in advising municipalities on telecommunications issues.
- Web-based resources, including state and county organizations with an interest in broadband, trade associations such as the American Public Power Association (APPA) and the Fiber-to-the-Home (FTTH) Council, municipal telecommunications consultants, archives of relevant Internet discussion groups (listservs such as telecom-cities and muni-telecom), and the websites of communities already identified as having broadband initiatives.

This research has identified several useful elements that will contribute to the requisite database, including:

- The NRRI's Community Broadband Deployment Database, which identifies 261 broadband projects. This was the most extensive data collection that we were able to locate. The bulk of entries, however, represent purely private-sector initiatives, mostly undertaken by competitive local exchange carriers. While this represents a useful starting point, it misses many local government-led initiatives that need to be included to accurately reflect the scope of activities underway. Also, the information about the nature of projects is largely free form, and therefore difficult to compare across communities. Finally, contextual data is limited.

- Case studies of specific projects. These differ widely in their comprehensiveness and focus. They contain a wealth of useful information for our database, but it needs to be extracted, reformatted, and supplemented to provide the basis for a comparative evaluation.
- Lists of communities that have undertaken broadband or “community networking” initiatives. These lists have been compiled from a range of points of view, each of which intersects in different ways with our focus on local government as the unit of analysis. They provide a useful basis for identifying communities for our sample, but as with the other secondary sources, need to be supplemented with additional research to be useful. Sources of broadband community lists included the FTTH Council, which lists communities with any form of FTTH deployment; the American Public Power Association (2002), which surveyed its members in 2001 and found “approximately 450 public power systems that offer some kind of broadband services,” including cable television and telephone service in addition to Internet access; “community networking” websites maintained by academics and public utility commissions; and other sources such as community websites and consultants, many of which report incomplete and inconsistent lists of communities with very little supporting information.

We are currently in the process of extracting and merging information from these sources to compile a list of communities verified as having undertaken local broadband initiatives with public participation (*i.e.*, not purely private-sector initiatives). We will continue this process until we find that additional information is no longer significantly extending the range of local government-led broadband initiatives represented in the database, or through the first half of the proposal period, whichever happens first. To date, we have identified 420 communities, and completed the verification process for 75 of them. These 75 vary in their motivations, levels of sophistication and socio-economic realities. Examples that illustrate their diversity include:

The examples vary across a wide range of initiatives, motivations, levels of sophistication and socio economic realities.

Bristol, Virginia is a community of just over 17,000 people with per capita income of nearly \$17,500. Motivated by community concerns for economic development, the municipal utility, Bristol Virginia Utilities (BVU), started deploying a fiber network to government buildings (including schools) in November of 1999. After a court battle for permission to offer services to the public, BVU has recently extended the fiber network to residences and businesses, and begun offering voice, video and data services (Kelly, 2002).

The City of Sun Prairie, Wisconsin, has a population of 2,308 and income per capita close to \$25,000. The school district asked Sun Prairie Water & Light to provide advanced telecommunication services at almost the same time as the city government was requesting proposals for linking city buildings and facilities. Wireless broadband Internet service was first introduced during 2001 and currently serves approximately 300 customers via radio antennae installed on the city’s water towers. Prices start at \$35 per month for residential, and \$50 per month for business customers.²¹

Chicago, Illinois, is a major city of nearly 3 million inhabitants, and income per capita of about \$20,000. Despite the city’s large size and density, many citizens were underserved by the existing

²¹ See http://www.spwl.net/utility_issues/frontpagenews.asp?ID=172

telecommunications infrastructure, with significant gaps in availability of broadband Internet access. The CivicNet initiative originated as a way to aggregate the city's buying power across diverse city agencies and schools, to induce private-sector investment in telecommunications infrastructure. The plan is to leverage the \$320 million for data and IT services the city expects to spend over the next ten years and have the City of Chicago be the anchor tenant of a fiber network connecting the more than 1,800 public facilities and offices of Chicago.²²

The results of this identification effort will need to be supplemented with more detailed data about the nature and measurable outcomes of each initiative. We propose to generate this data through three overlapping stages of data gathering and synthesis. First, we will conduct a series of telephone interviews of primary government managers representing the range of initiatives in the sample.²³ These interviews will be structured to generate as much consistency as possible in the nature of the information collected. Access to appropriate government managers will be facilitated by the National Association of Telecommunications Officers and Advisors (NATOA), a national organization whose membership largely consists of local government officials concerned with telecommunications issues. NATOA has agreed to partner with the project, providing access to its membership as in-kind support (see NATOA letter of support under "Supplementary Docs").

The second stage involves synthesizing the information emerging from the telephone interviews to characterize the nature of local government broadband initiatives along multiple dimensions. This multi-dimensional classification step represents fundamental, multi-disciplinary research that has not yet been done (to the best of our knowledge), but is critical to the analysis: without it, statistical techniques cannot be meaningfully applied to comparison and analysis of different community efforts. Underlying this proposed research is the premise, supported by our data collection to date, that despite the fact that every local initiative is unique when all community context variables are taken into account, the nature of the initiatives themselves exhibit certain patterns and categories that can be extracted and classified. It may also prove possible to identify combinations of dimensions that are theoretically possible but have not yet been observed, leading to new models for communities to consider.

The dimensions of this classification effort do not fall neatly into the confines of any single academic discipline. Initiatives are distinguished by institutional factors, such as the organizational home of the initiative's leadership within the local government; economic and business factors, such as the choice of whether to focus on stimulating user demand or private- or public-sector supply; technical factors, such as the choice of networking technology to deploy in the case of supply-side initiatives; and cross-cutting factors that emerge from different types of initiative. For example, initiatives that involve public-private partnerships may be further classified according to where the dividing line is drawn between public and private responsibility. Initiatives that involve public construction or operation of broadband networking facilities may be further distinguished by whether the local government serves as a wholesaler and/or retailer of communications services, or whether the facilities are intended to serve residences, businesses, or government facilities (including schools, town office buildings, and public safety sites).

²² See <http://www.cityofchicago.org/civicnet/RFQInformation.html>

²³ These are the same interviews noted above as informing the selection of relevant community context variables.

Effective classification of initiatives requires that these factors be considered together, not independently. The combined strengths of the cross-disciplinary team of investigators in the disciplines of computer science and engineering, political science, economics, business and policy will be required to accomplish this data synthesis task.

The third and final stage will incorporate the results of the telephone interviews and preliminary initiative classification scheme into a survey of an expanded sample of communities. The survey will augment the data gathering and synthesis in two ways. First, by surveying communities that are demographically similar but which do not yet appear in our lists, the survey will provide a check on any sampling bias in our data collection effort, and allow us to analyze the factors and conditions that characterize communities that have not adopted broadband initiatives. The survey format will also allow us to collect data from a broader range of actors involved in local government broadband initiatives, including private sector participants, providing an empirical test of our preliminary classification of initiative characteristics. Our partnership with NATOA and the National League of Cities (NLC) will assist us in efficient survey pre-testing, administration, and response.

Once the steps of data consolidation, gathering and synthesis are completed, we will analyze the data by formalizing and testing hypotheses such as those described above. We recognize, however, that this analysis will be limited to assessing only the types of outcomes that can be quantified or categorized. To capture other aspects and effects of local broadband initiatives that do not fit the quantitative model, we also propose to select at least three communities from our database for in-depth case study. The selection will be guided by the results of the telephone interviews and the preliminary initiative classification scheme, to ensure adequate variance among the three cases. Because the in-depth case studies will be carried out in parallel with the cross-sectional analysis, their preliminary results will also aid in the formulation of hypotheses to test on the cross-sectional data.

Case studies

Local governments will face important choices regarding broadband access during the next few years. By clarifying these challenges, the responses of government managers, and the implications of their decisions through the development of detailed case studies, we anticipate further building a knowledge base for researchers and helping government managers make more deliberate, better informed decisions regarding the decision paths taken by local governments that have successfully stimulated broadband access.

The technology enactment framework, developed during a decade of empirical research on government managers and the decision-making processes they have used to implement new technologies, serves as one theoretical foundation to guide the case study component our research design. In addition, a stream of research in political and organizational science has recently focused on evolutionary processes in government, specifically the importance of path dependence, timing, and sequencing.²⁴ It is not clear where in a path, or stream of decisions, local governments chosen for case research will fall. However, we propose that it is important to capture the start conditions and early decisions regarding broadband access in order to collect

²⁴ Regarding technology enactment theory, see Fountain (2001); Fountain with Osorio-Urzuza (2001). See the following for evolutionary theory applied to political development: Pierson (1993, 2000a, 2000b), Hacker (1998); Wolfinger (1971); Rose (1990); North (1993); Marwell and Oliver (1993); Liebowitz and Margolis (1995).

detailed, accurate data from the actual managers and other decision makers involved while they are in the process of puzzling over these challenges. Our case studies will be grounded in these theoretical approaches yet exploratory enough to allow us to consider variables and relationships that may not be articulated in existing theories.

We propose to undertake at least three detailed case studies of three local governments (municipalities, groups of municipalities, or counties) that are in the early stages of problem-solving and decision-making with respect to broadband access. To the extent possible, we intend to select communities to maximize the variance in bundles of local conditions that might lead to different types of strategies for building broadband capability. Variables we will consider include demographic indicators such as size, household income, and population density; economic indicators such as business density, existing communications infrastructure, and the local government's financial resources; and structural political indicators such as the presence of a municipal electric utility, state laws restricting local government action, and status of e-government initiatives. Our intent is not to produce generalizable results from the case study research, but to examine and to explain in detail how local conditions and a range of start conditions in particular types of communities enable and constrain the strategies that local government managers can undertake to stimulate broadband.

Three graduate students, one from each of the institutions involved in the study, will carry out the data collection and case study analysis under the direct supervision of the faculty investigators at each institution. Based on her extensive experience with field research and case study methodology, Jane Fountain will serve a coordinating role to ensure rigorous, consistent data collection methods across institutions and cases. The students will collect background information about the municipalities, drawing from the survey and database development portions of our study (see above) and by collecting other primary and secondary sources to understand the relevant history, culture, institutions, politics, and other contextual factors in which decision-making regarding broadband is embedded.

We will conduct a series of systematic face-to-face interviews with the key actors involved in the decision-making processes in each local government. We will use the interviews to triangulate across methods, that is, as a check on the validity and reliability of the results of the telephone interviews, survey, and our review of available government documents. The interview data also will expand greatly upon the data collected through telephone interviews. We expect that the actors interviewed will include those with official responsibilities for broadband access. As interviewers learn from their interviews who the central decision makers are, the list of interviewees may grow in order to encompass all the key decision-makers in a given community. The interviews will be conducted using a standard interview protocol²⁵ whose items follow from the research questions and hypotheses detailed above. We are interested not only in *what* and *why* decisions are made but *in what sequence*.

²⁵ Interviewers will take notes or tape record their interviews, with permission from interviewees, and will agree not to communicate interview results without the permission of the interviewee and to provide those interviewed with at least a summary of the research results. Field researchers will write up their notes, if sessions are not recorded, immediately following their interviews and send their notes to interviewees to be reviewed for accuracy and to gather details that may be missing from the notes. Interviews are recorded by date, place, and name of interviewee and interview data remain linked to their sources. No interviewee will be quoted without his or her permission.

The case studies also are intended to provide detailed data regarding the effects of broadband access on economic and governmental development. We are limited by the three-year time horizon of the proposed study. We intend, however, to probe for the ability and propensity of local governments to leverage their information infrastructure to promote economic development and innovation in government. This implies that government managers responsible for economic development will be interviewed as well as, possibly, the head of the chamber of commerce and other individuals likely to be most knowledgeable about new business startups, negotiations, proposals, and competition among local governments for business development. Regarding innovations in government, field researchers will interview several department heads in addition to chief information officers (or the closest equivalent) to gather information on the ways in which broadband has enabled the development of e-government in three ways: first, provision of information and services to citizens; second, internal process redesign efforts to take advantage of enhanced infrastructure; and, third, government-government partnerships whether across agencies or broader jurisdictions.

Finally, we expect that the results of intensive field research will feed back into refinement of hypotheses to be tested using our database of local governments. For example, we may find that the size or average income of a locality influences alternatives in ways that are not apparent from a quantitative analysis or we may discover mediating variables that are significant. More broadly, the case study research will inform our understanding of the underlying causal mechanisms that influence local government decision making with respect to broadband.

2.4. *Involvement by Government Managers*

Government managers will play active roles in ensuring both the success of the project and the relevance of the research to the needs of the practitioner audience. We propose to involve government managers in the project in three capacities: advisors, partners, and case study site hosts.

Bob Rowe, Richard Varn, and Denise Brady, three government managers with deep involvement in broadband-related issues, have agreed to serve on the project's advisory board (see their letters and biographies submitted under "Supplementary Docs"). Rowe is a Montana Public Service Commissioner who served on the committee that produced the National Research Council (2002b) broadband study and also serves (ex officio) on the Federal-State Joint Conference on Access to Advanced Services. Varn is Chief Information Officer for the State of Iowa and the co-author of Tibor and Varn (2000) which discusses the role of government involvement in broadband at the state and local level. Brady is Deputy Director of San Francisco's Department of Telecommunications and Information Services, is currently serving her second term as president of NATOA, and has over 25 years of regulatory and public service management experience in city government. As advisors, each has agreed to review the project design and implementation to ensure that the researchers are asking the right questions and taking account of important contextual issues, and otherwise providing feedback to keep the work grounded in the reality of government practice. Rowe, Varn and Brady will be complemented on the board by two academics with related expertise: Greg Laudeman of the Georgia Institute of Technology Economic Development Institute, whose deep knowledge of local initiatives in Georgia is reflected in Laudeman (1999); and Dr. Vivian Witkind-Davis of the National Regulatory Research Institute, director of the joint FCC-NRRI Community Broadband Deployment Database effort.

Two national associations have agreed to partner with us to assist with data collection from, and dissemination of results to, the government practitioner audience. NATOA has agreed to allow us access to the relevant government practitioner audience that resides within their membership (see the letter from NATOA submitted under “Supplementary Docs”). In particular, NATOA has agreed to an in-kind contribution of their resources (including access to their conferences, mailing list, and the mailing lists of other sister organizations) to ensure an adequate response to the proposed survey. In addition, NARUC has agreed to an in-kind contribution of expertise from the National Regulatory Research Institute, to provide data on state laws and state-level networking initiatives that bear, positively or negatively, on local government broadband efforts. Finally, both NATOA and NARUC run conferences and websites which will provide suitable venues for the project’s researchers to receive feedback from the local government practitioner community on preliminary results, and to disseminate final results.

The UTOPIA project, Paul Morris, Executive Director, will also be a major partner. UTOPIA is an interlocal government agency in Utah with 17 founding cities deploying a publicly owned advanced telecommunications network to all homes and businesses within member communities. Utopia has agreed to commit significant resources to assist the design of the research project, the facilitation of access to member communities, and the dissemination of research results (see the letter from Paul Morris submitted under “Supplementary Docs”).

Finally, for the project to proceed as planned, three communities will need to agree to be case study sites, which will require the active involvement of government managers in those communities as facilitators and interviewees. Because the selection of case study sites will need to be informed by research done in earlier stages of the project, it is not possible to identify these sites at this time. However, we have included letters from two communities that have already indicated their willingness to serve as case study sites, should their selection prove appropriate (see letters from Paul Morris of UTOPIA and Morgan Baldwin of the Tupelo, Mississippi MegaPOP project, submitted under “Supplementary Docs”). These letters clearly demonstrate the level of enthusiasm for the proposed research from local governments with interest in this issue.

2.5. Dissemination of Research Results

We will disseminate the outputs of our research to practitioners and scholars via: (1) publications and presentations by the research principals and graduate student researchers; (2) Web-based access to the cross-sectional database; and (3) Web-based tools to enable structured (and assisted) access to the data.

Publications and presentations

We plan to publish a series of research papers documenting the findings from this research in peer-reviewed journals. In addition, the work will be presented at various workshops and conferences in the United States and abroad. Each of the principal researchers on this project participates in a range of international and national conferences with multi-disciplinary attendance that focuses on telecommunications technology, business/economics, public management, political and other social sciences, and communications policy issues. Some of the conferences where this work would likely be presented include: Telecommunications Policy Research Conference; Rutgers' Conference on Telecommunications Regulation; International Telecommunications Society Conferences; and the annual meetings of the Association for Public

Policy and Management, the Academy of Management, the American Political Science Association, and the American Association for the Advancement of Science. In addition, our association partners (NATOA and NARUC) provide conference venues that should prove suitable for us to use to reach the government practitioner audience for this research.

Web-based access to cross-sectional database

Once we have completed the database of community initiatives in context, we plan to make it available on the web for access by scholars and public officials for use in tracking, analyzing, and formulating broadband initiatives and progress. We will encourage a variety of nonprofit, government, and academic researchers to link to the data repository in order to increase its availability. The data repository will be available through the web sites of the National Center for Digital Government at Harvard, MIT's Program on Internet & Telecoms Convergence, the Information Networking Institute at CMU, and potentially via the project's association partners (NATOA and NARUC).

Web tool for accessing data

Finally, we plan to create a web-based tool to facilitate access to and use of the data. This will enable structured data queries to generate sub-samples of communities according to a variety of conditions. For example, this tool would enable communities to input their relevant data and gain answers to questions such as "What other communities are similar to mine, what have they done, and what has and hasn't worked?"

2.6. Prior Research

The Principal Investigators have conducted extensive research in areas related to the current proposal. Beginning in the late 1980s, with funding from Bellcore, Prof. Sirbu examined the economic viability of fiber to the home (FTTH) networks, and the policy issues surrounding local exchange carrier entry into the video delivery market. While there was great enthusiasm at the time for FTTH, and numerous trials around the world, Sirbu, *et. al.* (1989) showed that FTTH was not economically viable, and would not become viable for another decade, a result borne out by subsequent events. In research for General Instruments, Omoigui, Sirbu, *et.al.* (1995) compared the economics of HFC and FTTC architectures, in the process developing novel methods for automatically laying out and pricing HFC networks. The results strongly influenced GI's decision to expand beyond HFC by acquiring Next Level, a FTTC supplier. More recently, a series of studies, funded by the MIT Program on Internet & Telecoms Convergence (MIT ITC, an industry-sponsored research program), developed engineering economic models for comparing DSL, HFC and broadband fixed wireless access (BFWA) networks for the delivery of Internet access and Voice over IP services. These models, which draw on detailed subscriber data for all 50 states, allow the comparison of technologies in areas ranging from urbanized Delaware to rural Montana. The results (Fryxell, Sirbu and Lanning, 1999, Wanichkorn and Sirbu, 2002) show that HFC architectures dominate in urban areas, while BFWA networks dominate in rural regions. Research currently underway is again examining FTTH architectures using the latest technologies and costs, and with special emphasis on the implications of technology choice for competition in service delivery. Sirbu and Banerjee (2002) introduce the concept of Optimal Fiber Aggregation Points and show how they facilitate competition while lowering overall network deployment costs. Four Ph.Ds. and two Masters students have been trained through these projects. Finally, CMU and 3 Rivers Connect (2002) documents a major study of alternative broadband

technologies and policy actions that Pittsburgh and Allegheny County Pennsylvania might take to promote broadband.

Dr. David Clark chaired the National Research Council working group that produced the report *Broadband: Bringing Home the Bits* (NRC, 2002b), a study of technology and policy issues surrounding broadband local communications services. This report lays out the technology alternatives for local broadband and discusses in detail various policy concerns related to the availability of broadband. Chapter 5 specifically examines the issues surrounding local government broadband initiatives and recommends an agenda for further research. In work sponsored by the MIT ITC, Clark, (1999), and Clark, Lehr and Liu, (2002) look at the relationship between local loop technology and industry structure, showing why the emergence of broadband is likely to sharply reduce the number of Internet service providers, and looking at models for maximizing competition, given technological realities.

Co-principal investigator Sharon Gillett and project researcher Dr. William Lehr have also conducted industry-funded prior research related to several aspects of the proposal. With funding from MIT ITC, Gillett and Lehr (1999) developed a data collection methodology for measuring local broadband availability that has application to the work proposed here; and Gillett supervised Tseng (2001) in assessing the political implications of different FTTH technical architectures, including case studies of two FTTH communities with significant local government involvement (Grant County, WA and Palo Alto, CA). With funding from AT&T, Lehr *et al.* (2002) have conducted an empirical study of the effect of competition on investment in communications infrastructure.

For the past decade, Prof. Fountain has extensively researched the interaction of institutional, technological, and governmental change (Fountain 1998; Fountain and Atkinson, 1998; Fountain, 2001c). She has developed a theoretical framework, the technology enactment model, which describes the mediating role played by organizational, socio-structural, and institutional variables in the development and implementation of new information technologies (Fountain, 2001a; 2001b; Fountain and Osorio-Urzu, 2001). The empirical base for the development of the theory has drawn on efforts of government organizations—including the U.S. Army, the Customs Service, and the Small Business Administration—to use IT across functions and jurisdictions. Currently, Prof. Fountain has an NSF grant to launch a National Center for Digital Government and to continue this line of research on government-to-government collaboration on IT-based projects. The research proposed here would extend the theoretical framework to local level government decision-making and would extend the technologies focused on to include broadband. A second active NSF grant funds extension of social science frameworks for research on digital government.

Results of Prior NSF Support

NSF award 9307548-NCR to MIT; Marvin Sirbu Co-PI

Start date: July 15, 1994, **End date:** February 28, 1998.

Title: Research in Networked Multimedia Information Services

The NMIS project was a large multidisciplinary, multi-institutional effort aimed at exploring some of the technical, economic and policy issues associated with the delivery of multimedia information over open networks such as the Internet. The use of a pricing mechanism is one way of ensuring that those who value broadband resources highly are most likely to be able to obtain

them. Accordingly, this research analyzed the relationship between the demand for network services, pricing of resource reservation as well as network usage, and optimal levels of capacity.

The research led to a three-stage model for determining optimal capacity investment in the long run, optimal pricing of virtual circuits in the presence of time varying demand, and optimal congestion-based pricing for best-effort traffic. Extensive simulations were conducted to examine the impacts on price, profits and consumer welfare of time varying demand, cross elasticity of demand among guaranteed services, and various forms of resale. This research was reported in several articles and in a Ph.D. dissertation by Qiong Wang: Wang, Peha, Sirbu, (1996) Wang, Peha Sirbu, (1997), Wang (1998). The issues examined in this prior project are particularly relevant when analyzing the economic viability of local “open access” models, such as Grant County’s Zipp Network, in which the municipality wholesales packet transport to multiple heterogeneous service providers.

NSF Award ANI-0082503 to MIT; David D. Clark, PI

Start date: October 1, 2000; **Expected duration:** 36 months

Title: Protocols for Open Access Wireless Deployment

The objective of this project is to dramatically increase the availability of wireless network access services by creating a rich, heterogeneous, dynamic and market-based playing field for offering and using these services. One component of the project, a hardware device, acts as a nexus for personal communications services, interfacing between, on the one hand, a broad range of digital "jewelry" in the possession of a user, and on the other hand, a wide range of network service providers interested in supplying connectivity to that user. The second component of the personal router project is focused on the algorithms and economic infrastructure that support use of the hardware device to rapidly and easily acquire services that may be environment, location, or performance-specific. Several PhD and masters student projects are underway; results of the automated negotiation portion of the project to date have been presented in Faratin, *et al* (2002).

NSF Award 0131923 to Harvard; Jane Fountain, PI

Start Date: May 01, 2002; **Projected Duration:** 36 months

Title: *A National Center for Digital Government: Integrating Information and Institutions*

This award will support the initial development of a social, political, and policy research center on the topic of government enabled by information technologies. Initial research will begin in two areas: i) institutional analysis (how information technologies are brought into government and affect the organization and its modes of operation, in particular across multiple agencies), and ii) policy networks as informational and deliberative structures. Other elements of the award will support the center aspects of the proposal to draw in and support the formation of a research community. These elements include a Doctoral Fellows program, support for graduate students, seminars, workshops, and other forms of outreach.

The National Center is building human resources in science through a seminar series, workshops on research methods, active engagement with government managers and partnerships. Currently, the center houses eight fellows. Center fellows engage in the seminar series and workshops, an informal discussion group for research in progress, and the ongoing research of the PI and co-PI. A competitive fellowship program will begin in 2003. As part of its outreach activities, the center currently includes 18 affiliated researchers from eight different departments and universities.

This research, a continuation of Fountain's research program, should contribute substantially to the proposed project by providing insights on research methods appropriate for examining local decision-making regarding broadband initiatives and in evaluating the impacts of these initiatives on eGovernment.

2.7. Project Plan

Project tasks are divided into four overlapping phases, as illustrated in the timeline chart on the next page. Phase 1 represents data gathering and consolidation; Phase 2, data analysis; Phase 3, in-depth case studies; and Phase 4, dissemination of data and results. Overall coordination of the project will be the responsibility of co-PI Sharon Gillett, who will serve as project manager.

For the first half of the project, a doctoral student at each of the 3 universities (MIT, CMU and Harvard) will be assigned to the data gathering tasks, in a coordinated fashion. The exchange of perspectives among researchers and students from different disciplines, programs and institutions is expected to lead to significant opportunities for intellectual fertilization.

As soon as results of the data gathering tasks begin to become available, we will begin our synthesis of an initiative classification scheme. We will continue to refine this scheme throughout the project. All project researchers and students will contribute to this task, providing a significant opportunity for teaching and learning.

One graduate student from each university will carry out the in-depth case studies, which will include an on-site component. The case study process will begin midway through the project. At that time, an additional graduate student will be added to the project at MIT and CMU, so that the survey development, statistical, and any other economic analysis tasks can proceed in parallel with the in-depth case studies.

Dissemination of project results will involve development and maintenance of web pages and database access tools. These tasks will be the responsibility of an MIT undergraduate, provided at no cost to the project by MIT's Undergraduate Research Opportunities Program.

Phase	Task	MONTH																																					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
1	Identify communities with broadband initiatives (1° & 2° sources)	X	X		X	X	X	X	X	X	X	X	X																										
1	Filter for local government involvement (consolidation of sources)		X	X	X	X	X	X	X	X	X	X	X	X																									
1	Telephone interviews (design, pre-test, execution, & writeup)			X	X	X	X	X	X	X	X	X	X	X	X																								
2	Analyze interview results					X	X	X	X	X	X	X	X	X	X	X																							
2	Select context variables (from interview results)															X	X																						
1	Collect context data															X	X	X																					
2	Develop initiative classification scheme (data synthesis)				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X							
2	Identify target communities for survey																	X	X	X																			
1	Develop and pre-test survey																			X	X	X																	
1	Administer survey																				X	X	X	X															
2	Analyze survey results combined with context data																								X	X	X	X	X	X									
3	Identify case study sites																		X	X	X																		
3	Background research on case study communities																				X	X	X																
3	Case study interviews (design, execution, & writeup)																						X	X	X	X	X												
3	Analysis of case study results																										X	X	X	X									
4	Make data available on Web																														X	X							
4	Develop web-based tool for customized database access																															X	X	X	X	X	X		
4	Publish papers and present results at conferences																															X	X	X	X	X	X		

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APPENDIX A: ADVISORY BOARD

Richard J. Varn is Chief Information Officer for the State of Iowa and Director of the Information Technology Department, roles by which he has become a nationally recognized leader in information technology management, privacy issues, and digital government. Mr. Varn is also a consultant, speaker, and trainer in a diversity of fields, and has authored several published articles on information technology, education, and government. Besides his technology leadership positions, he held the elected office of State Representative for four years and State Senator for 8 years. He was twice chosen as Majority Whip, created and chaired the first Communications and Information Policy Committee, and chaired the Education Appropriations, Human Services Appropriations, and Judiciary Committees. He earned his BA with honors in Political Science and a JD from the University of Iowa.

Bob Rowe is the Public Service Commissioner of the State of Montana, for the Fifth District of Northwestern Montana. A nationally recognized expert on telecommunications policy and consumer affairs, Mr. Rowe is Past President, National Association of Regulatory Utility Commissioners (NARUC), and past chairman of its Telecommunications Committee, member ex officio of the Federal-State Joint Conference on Access to Advanced Services and of the Federal-State Joint Board on Universal Service. He is B.A., Lewis and Clark College; J.D., University of Oregon; Harvard Kennedy School Executive Program; additional graduate work in public administration and public policy.

Denise Brady is President of National Association of Telecommunication Officers and Advisors (NATOAA), and Director of the Policy, Planning and Compliance Division of San Francisco's Department of Telecommunications and Information Services. She has over twenty-five years of regulatory and public service management experience, spanning several City agencies. Denise gained recognition as a valuable resource for government regulators trying to cope in the ever-changing arena brought on by early deregulation in California. In 1993, she was recruited by the League of California Cities to join its Telecommunications Task Force and was instrumental in developing the League's official Telecommunications Policy.

Vivian Witkind-Davis is Associate Director for Research at the National Regulatory Research Institute, providing staff support for the Federal-State Joint Conference on Advanced Services through the FCC interactive survey on deployment of broadband services available on the NRRI website. She has conducted numerous tutorials for new public utility commissioners covering universal service and other topics, led projects and authored or co-authored research reports at the NRRI in the areas of "best practices" in implementation of the Telecommunications Act of 1996, mediation and arbitration of interconnection agreements, and service quality. She holds a B.A. with college honors from Wellesley College in political science, an M.A. in international relations from the Fletcher School of Law and Diplomacy (Tufts University), and a Ph.D. in public policy and management from the Ohio State University

Greg Laudeman develops and delivers IT-based economic development solutions as member of the Economic Development Institute's TechSmart team at Georgia Tech, where he is also completing a Masters' Degree in Information and Telecommunication Policy. Prior to attending Tech he worked for BellSouth Business Systems (BBS) as a liaison between the CIO and end-users, and as a Systems Designer, developing telecommunication solutions for major customers. Greg has also worked as a Technical Consultant for MCI, and as a Telecommunication and Wide-Area Network Specialist for

Intelligent Systems and Networking in Chattanooga. He has a Master's degree in Information and Telecommunications Systems from Michigan State University, and professional experience in electronic media, graphic arts, computer support and training, and as a small business owner.

APPENDIX B: LETTERS OF PARTNERSHIP AND SUPPORT

1. W. Russell Newman, Senior Policy Analyst, Office of Science and Technology Policy, Executive Office of the President.
2. Robert Pepper, Chief, Office of Plans and Policy, Federal Communications Commission
3. Morgan Baldwin, President of the MEGAPOP - Mississippi Economic Growth Alliance and Point of Presence
4. Paul T. Morris, Executive Director, Utah Telecommunications Open Infrastructure Agency (UTOPIA)
5. Denise M. Brady, President, National Association of Telecommunications Officers and Advisor (NATOA) and Director of the Policy, Planning and Compliance Division of San Francisco's Department of Telecommunications and Information Services
6. Bob Rowe, Public Service Commissioner, District 5, State of Montana
7. Richard J. Varn, Chief Information Officer, State of Iowa
8. Brett A. Perlman, Commissioner, Public Utility Commission of Texas
9. Paul B. Vasington, Chairman, Department of Telecommunications and Energy, The Commonwealth of Massachusetts
10. Mitchell Adams, Executive Director, Massachusetts Technology Collaborative



**Office of Science and Technology Policy
Executive Office of the President
Eisenhower Executive Office Building
Washington DC 20502**

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Larry and Valerie:

I'm writing to convey our interest in the potential results of the MIT/CMU/Harvard proposed project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development." As you may know, broadband is a central element of the President's high tech agenda and one of the four areas he asked his Council of Advisors on Science and Technology to explore. PCAST released its report on Broadband on September 30, 2002 and we are now working within the White House to help prepare an appropriate and timely response to PCAST's challenge.

Jon Moore of the Grant County Public Utility District (Washington State) which has built out a community fiber system for the residents of the area came and spoke to the PCAST meeting that was held on September 30 over at the State Department. Dr. Marburger, the President's Science advisor, made a special point of the importance of monitoring these important experiments in highlighting best practices and promoting new ideas to stimulate broadband growth.

We would look forward to working with the MIT/CMU/Harvard team in the event that this project is funded.

Sincerely,

W. Russell Neuman
Senior Policy Analyst



Federal Communications Commission
Washington, D.C. 20554

November 6, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

I would like to express our interest in the project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant. The goal of the proposed work is to digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in appropriate theoretical and situational context. This work directly addresses a need identified by the National Research Council in their 2002 report *Broadband: Bringing Home the Bits*, for improved understanding of local government practices – both best and worst – to encourage broadband deployment and use.

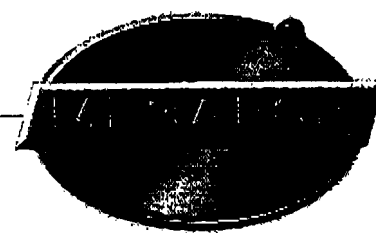
Broadband deployment and use is one of the top priorities of the Federal Communications Commission. This study can help us better understand the potential roles of local governments in fostering this deployment and use. Today, most information about these initiatives is anecdotal. The results of this study will be of great interest to the policy-making community, not just the FCC. Furthermore, we think the study's focus on the dissemination of knowledge to local governments, about what does and doesn't work in which local contexts, could contribute to more widespread broadband deployment and adoption at lower costs.

We view the interdisciplinary team of researchers assembled for this project as a strength for accomplishing the project's goals. Local government broadband strategy development unfolds within a rich context that is shaped by available technology, institutional capability, political forces, and market alternatives. An experienced group of researchers from Electrical Engineering and Computer Science, Political Science, Economics, and Policy is, therefore, a major advantage for understanding and considering the full context. The cross-institutional team assembled for this project appears to draw on the strengths of each of the participating institutions in these different areas.

We look forward to benefiting from the results of this joint research effort.

Sincerely,

Robert Pepper
Chief, Office of Plans and Policy



Board of Directors

Aubrey Patterson, Jr.

November 5, 2002

Robin McGraw

Sharon Eisner Gillett

MIT

Mabel Murphree

E40-235

Jerry Latch

One Amherst St.

Cambridge, MA 02139

Larry Oris

Dear Sharon:

Kenny Dill

Northeast Mississippi would like to express its desire to partner in the project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant. The goal of the proposed project is to digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in appropriate context. This work directly addresses a critical need identified by the National Research Council in their 2002 report *Broadband: Bringing Home the Bits*, for improved understanding of local government practices – both best and worst – for encouragement of broadband deployment and use.

David Rumbarger

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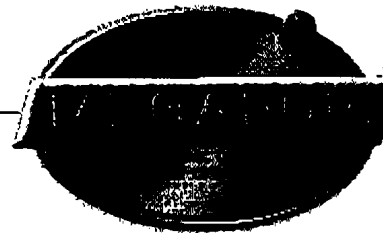
Tom Wicker

Counsel

Northeast Mississippi, a community of 800,000 people, is concerned about the community and its interest in stimulating communications infrastructure and services. The MEGAPOP is a non-profit agency designed to meet the ever-growing technology and communication needs by bringing affordable broadband to this region. The MEGAPOP will build a high capacity point of presence in Northeast Mississippi and connect the POP's via a fiber optic backbone to the Internet from Northeast Mississippi to Memphis, TN. Broadband will then be offered to the public at discounted prices while any excess revenues will be filtered into grants for the purpose of education and building out access to rural users.

We expect that the proposed collection, analysis and dissemination of knowledge will provide us with valuable insights as we develop our own strategies for stimulating broadband. We are also willing to make the following in-kind contributions to the success of this project:

- Provide guidance and feedback to the academic team in the design of the research and assist them in focusing the effort on questions of greatest concern to communities like ours
- Facilitate access to local government managers for the collection of information by project researchers
- Work with local organizations, such as the Mississippi Technology Alliance and the Enterprise Corporation of the Delta, to disseminate the results of the research to other communities in our region



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President

Oris Tims
Counsel

Tom Wicker
Counsel

Further, we would be willing to cooperate if our community is selected as a site for one of the detailed case studies proposed as part of the overall research project.

We look forward to participating in this joint research effort.

Sincerely,

Morgan Baldwin

Morgan Baldwin

Utah Telecommunication Open Infrastructure Agency



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executive director

DAVID J. SHAW
deputy director
and general counsel

DEAN NICKELS
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technical advisory
committee vice chair

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November 4, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

The Utah Telecommunication Open Infrastructure Agency (UTOPIA) would like to express its interest and desire in partnering in the project, *Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development*, proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant.

UTOPIA is a Utah interlocal agreement agency (comprised of 17 founding member cities) dedicated to accelerating economic development and quality of life for its citizens and businesses by deploying a publicly owned advanced telecommunications network over the last mile to all homes and businesses within member communities. The State of Utah recognizes the right of municipalities to form and enter into interlocal agreements under the Utah Interlocal Cooperation Act. This Act grants cities and other public agencies the authority to form political subdivisions to jointly execute governmental activities/services that they are authorized to perform individually. Interlocal governmental entities may issue bonds and share revenues.

As a wholesale provider of carrier-class transport, UTOPIA provides ubiquitous deployment (residence, business, government) over an all fiber network, delivering 100Mbps/1000Mbps edge connectivity through multi-Tbps of distributed core switch fabric. It is currently the largest Fiber To The Business / Fiber To The Home project in the world. UTOPIA's fiber optic telecommunications infrastructure will operate as an Open Service Provider Network™ (OSPN). UTOPIA solely provides carrier-class wholesale transport services; it does not provide retail service in any capacity. Each service provider owns its own customer relationships, directly selling, marketing, and billing its customers.

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
November 4, 2002
Page 2

The goal of the proposed project is to digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in appropriate theoretical and situational context. This work directly addresses a critical need identified by the National Research Council in its 2002 report, *Broadband: Bringing Home the Bits*, for improved understanding of local government practices, both best and worst, for encouragement of broadband deployment and use.

UTOPIA expects that this study will assist our local government members by:

- ▶ Collecting and analyzing data we would not have the resources to do on our own.
- ▶ Documenting the best uses of scarce local government resources.
- ▶ Bringing academic rigor and independence to the analysis.
- ▶ Adding appropriate consideration of local context to commonly cited anecdotal evidence.
- ▶ Improving dissemination of information among local governments, reducing repetition of work, and thereby allowing more communities to formulate effective, situationally appropriate broadband strategies more quickly and at less expense.
- ▶ Objectively examining the impact of broadband on local e-government and economic development, a need identified by the September 2002 Department of Commerce report, *Understanding Broadband Demand*.

In short, we expect that the proposed collection, analysis, and dissemination of knowledge will provide us with valuable insights to guide further development of the UTOPIA project and to help additional cities and towns in Utah decide if they wish to join our endeavor.

As a participating partner, UTOPIA is willing to make the following types of in-kind contributions to the success of this project:

- ▶ Provide guidance and feedback to the academic team in the design of the research and assist them in focusing the effort on questions of greatest concern to our member communities.
- ▶ Facilitate access to our member communities by project researchers for the collection of information.

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
November 4, 2002
Page 3

- ▶ Assist in disseminating the results of the research to our members and other communities within the state of Utah.
- ▶ Further, we would be willing to cooperate if UTOPIA is selected as a site for one of the detailed case studies, envisioned as part of the overall research project. We estimate the value of this in-kind support to be \$94,500.

UTOPIA views the interdisciplinary team of researchers assembled for this project as a strength for accomplishing the project's goals. Local government broadband strategy development unfolds within a rich context that is shaped by available technology, institutional capability, political forces, and market alternatives. The cross-disciplinary team that has been assembled, consisting of researchers from Electrical Engineering and Computer Science, Political Science, Economics, and Policy is therefore essential for understanding and consideration of the full context. The cross-institutional team assembled for this project draws on the strengths of each of the participating institutions in these different areas.

With my own background in law and public administration, I hope personally to add an additional dimension to the research team.

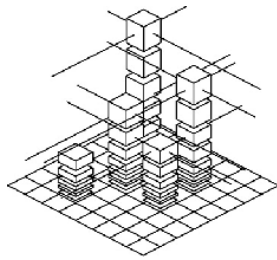
We look forward to participating in this joint research effort.

Sincerely,

A handwritten signature in black ink, appearing to read "P. T. Morris".

Paul T. Morris
Executive Director

natoa®



**The National Association of
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and Advisors®**

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October 28, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

The National Association of Telecommunications Officers and Advisors (NATOA) would like to express its interest in and support for the project “Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development,” proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant.

NATOA is a not for profit professional association made up of individuals and organizations responsible for – or advising those responsible for – telecommunications policies and services in local governments throughout this country. NATOA has a long-standing policy platform that fully supports the provision of broadband services to all consumers nationwide. Our members have worked diligently over the years to bring the best technologies into their communities and to see them made available to all of their citizens and businesses. One area in which our members are lacking information relates to the successes they have experienced. We often hear about the failures, but too frequently fail to share the positive outcomes and how those results were achieved.

The goal of the proposed work is to digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in appropriate theoretical and situational context. This work directly addresses a critical need identified by the National Research Council in their 2002 report *Broadband: Bringing Home the Bits*, for improved understanding of local government practices – both best and worst – for encouragement of broadband deployment and use.

NATOA expects that this study will assist our local government members by:

- Collecting and analyzing data we would not have the resources to do on our own
- Documenting the best uses of scarce local government resources
- Bringing academic rigor and independence to the analysis

- Adding appropriate consideration of local context to commonly cited anecdotal evidence
- Improving dissemination of information among local governments, reducing repetition of work and thereby allowing more communities to formulate effective, appropriate broadband strategies more quickly and at less expense
- Objectively examining the impact of broadband on local e-government and economic development – a need identified by the September 2002 Department of Commerce report, *Understanding Broadband Demand*

In short, we expect that the proposed collection, analysis and dissemination of knowledge will save time and resources for the local governments that NATOA serves.

In addition, NATOA is willing to make the following types of in-kind contributions to the success of this project:

- Assistance with data collection and survey response, by giving access to the broad government practitioner audience of its members.
- Dissemination of information to the local government community through:
 - the use of NATOA's Web site
 - the use of NATOA's proprietary listserve;
 - NATOA's mailing lists for local government jurisdictions
 - NATOA News (monthly newsletter)
 - Advertising in the *NATOA Journal of Municipal Telecommunications Policy*.
 - NATOA will also explore other opportunities, including the use of NATOA's regional and national conferences.

The estimated equivalent dollar value of this contribution is a minimum of \$2,500.00.

NATOA strongly believes that the end result of this research will be extremely valuable to all local governments. I am personally committed to seeing the best possible outcome, and to that end, I would be pleased to serve as a member of the advisory board to the research team. Given my years of experience within local government, and specifically my experience with respect to telecommunications issues, I hope to offer the team addition insight into the local government perspective.

We look forward to participating in this joint research effort.

Sincerely,



Denise M. Brady
President

cc: Libby Beaty, Executive Director



PUBLIC SERVICE COMMISSION

P O Box 202601
Helena, Montana 59620-
Telephone: (406) 444-6167
FAX #: (406) 444-7618
E-Mail: browe@state.mt.us

Bob Rowe, Commissioner
District 5

November 4, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Re: "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposal by Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University

Dear Dr. Brandt and Dr. Gregg:

Local initiatives to promote deployment of and access to broadband connectivity, applications, and content are now recognized as critical. These efforts are poorly understood. Precisely because they are local, they are especially difficult to identify, monitor, analyze, and disseminate.

The Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University proposal for an National Science Foundation Digital Government grant, "*Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development*," focuses on this important and poorly understood area in a rigorous and systematic way. It also fits squarely within the areas identified for further work by the Computer Science and Technology Board of the National Research Council, and by policymakers at the national, state and local levels.

I was honored to participate in the Committee on Broadband Last Mile Technology, convened by the Computer Science and Technology Board. In addition to examining technical and economic issues, we recognized the key role of local initiatives in promoting deployment and access. Broadband: Bringing Home the Bits, pp. 206-215, highlights several important local efforts, and summarizes the issues. Several recommendations, under the general heading "5. Increase Local Capacity to Promote Broadband Deployment," concern local initiatives (pp. 37-38).

Recommendation 5.3 suggests a clearinghouse to raise awareness, provide technical assistance, and disseminate best practices for local and regional efforts to accelerate broadband deployment. The *Local Government Stimulation of Broadband* proposal speaks directly to issues identified in the CSTB Broadband report.

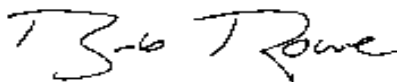
I am also a state public utility commissioner member of the Federal-State Joint Conference on Advanced Telecommunications Services (established by the Federal Communications Commission), and former President of the National Association of Regulatory Utility Commissioners (NARUC). The *“Local Government Stimulation of Broadband”* proposal meets core research needs identified by the Federal-State Joint Conference and through NARUC’s work with its research affiliate, the National Regulatory Research Institute (NRRI), located at The Ohio State University. Based on my consultation with colleagues, I make the following statements:

1. The National Regulatory Research Institute will make an in-kind contribution to research.
2. NRRI’s Associate Director, Vivian Witkind Davis, PhD, will serve on the project advisory committee and will supervise NRRI’s participation in project research.
3. NRRI will link the project results to its web page, and will otherwise aid in dissemination to its large and important audience.
4. I will serve on the project advisory committee, and will also actively participate in dissemination through NARUC, allied organizations, and the many other fora at which broadband access is a topic, and in which I participate.

You are already familiar with the high caliber work done by the project sponsors. They have demonstrated their ability to carry out the kind of research described. That research focuses directly on issues identified by the CSTB Broadband Last Mile Committee, and is core to understanding and furthering broadband deployment and access.

I hope that you will consider the project *“Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development,”* carefully and favorably. I will be delighted to answer any questions or provide any other assistance.

Sincerely,



Bob Rowe



THOMAS J. VILSACK
GOVERNOR

SALLY J. PEDERSON
LT. GOVERNOR

INFORMATION TECHNOLOGY DEPARTMENT
RICHARD J. VARN, DIRECTOR
CIO, STATE OF IOWA

November 4, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

I am writing to express my enthusiasm for serving on the advisory board of the project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant. The goal of the proposed work is to digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in their technical, economic, and governmental context. This research initiative directly addresses a critical need identified by the National Research Council in their 2002 report *Broadband: Bringing Home the Bits*, for improved understanding of local government practices – both best and worst – to encourage broadband deployment and use.

As the CIO for the State of Iowa, I have co-authored several reports addressing the issue of state- and local-level efforts to stimulate advanced communications services. All too often, little data exists to guide government decision-making. Academic research that gathers and analyzes data to address these issues would be a welcome addition.

I would be pleased to serve as an advisor to the proposed project. In that capacity, I would expect to contribute my practical expertise as a government manager to the detailed design of the study, to interpretation of data, and to discussion of preliminary findings with the project researchers. I would also be pleased to contribute my knowledge of and contacts to local government initiatives in Iowa.

I look forward to participating in this project.

Sincerely,



Richard J. Varn
CIO, State of Iowa



Public Utility Commission of Texas

October 28, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

As a Commissioner on the Public Utility Commission of Texas, I would like to express its interest in and support for the project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant.

In my opinion, this study will advance broadband deployment. As a member of a joint FCC-state PUC conference on broadband deployment, we have identified local governments as a prime underleveraged tool in promoting broadband deployment. The National Research Council in their 2002 report *Broadband: Bringing Home the Bits*, identified improved understanding of local government practices as a key driver for encouraging broadband deployment and use.

The proposed study will digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in appropriate theoretical and situational context. I believe that this work will improve broadband deployment in local communities by:

- Collecting and analyzing data we would not have the resources to do on our own
- Adding appropriate consideration of local context to commonly cited anecdotal evidence
- Bringing academic rigor and independence to the analysis
- Improving dissemination of information among local governments, reducing wheel re-invention and thereby allowing more communities to formulate effective, situationally appropriate broadband strategies more quickly and at less expense
- Objectively examining the impact of broadband on local e-government and economic development – a need identified by the September 2002 Department of Commerce report, *Understanding Broadband Demand*
- Documenting the best uses of scarce local government resources



In short, I expect that the proposed collection, analysis and dissemination of knowledge will further the state of understanding in how local governments can accelerate broadband deployment.

I have worked closely with several of the principal investigators. I believe that this interdisciplinary team of researchers bring unique skills to accomplish the project's goals. Local government broadband strategy development unfolds within a rich context that is shaped by available technology, institutional capability, political forces, and market alternatives. An experienced group of researchers from Electrical Engineering and Computer Science, Political Science, Economics, and Policy is therefore essential for understanding and consideration of the full context. The cross-institutional team assembled for this project draws on the strengths of each of the participating institutions in these different areas.

I hope that you will look favorably on this proposal. We look forward to participating in this joint research effort.

Sincerely,

A handwritten signature in black ink, appearing to read "Brett A. Perlman", with a long horizontal flourish extending to the right.

Brett A. Perlman



THE COMMONWEALTH OF MASSACHUSETTS
OFFICE OF CONSUMER AFFAIRS AND BUSINESS REGULATION

**DEPARTMENT OF
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DEIRDRE K. MANNING
COMMISSIONER

October 25, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

I would like to express interest in and support for the project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant. The goal of the proposed work is to digest lessons from local governments that have tried a range of strategies for stimulating broadband, and to place those results in appropriate theoretical and situational context. This work directly addresses a critical need identified by the National Research Council in their 2002 report *Broadband: Bringing Home the Bits*, for improved understanding of local government practices – both best and worst – for encouragement of broadband deployment and use.

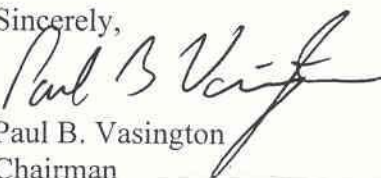
I expect that this study will help the Massachusetts Department of Telecommunications and Energy by collecting and analyzing data we would not have the resources to do on our own, and bringing academic rigor and independence to the analysis. In short, the proposed collection, analysis, and dissemination of knowledge will save time and otherwise-misspent resources for state utility regulators.

The interdisciplinary team of researchers assembled for this project is a strength for accomplishing the project's goals. Local government broadband strategy development unfolds within a rich context that is shaped by available technology, institutional capability, political

forces, and market alternatives. An experienced group of researchers from Electrical Engineering and Computer Science, Political Science, Economics, and Policy is therefore essential for understanding and consideration of the full context. The cross-institutional team assembled for this project draws on the strengths of each of the participating institutions in these different areas.

The Massachusetts Department of Telecommunications and Energy looks forward to participating in this joint research effort.

Sincerely,



Paul B. Vasington
Chairman

October 25, 2002

Dr. Lawrence E. Brandt
Dr. Valerie Gregg
Program Managers, Digital Government
National Science Foundation
4201 Wilson Blvd.
Arlington, VA 22230

Dear Dr. Brandt and Dr. Gregg:

The Massachusetts Technology Collaborative would like to express its interest in and support for the project "Local Government Stimulation of Broadband: Effectiveness, E-Government, and Economic Development," proposed jointly by the Massachusetts Institute of Technology, Carnegie Mellon University, and Harvard University, for an NSF Digital Government grant.

By way of introduction, the Massachusetts Technology Collaborative (MTC) is a quasi-public economic development corporation, chartered by the Commonwealth of Massachusetts to conduct projects throughout the state that promote the growth of technology-based industries, or the growth of technology infrastructure necessary for economic growth. MTC was instrumental to the creation of Berkshire Connect project, an organization of business Internet users that has brought competitive, facilities-based broadband communications to our westernmost county, and we are the co-organizer of the MassBroadband Initiative, a project to identify pro-active strategies to encourage the continued deployment of competitive broadband services throughout the state.

We strongly support the project proposed by MIT's Program on Internet and Telecoms Convergence, in collaboration with Carnegie Mellon University and Harvard University. We know from experience that the MIT program has proven record of performance in assessing the complex issues relative to the economics of broadband deployment and their interaction with changing broadband technologies.

We strongly believe that continued deployment of competitive broadband services, through the entire range of available and emerging technologies, is a critical objective for general economic development in Massachusetts, and as a means of supporting continued

innovation in our very important communications hardware and software industry clusters. Our hope is that the findings of the proposed project will find immediate use in our continuing work throughout the Commonwealth of Massachusetts, and we look forward to providing as much support to the project, formally and informally, as we can.

More specifically, we believe that our organization and others in Massachusetts will benefit from the work of the research team in:

- Collecting and analyzing data we would not have the resources to do on our own
- Adding appropriate and rigorous consideration of local context to commonly cited anecdotal evidence
- Improving on a base of publicly available data, and best practice examples that can be disseminated widely among local governments, thus allowing communities to formulate effective, situationally appropriate broadband strategies more quickly and at less expense
- Objectively examining the impact of broadband on local e-government and economic development – a need identified by the September 2002 Department of Commerce report, *Understanding Broadband Demand*
- Documenting the best uses of scarce local government resources

MTC views the interdisciplinary team of researchers assembled for this project as a strength for accomplishing the project's goals. Local government broadband strategy development unfolds within a rich context that is shaped by available technology, institutional capability, political forces, and market alternatives. An experienced group of researchers from Electrical Engineering and Computer Science, Political Science, Economics, and Policy is therefore essential for understanding and consideration of the full context. The cross-institutional team assembled for this project draws on the strengths of each of the participating institutions in these different areas.

We look forward to participating in this joint research effort.

Sincerely,

A handwritten signature in dark ink, appearing to read 'Mitchell Adams', with a long horizontal flourish extending to the right.

Mitchell Adams
Executive Director