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Barriers to Broadband Adoption

A Report to the Federal Communications Commission

The Advanced Communications Law & Policy Institute
New York Law School

BARRIERS TO BROADBAND ADOPTION:

A REPORT TO THE FEDERAL COMMUNICATIONS COMMISSION

THE ADVANCED COMMUNICATIONS LAW & POLICY INSTITUTE
NEW YORK LAW SCHOOL

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TABLE OF CONTENTS

I. INTRODUCTION........ 1

A. Report Context........ 1

1. Myriad of Broadband Adoption Barriers........ 2
2. Importance of Promoting Broadband Adoption........ 2
3. Key Role of Wireless Broadband........ 3

B. Report Structure........ 4

II. SENIOR CITIZENS........ 6

A. An Overview of Broadband & Senior Citizens........ 6

1. Broadband Adoption Among Senior Citizens........ 6
2. The Impacts of Broadband on Senior Citizens........ 7
3. Cost Savings Enabled by Broadband........ 8

B. Barriers to Broadband Adoption........ 10

1. Lack of awareness or skepticism regarding the value of broadband........ 10
2. Usability concerns........ 11
   a. Computer hardware & software........ 11
   b. Online content........ 12
3. Low rate of computer ownership........ 13
4. Affordability of broadband for seniors who live on fixed incomes........ 13
5. Online security concerns........ 14
6. Unique living conditions........ 15
   a. Rural seniors........ 15
   b. Non-traditional living arrangements........ 15
7. Disincentives for using broadband to work past retirement........ 16
8. Lack of training and core computer competencies........ 16

9. Systemic lack of coordination among government entities regarding funding of senior-oriented training programs 17

III. PEOPLE WITH DISABILITIES 18

A. An Overview of Broadband & People with Disabilities 18

1. Broadband Adoption Among People with Disabilities 18

2. The Impacts of Broadband on People with Disabilities 20

3. Educational & Economic Opportunities Facilitated by Broadband 21

B. Barriers to Broadband Adoption 22

1. Availability of broadband for people with disabilities living in remote areas 23

2. Low levels of computer usage and ownership 23

3. Limited access to public computers 24

4. Low levels of exposure to the benefits enabled by broadband 24

5. Negative perceptions regarding the accessibility of broadband 25

6. Affordability concerns related to subscription price and costs of assistive technologies 26

7. Interoperability of assistive technologies 27

8. Lack of training and expertise among people with disabilities and among educators 28

9. Lack of data regarding the individual needs of people with disabilities vis-à-vis broadband 29

10. Lack of best practices for spurring awareness, demand, adoption, and use of broadband 30

11. Uncertainty regarding the relationship between legislation, innovation, and access to new technologies and services 30

IV. TELEMEDICINE 32

A. An Overview of Broadband & Telemedicine 32

1. Impacts and Uses of Broadband-Enabled Telemedicine 32

2. Cost Savings Enabled by Telemedicine 34

B. Barriers to Broadband Adoption 36

1. Inadequate reimbursement mechanisms for most telemedicine services 37

2. Outdated and fragmented privacy policies for the electronic transmission of health data 38

3. Lack of security standards for data generated from telemedicine services 40

4. Patchwork of state-by-state physician regulation 41

a. Licensing 42

b. Credentialing 42

5. Uncertainty regarding the scope of tort laws 43

6. Negative perceptions and inadequate value propositions for using telemedicine services by patients 44

7. Inadequate value propositions and high costs associated with telemedicine applications for physicians 45

8. Concerns related to the outsourcing of certain medical functions 46

9. Limited scope of federal telemedicine funding 47

10. Lack of standards to guide the interoperability of new telemedicine services 48

11. Lack of available spectrum for the deployment of new telemedicine services and applications 49

12. Institutional inertia among some physicians 50

V. ENERGY 51

A. An Overview of Broadband & The Energy Sector 51

1. Electric Grid Enhancements ... 51

2. Energy Conservation & Efficiency ... 53

B. Barriers to Broadband Adoption ... 55

General Barriers to Broadband Adoption in the Energy Sector

1. Lack of better coordination among stakeholders and regulators in the energy and advanced communications sectors ... 56

2. Lack of an "ecosystem of innovation" due to prevailing regulatory paradigm and resulting business model ... 58

a. Prevailing regulatory paradigm ... 59

b. Resulting business model ... 60

3. Fragmented nature of energy regulation ... 60

Barriers to Broadband Adoption for Smart Grid Deployments

4. Lack of consumer awareness of and demand for smart grid applications and devices ... 61

5. Lack of generally applicable, consensus-based standards for the development of interoperable smart grid technologies ... 62

6. Spectrum needs for the deployment of smart grid technologies ... 63

7. Unresolved security concerns ... 64

a. Network security ... 64

b. Network reliability ... 64

8. Uncertainty regarding the privacy and storage of customer data collected via the smart grid ... 65

a. Privacy ... 65

b. Data storage ... 66

Barriers to Using Broadband for Energy Efficiency Initiatives

9. Lack of incentives for employers to encourage telecommuting ... 66

10. Lack of clear policies regarding sharing and usage of consumption information ... 67

VI. EDUCATION 68

A. An Overview of Broadband & Education 68

1. The Impacts of Broadband on Education 68

2. Current Uses of Broadband for Educational Purposes 70

B. Barriers to Broadband Adoption 72

1. Costs of comprehensive utilization of broadband and broadband-enabled technologies 73

2. Lack of computer access 74

3. Outdated components of the E-rate program 75

4. Lack of a more targeted strategy for allocating federal funding 76

5. Inadequate teacher training on incorporating broadband technologies into the curriculum 78

6. Limited access to supportive software and technical assistance by educators 79

7. Demographic disparities in technology literacy 80

8. Cultural and organizational barriers among educators 81

9. Lack of adequate bandwidth within schools 82

10. Lack of national curriculum standards regarding use and integration of education technology 83

VII. GOVERNMENT 84

A. An Overview of Broadband & Government 84

1. How Government Uses Broadband & Broadband-Enabled Technologies 85

2. How Citizens Use Broadband to Interact with Government....87

B. Barriers to Broadband Adoption 88

1. Inertia among many government agencies and government staff regarding the implementation of broadband-enabled e-government solutions 89

2. Lack of expertise regarding how to effectively use broadband for e-government purposes....................................... 90

3. Lack of coordination among federal agencies and departments regarding best practices for effectively using broadband.. 91

a. Web design.. 91

b. Interagency collaboration & information sharing.......... 92

4. Cost concerns related to further integration of broadband into government functions.. 93

5. A complex array of laws and policies regarding transparency, administrative procedure, and e-government... 94

6. Lack of public awareness regarding the value of using broadband to participate in deliberative e-government services.. 96

7. Unresolved privacy issues.. 97

8. Unresolved data security issues.. 98

VIII. CONCLUSION... 100

ENDNOTES.. 101

TABLES

Table 1 – Trends in Broadband Adoption by Age Group 7

Table 2 – Overview of Broadband's Impacts on Senior Citizens 7

Table 3 – Overview of Cost Savings Enabled by Broadband for Seniors 9

Table 4 – A Survey of Statistics re People with Disabilities 19

Table 5 – Overview of Broadband's Impacts on People with Disabilities 20

Table 6 – Employment, Income & Educational Attainment Comparison 21

Table 7 – Overview of Educational & Economic Opportunities Enabled by Broadband 22

Table 8 – Overview of the General Impacts of Broadband-Enabled Telemedicine.. 33

Table 9 – Overview of Current Broadband-Enabled Telemedicine Uses 34

Table 10 – Overview of Cost Savings Enabled by Telemedicine 35

Table 11 – Impacts of a Broadband-Enabled Smart Grid 52

Table 12 – Overview of Smart Grid-Enabled Consumer Tools 54

Table 13 – Overview of Broadband's Impacts on the Traditional Education Paradigm 69

Table 14 – Overview of Current Uses of Broadband for Educational Purposes....... 70

Table 15 – Overview of How Government Uses Broadband 85

Table 16 – Overview of How Citizens Use Broadband to Interact with Government 88

I. INTRODUCTION

The Advanced Communications Law & Policy Institute (ACLP) at New York Law School submits this Report to the Federal Communications Commission (FCC) for use during the development of its national broadband plan.

This Report focuses on two demographic groups – Senior Citizens and People with Disabilities – and on four sectors of the economy – Telemedicine, Energy, Education and Government – that stand to benefit greatly from more robust utilization of broadband but, for the reasons discussed herein, face a number of barriers to further adoption of broadband and broadband-enabled technologies.

A. Report Context

Ubiquitous availability and usage of broadband is vital to continued innovation, social advancement, and economic development in the United States.[1] In order to realize these goals, however, broadband adoption rates must be maximized across all demographic groups and sectors of the economy. Yet, as discussed herein, there are a number of fundamental barriers to further adoption and use of broadband.

That broadband is a critical tool for the United States and its citizenry is undisputed. However, the dimensions associated with maximizing broadband usage in the United States are multiple and include not only additional network deployments to unserved parts of the country but also an understanding of the many factors influencing broadband adoption and usage among all user groups.

Broadband is available to the vast majority of Americans, and service providers continue to invest billions of dollars in enhancing and extending network infrastructure.[2] Indeed, the FCC has observed that many residents live in areas with multiple broadband providers,[3] and billions of dollars in stimulus funding have been allocated to spur the deployment of network infrastructure to those parts of the country that remain unserved.[4] Yet, in the areas where broadband is already available, a significant number of potential users have yet to adopt and actively use this technology.

While the adoption rate for all U.S. adults has steadily increased over the last few years, more than half of some demographic groups (e.g., senior citizens, people with disabilities, African Americans, and people earning less than $20,000) do not subscribe to broadband.[5] In addition, even though broadband is a dynamic platform that enables a wide range of cutting-edge applications and services, adoption and use remains relatively low in key sectors of the U.S. economy.

1. *Myriad of Broadband Adoption Barriers*

The factors impeding more robust broadband adoption among different demographics and sectors are numerous, varied, and substantial. Throughout the following analysis, major themes regarding non-adoption will emerge for each of this Report's six focus areas. As an overview:

- For **senior citizens**, a general lack of adequate education and training are key contributors to a relatively low broadband adoption rate;
- For **people with disabilities**, widespread negative perceptions regarding the accessibility of broadband impedes further adoption and use of this technology;
- In the **telemedicine** sector, a number of outdated legal and policy frameworks hinder more robust adoption and use of broadband-enabled telemedicine services by patients and healthcare providers;
- In the **energy** arena, the highly regulated and conservative nature of many energy utilities challenges the dynamic nature of broadband and the ecosystem of innovation that it fosters;
- In the **education** space, lack of targeted funding and inadequate training impede further adoption and usage of broadband and broadband-enabled educational tools in schools across the country; and
- For **government** entities, institutional inertia and a lack of cross-government collaboration regarding best practices has slowed the effective integration of broadband into many government processes.

With regard to forging policies that spur broadband adoption in each sector, one size will not fit all. Indeed, as discussed throughout this Report, each sector faces a unique set of barriers to further broadband adoption. Overcoming these barriers will likely require carefully tailored policies that target the distinctive needs of each discrete group. In addition, promoting widespread awareness of the many benefits that can flow from a broadband connection, including an array of cost savings and economic opportunities, is critical to spurring adoption.

2. *Importance of Promoting Broadband Adoption*

The cost savings and positive benefits enabled by broadband have the potential to enhance individual lives, the country's economic performance, and how government governs. Examples, discussed in detail throughout this Report, include:

- Lower prescription drug bills for seniors who use broadband to conveniently comparison shop online;
- Using broadband to access a growing universe of educational and employment opportunities for people with disabilities;
- Millions if not billions in potential cost savings associated with using real-time broadband-enabled monitoring services that track vital signs and allow patients to age at home for longer;
- More reliable, affordable, and efficiently-used energy via a broadband-enabled smart grid;
- Wider availability of online and distance learning courses for students of all ages and in all parts of the country; and
- More transparent, interactive, and streamlined administration of government services.

3. *Key Role of Wireless Broadband*

A key enabler of broadband is the continued deployment of advanced network infrastructure across all parts of the United States. In particular, wireless broadband is quickly emerging as a vital platform for services and applications in each of the six sectors discussed in this Report.[6] Specific examples of the role that wireless broadband is playing in these segments are provided herein. As an overview, wireless broadband is increasingly being used to:

- Support in-home monitoring systems and other mobile healthcare applications for all patients, including senior citizens[7];
- Enable advanced smartphones, which are being used by healthcare providers to enhance the quality of care and by students to access cutting-edge educational tools and services; and
- Facilitate the rapid deployment of the smart grid, which uses a number of wireless sensors to transmit usage data in real-time.

Unlike wired broadband, however, the deployment of wireless broadband is impacted by factors other than investment levels. The major distinguishing factor is that wireless broadband requires ample spectrum to be deployed on the scale needed to enable the services and benefits described below.[8] Many stakeholders, including the FCC,[9] agree that additional swaths of spectrum are needed to support the robust types of services discussed in the Report. However, this is a "complex challenge" for a number of reasons.[10]

First, there is generally a lack of information regarding how some spectrum bands are being utilized. Swaths of spectrum are owned by a large number of diverse stakeholders for both federal and non-federal uses. Most owners are required to use their allocated spectrum in specific ways according to rules the FCC attaches to each band.[11] Yet, despite these rules, some feel that there is uncertainty regarding how each band of spectrum is being used, whether it is being fully utilized or under-used, and whether a particular band of spectrum could be utilized for more innovative purposes. In response, policymakers are actively reevaluating spectrum allocation and usage policies and considering methods for reallocating some portions of the airwaves.[12] How to effectively bolster spectrum allocation and reallocation, however, remains a point of some debate – including some arguments designed to delay any process. *That said, the debate on spectrum uses should not in and of itself become a barrier to making more spectrum available in the near term*.

Second, mobile broadband deployment is impacted by policies related to the construction and usage of towers, poles, and other aspects of the wireless infrastructure. As the FCC has observed, these components are "the backbone of [the] wireless infrastructure, supporting both commercial and private wireless services, in addition to critical public safety and homeland security wireless communications."[13] However, since wireless infrastructure-related policies are largely local in nature, carriers face a patchwork of policies that may create inefficiencies and delays in network deployments. This patchwork of policies represents another major barrier for innovators in the wireless broadband space.[14]

Going forward, wireless broadband will play an increasingly invaluable role in extending the reach of new services and applications and sustaining an ecosystem of innovation across all sectors of the economy. As a result, implementing forward-looking policies that support continued network deployment and innovation is imperative to spurring broadband adoption in the sectors discussed herein.

B. <u>Report Structure</u>

This Report is composed of six substantive sections, each of which consists of two primary parts.

Part A of each section discusses the adoption, use, and impacts of broadband on

- Senior citizens (**Section II**);
- People with disabilities (**Section III**);
- Telemedicine (**Section IV**);
- Energy (**Section V**);

- Education (**Section VI**); and
- Government (**Section VII**).

Part B of each section sets forth the key policy and non-policy barriers to further broadband adoption and usage. These barriers encompass a broad range of impediments flowing from outdated laws, antiquated policies, and a general unawareness by many stakeholders regarding the true value of adopting broadband.

As the FCC moves forward with its national broadband plan, understanding the many policies that directly and indirectly impact demand for and adoption of broadband will ensure a comprehensive and effective plan that stimulates awareness and usage of this vital technology.

* * * * * *

II. SENIOR CITIZENS

For senior citizens, broadband enables a wide range of life-enhancing social, economic, and health-related benefits.[15] It allows them to stay in better touch with family, to obtain relevant and timely health information, to work from home or start a small business, and to use the growing universe of telemedicine tools enabled by broadband. These impacts are discussed in Part A. However, for the many reasons set forth below, a significant number of older adults remain offline. Part B identifies key policy and non-policy barriers to further broadband adoption and usage by senior citizens.

A. An Overview of Broadband & Senior Citizens

This part provides: (1) an analysis of current levels of broadband adoption among senior citizens; (2) an overview of the impacts of broadband on this demographic; and (3) a summary of potential key cost savings enabled by this technology.

1. *Broadband Adoption Among Senior Citizens*

According to recent data, there were nearly 38 million people over the age of 65 living in the United States in 2007, representing just over 12 percent of the population.[16] The number of seniors grew by 11 percent between 1997 and 2007[17] and is poised to double by 2050, at which time seniors will make up nearly 20 percent of the population.[18] The senior population will also grow significantly as "baby boomers" begin to retire in 2011.[19] According to the U.S. Census Bureau, there are over 78 million boomers in America, making it the largest generation in history.[20]

While broadband is already available to "most of us,"[21] a majority of seniors have yet to adopt broadband. Currently, only 30 percent of adults over the age of 65 have adopted broadband at home.[22] However, two trends are illustrative of increasing adoption of broadband among this demographic group.

First, as depicted in Table 1, broadband adoption by adults over 65 has increased more than any other age group over the last several years.

Table 1 - Trends in Broadband Adoption by Age Group

Age Group	% Change in Broadband Adoption 2005-2008
18-29	84.2
30-49	91.7
50-64	85.5
65+	137.5

Source: Pew[23]

This trend continues. The percent change in broadband adoption between 2008 and 2009 among adults over 65 was 58 percent.[24] Similarly, senior use of mobile Internet grew by 67 percent between 2008 and 2009.[25] Senior growth rates for both broadband and mobile Internet adoption outpaced all other age groups over the past year.

Second, younger seniors are more likely to adopt broadband than older seniors, creating a "gray gap": 58 percent of people age 55-59 have home broadband; 48 percent of those between age 60-64, 42 percent of those age 65-69, and 31 percent of those age 70-75 have adopted broadband, while 16 percent of those over 76 have home broadband.[26] Anecdotal evidence, however, suggests that targeted training efforts are successful in closing this gap and bringing all seniors online.[27]

2. *The Impacts of Broadband on Senior Citizens*

Those seniors already online via broadband are benefitting from an array of positive impacts enabled by this technology. Table 2 provides an overview of these impacts.

Table 2 - Overview of Broadband's Impacts on Senior Citizens

Social Impacts	*Economic Impacts*	*Impacts on Healthcare & Well-Being*
▪ Broadband increases connectivity with family and friends. ▪ Broadband fosters feelings of relevance and provides seniors with an interactive outlet to the world. ▪ Enhancing personal communications can decrease feelings of depression and isolation.	▪ Individual economic gains include: e-commerce; managing personal finances online; savings on prescription drugs; and enhanced employment opportunities. ▪ Economy-wide gains include increases in: small business creation; seniors in the workforce; senior-oriented content and applications; and healthcare savings.	▪ Broadband is enhancing senior wellness and preventive care. ▪ Broadband is enabling lifesaving and life-enhancing telemedicine services like in-home, real-time monitoring. ▪ The potential for cost savings flowing from increased usage of broadband-enabled healthcare services and applications is tremendous.

With some 30 percent of non-institutionalized seniors living alone,[28] broadband is a key tool for combating feelings of disconnectedness, which can lead to depression or a host of other debilitating diseases. Studies have found that seniors who master computer skills appear to have fewer depressive symptoms than those who remain technologically unconnected[29] and that increased integration through social support services can protect against some mortality risks and lead to better mental health.[30]

In addition, the nation's current economic crisis has further underscored the value of broadband as an employment tool for older adults. Unemployment levels for adults aged 65 and over rose from 3.4 percent in 2007 to 6.8 percent in 2009, reaching "the highest level recorded since the federal government began computing reliable unemployment rates in 1948."[31] Similarly, the unemployment rate for those over age 55 increased from 2.7 percent in 2007 to 5.9 percent in 2009.[32] In particular, low-income older workers have been profoundly impacted by the recession, as nearly half of those over age 55 must continue working in order to keep their homes, and 68 percent report that their retirement income is inadequate to support them.[33] Experience Works recently found that 45 percent of low-income older workers had planned to be already retired, and 38 percent need to leave retirement and return to work.[34] Broadband-enabled telework options and increased online training opportunities may allow many of these low-income seniors to work past retirement age (see Barrier #7 for further discussion).[35]

3. *Cost Savings Enabled by Broadband*

The many life-enhancing impacts of broadband enable enormous cost savings for senior citizens. Table 3 provides a summary of some of the actual and potential savings.

Table 3 - Overview of Cost Savings Enabled by Broadband for Seniors

e-Commerce Generally	*Prescription Drug Savings*
▪ The fastest growing sector in the U.S. marketplace, e-commerce provides significant financial benefits for those utilizing broadband to purchase goods and services online. A recent report observed that "[b]usinesses and consumers that use e-commerce benefit from a reduction in costs in terms of the time and effort required [to search] for goods and services and complete transactions."[36] ▪ Use of the Internet enables buyers to find products or sellers with the lowest prices, thereby benefitting from an immediate financial gain.[37] ▪ Shopping from home has a number of other impacts, including lower transportation costs and less physical exertion for seniors.	▪ Broadband facilitates the easy comparison of prescription drug prices and lowers costs for older adults. For example, *Checkbook* magazine has found vast price differences among prescription drugs within the same metropolitan areas and concluded that online retailers often offered lower prices for certain drugs.[38] ▪ A wide array of online resources has been developed for seniors who are looking for affordable prescription drugs. AARP, for example, has partnered with Walgreens to provide seniors with an online portal to purchase discounted drugs.[39] In addition, one organization helped a group of seniors use the Internet to save over $19,000 on their prescription drugs via the Medicare Part D website.[40]
Total Healthcare Related Cost-Savings	***Remote Monitoring Cost Savings***
▪ It has been estimated that broadband-based health resources can save some $927 billion in health care costs for seniors and people with disabilities.[41] ▪ Broadband-enabled technologies lower healthcare costs through early intervention and preventative techniques, less need for physician visits, and the decreased distance required for physician and patient travel, among others.[42]	▪ The average cost for a private room in a nursing home is $213 per day or $77,745 annually.[43] The average monthly cost of living in an assisted living facility is $2,969 or $35,628 annually.[44] And the average hourly rate for a certified home health aide is $32.37.[45] In-home health monitoring systems allows seniors to age at home longer, reducing or eliminating many of these costs. ▪ A recent study estimated that "a full embrace of remote monitoring alone could reduce healthcare expenditures by a net of $197 billion (in constant 2008 dollars) over the next 25 years with the adoption of policies that reduce barriers and accelerate the use of remote monitoring technologies."[46]

A variety of other cost savings are possible via broadband. These include the elimination of fees to a money manager by personally managing retirement savings online and reduced communications costs by using email and more affordable telephony services (e.g., Skype) to stay in touch with family and friends. The amount and variety of cost savings could help offset the monthly subscription price of broadband for a senior living on a fixed income.

B. Barriers to Broadband Adoption

A wide array of policy and non-policy barriers hinders more robust broadband adoption and usage by senior citizens. These barriers include:

1. Lack of awareness or skepticism regarding the value of broadband
2. Usability concerns
    a. Computer hardware & software
    b. Online content
3. Low rate of computer ownership
4. Affordability of broadband for seniors who live on fixed incomes
5. Online security concerns
6. Unique living conditions
    a. Rural seniors
    b. Non-traditional living arrangements
7. Disincentives for using broadband to work past retirement
8. Lack of training and core computer competencies
9. Systemic lack of coordination among government entities regarding funding of senior-oriented training programs

* * * * * *

1. *Lack of awareness or skepticism regarding the value of broadband*

Seniors have a much lower broadband adoption rate than any other age group.[47] This low adoption rate stems largely from inadequate value propositions (or perceived inadequate value propositions) and a general lack of awareness of the benefits of broadband.

Seniors are more likely than any other age group to cite low interest or lack of relevance to their lives as a reason for not adopting broadband. *Among seniors without broadband access, 44 percent state that they are not interested in broadband, nothing could get them to switch, or they are just too busy*;[48] only eight percent of adults ages 18 to 29, and 26 percent of those 50 to 64, made such claims.[49] Further, one study from 2003 found that eight in ten off-line seniors do not think that they will ever go online.[50] Moreover, in

2006, adults over the age of 65 were less than half as likely as those aged 18 to 29 to consider home computers and high-speed Internet access a necessity.[51]

Lifestyle factors, limited awareness, and lack of relevant of web content may prevent many seniors from appreciating the full value of broadband. Seniors are a group who did not grow up using computers and the Internet and may also not have been in the workforce when computers became standard.[52] Indeed, according to a study from 2004, seniors "often live lives far removed from the Internet, know few people who use email or surf the Web, and cannot imagine why they would spend money and time learning how to use a computer."[53] A lack of understanding of what broadband is and what it can do thus remains a large obstacle.[54] And once online, senior-specific content is relatively sparse (see Barrier #2). These various factors combine to lessen the value proposition being offered to senior citizens, creating a formidable barrier to further adoption of broadband among this age group.

2. *Usability concerns*

Senior citizens, as a group, have a number of unique needs vis-à-vis effective broadband use. For example, many seniors suffer from age-related vision degradation, making it more difficult to read some online content.[55] In addition, age-related physical impairments (e.g., hand tremors) may make it difficult for some to accurately maneuver a mouse or other computer hardware. These and other such conditions thus make the design of hardware, software, and online content critically important for facilitating further adoption and use of broadband among seniors. However, many of these issues remain unresolved. This section focuses on barriers to broadband adoption associated with (a) the usability of computer hardware and software and (b) the design of online content for seniors.

a. *Computer hardware & software*

Age-related changes in perceptual, cognitive, and psycho-motor abilities pose a number of barriers to further broadband adoption and use by many senior citizens.[56] For example, in addition to the challenges of developing technology skills generally, many seniors have trouble reading small fonts, distinguishing certain colors, and remembering information in the short term.[57] Vague or overly complex wording on computer error messages and websites can also be difficult for seniors to understand.[58] Further, mobility impairments from arthritis and hand tremors make basic computer use problematic for some seniors.[59] As a result, many seniors perceive the Internet and related technologies to be unusable.

A recent study found that 59 percent of seniors cite a lack of usability as a major reason for not adopting broadband at home, compared to just four percent of adults aged 18 to 29.[60] Significantly, this perception is often matched by reality. To this end, a 2002 study, which examined the ability of adults over age 65 to complete basic tasks online, found that adults aged 21-55 significantly outperformed seniors in terms of success rate for task completion, time taken to complete the task, number of errors and subjective rating. The normalized overall usability rate for seniors was 100 percent, compared to 222 percent for participants age 22-55.[61]

Negative perceptions regarding usability, along with high levels of frustration with trying to learn these new technologies, represents a formidable barrier to further adoption and usage of broadband among many older adults.

b. *Online content*

Much online content is not designed with the senior user in mind.[62] Web designers often assume that users have full physical and mental capabilities, as well as developed technological skills.[63] However, a number of innovators in this space have begun to accommodate the special needs of older adults, and web content accessibility is improving.[64] To speed along this process, many organizations have begun publishing web usability guidelines. The National Institute on Aging (NIA), for example, has published guidelines pertaining to site organization, text formatting, navigation, and media use.[65] Usability.gov serves as the primary government source for usability and user-centered design resources.[66] Nonetheless, one study found that there is a lack of consistency in accessibility for websites designed for older adults. Most of the examined websites complied with NIA guidelines regarding basic navigation and content style, but not for text size, text weight, or site map availability.[67]

Concerns with web content usability are further pronounced with regards to senior-oriented government information found online. A recent study by the University of Miami regarding the usability of the Medicare website by senior citizens is instructive. Results showed that the site is difficult for older adults to use, and that many find it confusing and overly complex.[68] While enrolling in the Medicare Part D prescription drug program, 72.3 percent of participating seniors had difficulty navigating to the necessary Web pages, locating information, and following the steps necessary to select a plan.[69] Such senior web-based services are often not sufficiently intuitive and may prevent many older adults from obtaining the information they need.[70]

Several government agencies, however, have developed senior-friendly tools. The IRS, for example, has increased the usability of IRS.gov in order to spur the usage of online paper filing. Ongoing usability tests, online surveys, and focus groups have been used to understand customer needs and improve the site's usefulness and flexibility.[71] The IRS also relies on the American Customer Satisfaction Index, an independent organization, to benchmark customer experiences on the website.[72] As a result of these efforts, the IRS saw record numbers of site visits in 2008[73] and a 19 percent increase in e-filings from home computers in 2009.[74]

Improvements in accessibility and usability of some government services have proven to be effective in spurring usage of these services by the general public (see Section VII) and may likely be critical to ensuring that older adults become active online participants.[75]

3. *Low rate of computer ownership*

Owning a computer is an essential prerequisite to adopting and using broadband at home. Those without a home computer have lower levels of demand for broadband. To this end, a recent study of homes in Tennessee found that 36 percent of residents with no home broadband connection attributed their non-adoption to the lack of a home computer. Lack of a computer outweighed both price and availability as a major deterrent to broadband adoption.[76]

Senior citizens are less likely than any other age group to own a computer.[77] As the Consumer Electronics Association has observed, "[a]dults over the age of 65 are 21 percent less likely to own a home computer than adults under the age of 30."[78] Owning or having access to a computer is essential to using wire-based broadband and is essential for developing technology skills and overcoming initial cost-barriers to broadband adoption. Continued low computer ownership among seniors represents a formidable barrier to broadband adoption.

4. *Affordability of broadband for seniors who live on fixed incomes*

While broadband prices have decreased over time, many seniors live on fixed incomes and find the service to be unaffordable.[79] The median income for seniors in 2007 was $24,323 for males and $14,021 for females.[80] For households containing families headed by someone over the age of 65, median income in 2007 was $41,851.[81] By way of comparison, the median income for households headed by someone under the age of 65 was $56,545 in 2007.[82] Income levels impact broadband adoption. Indeed, the vast majority of homes with incomes above $75,000 have adopted broadband, compared to 35 percent of households with annual incomes below $20,000.[83]

With the average price of broadband service estimated to be $39 per month, compared to $26.60 for dial-up,[84] many seniors are opting for the slower but cheaper alternative. While spending an additional $10-15 per month may be worthwhile and could potentially be offset by cost savings enabled by their broadband connection (see above), many seniors have not done so. However, once seniors experience the difference between dial-up and broadband, anecdotal evidence suggests that many opt to pay more for broadband service.

While the Universal Service Fund (USF) assists many low-income individuals in obtaining basic telephone service, such an option does not currently exist for broadband. The Lifeline and Link-Up programs currently offer up to $30 for installation fees and $10 per month to offset phone costs to help many low-income Americans access the technology they need.[85] Lack of similar funding for broadband services may prevent many older adults from utilizing such technologies. A growing number of organizations and entities support expansion of USF subsidies to include broadband services.[86] Legislation was introduced in the U.S. House of Representatives in September 2009 that would devote a percentage of Lifeline funds for broadband purposes.[87]

However, in the absence of policy reforms and of effective outreach initiatives to educate seniors on how to use a broadband connection to save money, many seniors will likely remain off-line because of the perception that the cost of the service is too high.

5. O*nline security concerns*

Older adults tend to be wary of providing personal information online. Pew found that 82 percent of senior Internet users did not like sharing their credit card number or personal information online, compared with 71 percent of those aged 18 to 29.[88] While 46 percent of Internet users ages 30 to 49 are online shoppers, only six percent of those over 65 have ever purchased a product online.[89] Anxiety over Internet use stems largely from the many reports of identity theft, viruses, malware, Internet fraud, and technology breakdowns.[90] A 2008 study found that older adults are afraid of venturing into chatrooms, where they might fall victim to predatory conduct.[91] In addition, many seniors doubt the trustworthiness of online information sources.[92] Moreover, some seniors express a fear of having their financial information or e-mail address to fall into the wrong hands.[93]

Senior citizens may be more at risk for Internet fraud than other demographics. A study by the American Psychological Association found a strong correlation between memory problems and vulnerability to scams.[94] The study found that older adults are ten times more likely to remember false information than younger adults.[95] Further, a lack of technical expertise and knowledge of Internet safety can put individuals at greater risk for online ploys.[96] Among common Internet crimes, seniors are at greatest risk for financial exploitation.[97] As a result, many seniors are wary of even venturing online for fear of having their identity stolen or otherwise being manipulated. Entities like AARP have sought to educate older users about how to safely surf the Web,[98] but concerns about online security are still prevalent.

6. U*nique living conditions*

This barrier examines two types of living conditions that are prevalent among older adults: (a) living in rural areas and (b) living in non-traditional housing.

a. *Rural seniors*

According to the FCC, competition for customers has driven broadband deployment to most parts of the country.[99] The U.S. Internet Industry Association has also found that "the deployment gap between metropolitan and rural areas is closing."[100] According to the U.S. Department of Agriculture (USDA), Internet adoption rates are similar in urban versus rural areas when income factors are accounted for.[101] However, the gap between broadband adoption in rural and urban areas remains, regardless of income level.[102]

This digital gap holds considerable implications for the senior demographic since older adults are more likely than the average U.S. resident to live in a rural part of the country. According to the USDA, some 15 percent of seniors live in rural areas, compared with just 12 percent of the general population.[103] In addition, the USDA has observed that, compared to their more urban counterparts, rural seniors "generally have less income, lower educational attainment, and a higher dependence on social security income."[104] Adoption of broadband by rural seniors is especially important because of the many social, economic, and healthcare-related benefits it can deliver.

b. *Non-traditional living arrangements*

Seniors living in nontraditional institutions are less likely to be exposed to broadband than those in traditional homes. Even though a majority of adults over the age of 65 live at home, 4.4 percent live in nursing homes.[105] However, these numbers vary widely among generations of seniors. Only 1.3 percent of seniors between 65 and 74 are in nursing homes; this number rises to 15.1 percent for those over age 85.[106] Thirty percent of seniors live alone.[107]

These trends are important because second-degree Internet access is a key aspect of broadband adoption.[108] Indeed, a study of a Navajo farm community found that such a "social infrastructure" is critical to bridging gaps in adoption and usage.[109] For seniors in particular, the traditional household is a valuable source of information about computers and the Internet, as children and grandchildren are likely to utilize such technologies. Data shows that broadband use is positively correlated with marital status, or living with a partner, and whether one is the parent of a minor child in the household.[110] If seniors are not around others who use the Internet, and thus do not observe its benefits, then it will be difficult for older adults to understand the true value of broadband.[111]

7. *Disincentives for using broadband to work past retirement*

Broadband can enable seniors to extend their careers past retirement age or begin new careers via the Internet. This is critical, considering the recent rise in unemployment levels for those over age 55 and the increasing number of older adults who are looking to return to the workforce after retirement (see above).

According to AARP, older adults are poised and willing to work past retirement: "69 percent of workers [between the ages of] 45 to 74 plan to work during retirement years."[112] While 29 percent of low-income older workers plan to work just to stay active, 68 percent must work because their retirement income is not enough to live on.[113] Further, many older adults hope to work on different terms, with more flexibility and autonomy than during earlier careers. Seventy percent of older workers say they are looking for ways to balance work and their personal lives, and 41 percent report that the ability to work from home is an absolutely essential part of their ideal job."[114] A recent report issued by the Taskforce on the Aging of the American Workforce (TAAW) observed that the supply of seniors in the workforce will increase significantly over the next decade, rising by 74 percent between 2004 and 2014.[115] AARP has noted that broadband will play a major role in extending the careers of seniors.[116]

Broadband-enabled telecommuting will be important for older workers. Indeed, the TAAW has recommended that employers promote telework and flexible retirement options for older workers in order to retain them[117] and continue benefiting from their managerial experience and expertise.[118] *However, disincentives stemming from Medicare and Social Security program requirements may deter many seniors from utilizing broadband to work past retirement.*

Clauses in the Medicare laws, for example, create unnecessary obstacles for seniors who wish to use broadband to bolster their income. For instance, the cost of some Medicare benefits increases if a senior returns to work and earns over a certain amount in income per year.[119] Likewise, Social Security benefits may be reduced if an individual works part-time before retiring.[120] Moreover, those who attempt to return to work after receiving Social Security funds may face benefit reductions if they earn over a certain amount in income each year.[121] Thus, for older adults who wish to use a broadband connection to work past retirement, these types of rules may deter those who do not wish to have to ultimately pay more for benefits they have earned.

8. *Lack of training and core computer competencies*

Many baby boomers and younger seniors typically develop computer and Internet skills in the workplace, carrying those skills into retirement.[122] However, many older seniors likely left the workforce before computers were regularly used.[123] Thus, many now lack the requisite skills to use broadband to enhance their lives.[124] To this end, a survey of older adults participating in a SeniorNet computer-learning course found that personal frustrations, functional limitations, and time constraints were among the most significant barriers to Internet use.[125] Many of the participants had experienced frustration with their own perceived limitations during the learning process.[126] Mental and physical limitations include their perceived lack of knowledge of computer skills, loss of mental acuity, and mobility limitations. Other seniors feared that they lacked enough time to learn how to effectively use the technology.[127] Another study found that barriers identified by older adults include the complicated nature of computer and Internet applications, too much technical jargon, and a lack of support both during the learning process and with on-going use.[128]

Anecdotal evidence, however, suggests that, even though learning to use the Internet can be a very confusing process for some seniors, the opportunity to learn in a supportive educational environment helps to overcome this barrier.[129] Moreover, once seniors are able to acquire the necessary computer-literacy skills, they become avid users and increasingly incorporate broadband into their daily lives.[130] However, many seniors simply remain offline because they lack basic computer and Internet skills.

9. *Systemic lack of coordination among government entities regarding funding of senior-oriented training programs*

Senior-specific training efforts have been deployed across the nation by private actors such as AARP, SeniorNet, and the Alliance for Public Technology. In addition, local efforts like that of the Older Adults Technology Services (OATS) in New York City[131] are increasingly prevalent. These types of programs have been very effective in enabling seniors to develop the skills they need to incorporate broadband into their lives. However, many of these organizations lack funding to expand their efforts.

Public funding provides the lifeline for many of these senior-specific education programs. While some local nonprofits like OATS in New York are able to attract private support, many programs, like Computers4Seniors in Georgia, rely entirely on public funding.[132] There is an overall lack of funding and coordination among many local state governments regarding how to effectively target and fund broadband and Internet-related training programs. Also, many local and state governments do not even consider the funding of senior technology training programs a priority, focusing instead on traditional senior care services, such as senior recreation centers. Stimulus funding has been allocated to support "sustainable adoption programs," but additional funding is likely needed in order to support proven training approaches to spurring broadband adoption among senior citizens.

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III. PEOPLE WITH DISABILITIES

For people with disabilities, broadband is a transformative tool that enables a number of life-enhancing impacts and facilitates wider availability of educational and employment opportunities. These impacts are analyzed in Part A. Many people with disabilities, though, remain offline. Part B identifies key policy and non-policy barriers to further broadband adoption and usage by people with disabilities. These range from negative perceptions that broadband technologies are inaccessible to a variety of affordability concerns.

A. An Overview of Broadband & People with Disabilities

This part provides: (1) an overview of broadband adoption among people with disabilities; (2) a broad survey of how broadband is impacting the lives of people with disabilities; and (3) a summary of the educational and economic opportunities enabled by this technology.

1. *Broadband Adoption Among People with Disabilities*

There are approximately 50 million people with disabilities living in the United States;[133] 41.3 million are non-institutionalized people over the age of five.[134] Of those between the ages of 16 and 64, 7.1 percent reported an employment disability.[135] Older Americans report a higher rate of disability than any other age group. According to a 2007 report, the prevalence of disability among those over age 75 was 52.9 percent, compared to 12.8 percent for persons between the ages of 21 and 64.[136]

In order to appreciate the various types of broadband-enabled impacts and challenges among people with disabilities, understanding the vast spectrum of individual disabilities is crucial. Table 4 provides a broad survey of recent statistics regarding the number of people with physical, sensory, cognitive, developmental, and a number of other disabilities. This Table is by no means exhaustive but is representative of the diversity in the current population of people with disabilities in the United States.

TABLE 4 - A Survey of Statistics re People with Disabilities

Physical[137]	Sensory[138]
▪ Nearly 26 million adults in the United States report some form of physical disability.[139] ▪ The number of people with spinal cord injuries was estimated to be 259,000 as of April 2009.[140] ▪ Over 32 million adults report some sort of physical functioning difficulty.[141] ▪ 15.4 million adults are unable to walk a quarter of a mile.[142]	▪ In 2006, 21.2 million non-institutionalized Americans reported "vision loss," which includes "individuals who reported that they have trouble seeing, even when wearing glasses or contact lenses, as well as individuals who reported that they are blind or unable to see at all."[143] ▪ In 2006, 37 million adults in the United States reported being deaf or hard of hearing.[144]
Cognitive[145]	**Developmental, Learning, Speech, etc.**
▪ Over 20 million people in the United States have a cognitive disability.[146] ▪ An estimated 57.7 million people over the age of 18 suffer from a diagnosable mental disorder in a given year, while nearly 6 percent of the population suffers from a serious mental illness.[147] ▪ Over 5 million people in the United States have Alzheimer's disease. Ten million baby boomers will develop Alzheimer's.[148] ▪ Over 500,000 people in the United States have some degree of cerebral palsy.[149]	▪ Between 30 and 50 percent of the United States population has undiagnosed learning disabilities.[150] ▪ As many as 1 out of every 5 people in the United States has a learning disability, with nearly 3 million public school children (ages 6 through 21) having some form of a learning disability and receiving special education in school.[151] ▪ Over 14 million Americans have some sort of speech/communication disability not associated with hearing loss.[152] ▪ 1.5 million Americans are living with the effects of autism spectrum disorder.[153]

As discussed below, broadband is an essential tool for people with disabilities. It empowers them to live more independent lives, to stay in better contact with family and friends, to work from home, to start a small business, and to participate in a wide array of educational activities. However, even though broadband is widely available,[154] a significant number of people with disabilities have yet to adopt broadband.

According to one study, less than a third of people with disabilities – 24 percent – had adopted broadband by 2008.[155] Moreover, just 51 percent of people with a disability or chronic illness went online in 2007, compared to 74 percent of those with no chronic condition. This number rose by 46 percent for people with a disability or chronic illness between 2002 and 2007, compared to just 21 percent for those with no chronic condition.[156]

Rising computer ownership rates[157] coupled with more widespread Internet usage[158] by people with disabilities suggests that this demographic group, as a whole, is increasingly aware of, demanding, and adopting broadband. As set forth in Part B below, however, robust adoption of broadband by people with disabilities is inhibited by a number of barriers.

2. *The Impacts of Broadband on People with Disabilities*

Broadband enables a wide array of social, economic, and health-related impacts for people with disabilities. Table 5 provides an overview of these impacts.

Table 5 - Overview of Broadband's Impacts on People with Disabilities

Social Impacts	*Economic Impacts*	*Health-Related Impacts*
▪ Broadband increases connectivity with family and friends. ▪ Broadband provides many people with disabilities with an interactive outlet to the world. ▪ Family, friends, and caretakers use broadband for support and for the exchange of critical care information.	▪ Individual economic gains include: enhanced education opportunities; e-commerce; and enhanced employment opportunities. ▪ Economy-wide gains include increases in: small business creation; workforce participation; productivity; and innovation vis-à-vis tailored content, services, and applications.	▪ Broadband is generally enhancing the wellbeing of people with disabilities. ▪ Broadband enables life-enhancing telemedicine services like in-home monitoring and other remote services. ▪ Cost savings associated with widespread usage of broadband-enabled healthcare services and applications among people with disabilities could be enormous.

An important impact of broadband for many people with disabilities is its use in enhancing communications among family, friends, and care givers. A number of recent surveys have found that well over 80 percent of people with disabilities who are online use the Internet to send and receive emails.[159] Chat services (e.g., instant messaging programs) are also popular[160] and represent another important social outlet for people with disabilities, particularly those with speech and hearing disabilities, liberating them from dependence on a telephone.[161] Broadband also enables more personal and interactive communications via video, which has recently emerged as a critical medium for people who are hard of hearing or deaf. To this end, Video Relay Services enhance traditional text-based telephone communications by making interpreter services widely available and convenient for people who are deaf. A deaf person with a web-cam or other broadband-enabled video device can call an interpreter via the Internet, who then facilitates communication with a hearing person.

Broadband also allows for more real-time transmission of important health information. For people with disabilities, accessing information related to their individual healthcare needs is particularly empowering because it increases a sense of independence and self-determination.[162]

3. *Educational & Economic Opportunities Facilitated by Broadband*

The educational and economic opportunities enabled by broadband are vitally important to people with disabilities since this demographic, as a whole, (a) has a higher unemployment rate than people without disabilities, (b) earns less than people without disabilities, and (c) has completed less schooling than people without disabilities. Table 6 provides a summary of these metrics.

Table 6 - Employment, Income & Educational Attainment Comparison

	Employment Rate	**Median Annual Household Income**	**% Attaining a Bachelor's Degree**
People with Disabilities	37%	$38,400	12.5
People without Disabilities	80%	$60,000	31

**All data as of 2007*

Source: Cornell University Rehabilitation Research & Training Center on Disability Demographics and Statistics, *2007 Disability Status Report* [163]

Broadband is essential to this demographic group as it facilitates an array of economic opportunities that might otherwise be impossible or difficult to realize. Table 7 summarizes these opportunities.

Table 7 - Overview of Educational & Economic Opportunities Enabled by Broadband

Educational Opportunities
▪ Broadband enables a wide array of distance education programs and other educational applications. In addition, many universities now offer online classes, enabling people with disabilities to earn undergraduate and advanced degrees (see Section VI).
Employment Opportunities
▪ Broadband can help level the playing field between employment opportunities available to people with disabilities and people without disabilities. For example, there are a number of websites that provide job listings that specifically target people with disabilities. These and other such resources are a boon to this demographic. ▪ Telework options are also increasing for all workers, including people with disabilities. Approximately 42 percent of employers currently offer employees a telework option, up from 30 percent in 2007.[164]
Entrepreneurial Opportunities
▪ Broadband is a fertile medium for small business creation and can reduce or eliminate a number of overhead costs associated with traditional businesses. This is especially important for people with disabilities since this demographic "[has] a higher rate of self-employment and small business experience than people without disabilities."[165]

Notwithstanding the opportunities and other positive impacts enabled by broadband, a large number of people with disabilities remain offline.

B. Barriers to Broadband Adoption

This part identifies key policy and non-policy barriers to further adoption and usage of broadband by people with disabilities. These barriers include:

1. Availability of broadband for people with disabilities living in remote areas
2. Low levels of computer usage and ownership
3. Limited access to public computers
4. Low levels of exposure to the benefits enabled by broadband
5. Negative perceptions regarding the accessibility of broadband
6. Affordability concerns related to subscription price and costs of assistive technologies
7. Interoperability of assistive technologies

8. Lack of training and expertise among people with disabilities and among educators
9. Lack of data regarding the individual needs of people with disabilities vis-à-vis broadband
10. Lack of best practices for spurring awareness, demand, adoption, and use of broadband
11. Uncertainty regarding the relationship between legislation, innovation, and access to new technologies and services

* * * * * *

1. *Availability of broadband for people with disabilities living in remote areas*

Despite increasing availability of broadband, the FCC has concluded that more needs to be done to deploy networks to unserved areas of the country.[166] This is of particular consequence for the large number of people with disabilities living in rural areas.

People with disabilities are more likely than most other demographic groups to live in less densely populated areas. It is estimated that upwards of 20 percent of people with disabilities – roughly 11 million people – live in rural parts of the country,[167] compared with just 12 percent of the general population.[168] Though rural broadband access and adoption have increased in recent years,[169] individuals living in rural locations are much less likely to have home broadband. Over the past year, broadband adoption rates in rural areas increased from 38 percent to 46 percent, which is still lower than the 63 percent adoption rate for the entire United States.[170] Among people with disabilities, Internet use rates for people in non-metro areas remains significantly lower than that of people with disabilities in urban locations.[171]

2. *Low levels of computer usage & ownership*

Owning a computer is a necessity for individuals utilizing wire-based Internet connections. Moreover, those with a home computer are much more likely to demand broadband than those without one.[172] However, computer ownership, though rising, remains low among people with disabilities. A 2000 study found that only 24 percent of people with disabilities had a computer at home, compared to nearly 52 percent for people without a disability.[173] By 2006, the number of people with disabilities who had a home computer had risen substantially, to nearly 40 percent, but this number was still lower than for people without disabilities.[174] In 2008, slightly more than half of people with disabilities – 51 percent – reported having a computer at home.[175]

Concerns regarding the accessibility, price, and awareness of assistive technologies may prevent many people with disabilities from purchasing a home computer to enable broadband use (see Barriers #5 and #6). Many types of disabilities render computers on their own inaccessible, requiring the identification and purchase of additional hardware (e.g., a certain type of mouse or keyboard) and software (e.g., a screen-reader program). The vast number of products available may overwhelm many people with disabilities who are unfamiliar with these types of assistive technologies. In addition, the initial cost of computers and necessary assistive technologies may be unaffordable for a large number of people with disabilities, as this demographic as a whole earns less than people without disabilities.[176] Further, there is a general lack of awareness of assistive technologies for computer and Internet use, as a 2007 survey discovered that just 3 in 10 people with disabilities were aware of all of the services available to them.[177]

3. *Limited access to public computers*

Public computers are an important resource for some people with disabilities who wish to get online. Libraries, public computing centers, and other such places that offer free access to computers and the Internet may be "viable alternatives" for some people with disabilities who do not have a computer at home.[178] Frequently, however, access to public sites that provide public Internet access and computers are structurally inaccessible to people with certain types of disabilities, representing a significant barrier to computer use.[179] Despite accessibility mandates for places of public accommodation, many libraries, community centers, and other locations may still lack ramps or elevators leading to computer terminals.[180] And even when adequate physical access to public computers is provided, necessary assistive technologies and custom configurations to utilize computers and the Internet are often unavailable.[181]

Stimulus funding has been allocated to bolster public computer and Internet access for people with disabilities, among other groups.[182] This includes, for example, using funding to purchase assistive technologies to make a computing center more accessible to people with certain types of disabilities.[183] The $50 million in stimulus funding available for these purposes, however, is likely inadequate to enhance computer access for people with disabilities in the more than 17,000 public libraries and thousands of other public computing centers in the United States.[184]

4. *Low levels of exposure to the benefits enabled by broadband*

A significant number of adults, including people with disabilities, remain offline and cite a lack of interest in the Internet as the primary reason for not adopting broadband.[185] According to one study, "Some people may not express interest in Internet use because they do not realize the wealth of information and social connections use of the medium would make possible."[186] There continues to be a gap between those people with disabilities who recognize and appreciate the life-enhancing benefits of broadband and those who are unaware of the benefits.

Exposure to broadband is a critical component to adoption, as it tends to stimulate demand among potential users.[187] When individuals are not around others who use broadband, they are unable to witness, first-hand, its benefits or receive help from others, thus negatively impacting broadband adoption.[188] Indeed, "Most Internet users have many years of online experience," while the amount of users with less than one year of experience accounts for just six percent of the overall adult Internet population.[189]

Broadband users garner critical computer and Internet skills through education and work environments, to which many people with disabilities are not exposed. Lower levels of employment and educational attainment mean that people with disabilities, as a whole, have less exposure to computers and the Internet in formal settings.[190] Indeed, a 2007 study found that people with a disability or chronic illness are much less likely to go online from work than those without chronic conditions (31 percent compared to 54 percent).[191] Further, just 30 percent of adults with less than a high school degree have broadband access at home, compared to 83 percent of those with a college degree or more.[192] More generally, a recent study found that 64 percent of people without a disability access the Internet "anywhere," compared to 31 percent of people with disabilities.[193]

Low levels of experience and exposure to broadband may contribute to a diminished value proposition and perceived relevance of broadband among people with disabilities. A significant portion of people with disabilities generally view the Internet as unnecessary and do not recognize or appreciate the many benefits associated with a broadband connection.[194] One recent study found that 22 percent of offline adults cite a lack of interest as their primary reason for not using the Internet or email.[195] The study also found that just one percent of all non-Internet users report being "physically unable" to use these types of technologies.[196] Many people with disabilities may fail to see the benefit of broadband simply due to a lack of exposure and awareness.

5. *Negative perceptions regarding the accessibility of broadband*

Lack of exposure to broadband, along with a number of other factors, contributes to a general perception among many people with disabilities that broadband and broadband-enabled technologies are inaccessible.

Accessibility concerns tend to stem from problems operating hardware and software. Moreover, various types of disabilities make it physically difficult to use a computer or broadband connection. According to one organization, "broadband equipment and multimedia applications often require vision and/or hearing to manipulate functions and controls, creating barriers for people who do not have one or both of these senses."[197] For example, advanced user interfaces may be an issue for people with certain types of disabilities.[198] Touch screens, soft-buttons, or graphical interfaces are growing in popularity but present significant challenges to people with vision loss.[199] In addition, the miniaturized keypads found on numerous portable electronic devices are difficult to use by many people with vision impairments or limited manual dexterity.[200]

Some online content also raises accessibility concerns among people with disabilities.[201] In response, a number of organizations have developed accessibility standards, including the World Wide Web Consortium,[202] and an increasing number of websites have begun to incorporate these standards into their sites. In addition, many websites are engaging users to build accessibility into existing services. For example, YouTube recently announced that it will allow users to embed closed captioning in its videos.[203] This enables people with hearing disabilities to view more accessible video content on this site. Other sites, like Hulu, have pledged to expand their libraries of captioned content.[204]

Emerging and more developed assistive technologies help address many of these barriers.[205] These include screen readers for use by people who are blind, speech recognition technologies to facilitate navigation and writing (e.g., email), and mouse devices that are controllable by eye or head movements.[206] Yet, as noted, many people with disabilities are unaware that assistive technologies are available to help them access the Internet and broadband-based applications.[207] This unawareness, combined with lower levels of exposure to broadband, may contribute to the perception that advanced technologies are inaccessible to people with disabilities.

6. *Affordability concerns related to subscription price and costs of assistive technologies*

While broadband prices have generally declined over the past several years,[208] the adoption rate among people earning less than $20,000 per year, which includes a substantial number of people with disabilities, continues to lag behind all other income groups.[209] Since many people with disabilities earn substantially less than people without disabilities, many potential users are unable to afford broadband access. Indeed, a 2007 study found that working-age people with disabilities earn approximately $6,500 less per year than people without disabilities.[210] The same study also found that, in 2007, the poverty rate of working-age people with disabilities in the United States was 24.7 percent, compared to only 9 percent for people without disabilities[211] (the poverty rate for the entire U.S. population rose to 13.2 percent in 2008).[212] In September 2009, the unemployment rate of people with disabilities reached 16.2 percent, compared to 9.2 percent for people without disabilities.[213]

Another cost factor for people with disabilities vis-à-vis broadband adoption is the price of assistive technologies that may be necessary for effectively using a computer and an Internet connection. One organization has observed that "[the] hardware and software needed to make computers and broadband service accessible to people with disabilities can be very costly – and most definitely enough to turn people away from these services."[214] Such technologies might include an adaptive keyboard to facilitate typing for people with motor disabilities, screen readers for people who are blind or visually impaired, speech recognition software, and a wide array of similar types of hardware that make navigation easier.[215] The two most common screen readers, JAWS or Window Eyes, can cost around $1,000 each.[216] Added costs include the installation, maintenance, and upkeep of these assistive technologies.[217]

The multiple cost components for people with disabilities who wish to adopt broadband have had a discernible impact on broadband adoption. Individual components – e.g., a broadband subscription – may be affordable, but when combined with expensive ATs and the cost of purchasing a computer, broadband adoption becomes beyond the means of many people with disabilities.[218]

7. *Interoperability of assistive technologies*

The interoperability of various components of the broadband ecosystem is a major challenge facing device and application manufacturers today. With regard to people with disabilities, major issues concern the interoperability of different generations of technology (e.g., compatibility between first-generation TTY devices and next-generation IP-based services). When "off-the-shelf" interoperability amongst applications and platforms is not an option, people with disabilities are unable to enjoy the benefits that assistive technology and broadband-enabled devices can offer.[219]

Lack of interoperability among assistive technologies is thus a significant barrier to further broadband adoption. Customers may invest in a device with certain accessibility features that are incompatible with their other devices due to generational and technical differences among the devices.[220] Considering the high cost of many ATs, this issue may prevent many people with disabilities from utilizing computers and other devices to access the Internet (see Barrier #6). Indeed, according to the Telecommunications Industry Association, "[This is] a continuing challenge because a product has generations to it and it's just the nature of how we deliver a product to the marketplace."[221]

As an example of interoperability concerns in this space, consider the compatibility issues arising from older TTY technologies and new IP technologies. Unlike newer VoIP technologies, a consistent and reliable protocol has yet to be developed for the delivery of real-time interactive text over IP data networks.[222] This poses significant problems for deaf users in emergency situations since messages can be dropped, overlap one another, and appear out of order.[223] According to one group, "The lack of a…uniform standard could also produce a lower quality of service than that which is provided for the conveyance of voice over IP technologies, resulting in the loss of text calls in times of heavy Internet usage."[224] While TTY use is declining among people with hearing disabilities, those in rural areas or with low income still rely on TTY as their primary mode of communication.[225]

A more recent example concerns hearing aid compatibility with cell phones. The Hearing Aid Compatibility Act,[226] a 1988 law, required the FCC to ensure that "telephones manufactured or imported for use in the United States after August 1989, and all "essential" telephones, are hearing aid-compatible."[227] Over the past several years, as the market for wireless telephony has evolved, the FCC has revisited its compatibility rules and "set benchmark dates by which digital wireless handset manufacturers and service providers had to gradually increase the number of hearing aid-compatible digital wireless phones available to consumers."[228] In response, the industry has developed and made available a number of phones that are interoperable with hearing aids.[229]

Manufacturers continue to pursue a range of accessibility and design solutions. For example, representatives from a variety of private sector companies have begun to work with disability advocates to develop recommendations for approaching accessibility and interoperability issues. These stakeholders recently joined together to form the Telecommunications and Electronic and Information Technology Advisory Committee (TEITAC), which provided the federal government's Access Board with recommendations for enhancing accessibility of new and existing technologies.[230] Many individual companies have also announced plans to enhance accessibility and interoperability. Microsoft, for example, designs its products to be interoperable with third-party ATs and other products that enhance accessibility.[231] Adherence to universal design principles, which "intends that products – especially software and computers – provide an interface that is suitable for all potential users, including persons with disabilities,"[232] is also increasingly common among innovators.[233]

8. *Lack of training and expertise among people with disabilities and among educators*

Because many people with disabilities have unique needs when using a computer and accessing the Internet, broadband adoption may be especially difficult for some without proper education, training, and technical support. Indeed, a 2003 study found that 21 percent of people with disabilities remained offline because they thought it was confusing and hard to use.[234] Moreover, a 2007 Pew study found that 31 percent of people with a disability or chronic illness felt frustrated during their online search for health information, compared to 20 percent of people with no chronic condition.[235] Other studies have shown a general lack of awareness and understanding of the

Internet and assistive technologies.[236] A general lack of training for people with disabilities, their family members, and caregivers, and more targeted training for specific types of disabilities, is a major barrier to expanded technology and broadband use.[237]

Lack of expertise among educators and trainers is also a formidable barrier. Many people with disabilities rely on the knowledge of educators to teach them the requisite skills for using an assistive technology or new device. However, a number of studies have found that these skills are lacking in a variety of settings. For example, the National Center on Education Statistics found that a lack of adequate teacher training was the most prevalent barrier to computer adoption for students with disabilities.[238] In addition, many computer programs in public libraries are unable to select appropriate ATs or provide support to disabled users.[239] A 2005 study found that a number of librarians expressed concerns over a general lack of expertise with computer accessibility and listed failed attempts to increase accessibility resources in their libraries.[240]

Although anecdotal evidence suggests that local education and training programs are increasingly available across the nation, there appears to be a continued lack of information and expertise for training people with various types of disabilities to effectively use ATs and broadband connections.

9. *Lack of data regarding the individual needs of people with disabilities vis-à-vis broadband*

Comprehensive data is necessary to fully understand the diverse needs of people with certain types of disabilities vis-à-vis broadband adoption and use. To date, there has been a lack of properly disaggregated information pertaining to broadband adoption, computer ownership, and technology usage among people with various types of disabilities.[241] This has resulted in imprecise measures of actual usage of Internet technologies. For example, the RTC Rural Institute has found that survey estimates of national Internet access and use by people with disabilities have ranged from 10 to 80 percent.[242] According to another influential study, "Lack of consistency in defining exactly what constitutes a disability makes comparison across studies difficult."[243] In addition, many statistics currently available are only descriptive in nature, and therefore cannot point to the independent effects of different factors on low levels of adoption.[244] Moreover, disability status has been excluded entirely from the widely cited and respected Pew Internet Home Broadband Adoption reports.[245] Further, studies regarding broadband adoption by people with disabilities largely focus on the prevalence of disability status rather than on the differences and challenges faced by individual disability types.

More precise data would enable more targeted and effective outreach and training programs to be developed and deployed. Moreover, such data would help organizations and service providers to more fully understand the implications of broadband adoption for people with disabilities. The absence of such granular data creates a barrier to more targeted initiatives.

10. *Lack of best practices for spurring awareness, demand, adoption, and use of broadband*

The diverse needs of people with disabilities underscores the need for the development and promulgation of best practices to increase broadband adoption. The dearth of comprehensive disability literature on this subject and low levels of educator expertise (see Barrier #8) are further compounded by a shortage of exemplary research. Though progress has been slow, public and private organizations have begun compiling such data in order to spur broadband adoption among people with disabilities. For example, the Bill and Melinda Gates Foundation published recommendations for computer and assistive technology education at public libraries.[246] The National Council on Disabilities (NCD) has also released policy papers aimed at addressing legal issues concerning broadband and people with disabilities.[247] Other stakeholders have also added to this growing body of research, including the American Association of People with Disabilities and Office on Disability housed within HHS. However, these various efforts have yet to provide best practices for spurring broadband adoption by people with disabilities. Thus, individuals and groups that wish to bolster their disability services face a significant lack of information and have few resources for best practices regarding broadband and people with disabilities.

11. *Uncertainty regarding the relationship between legislation, innovation, and access to new technologies and services*

In general, the ever-evolving nature of technology presents significant challenges for lawmakers. Laws implemented today regarding certain technologies will likely become obsolete or ineffective a short time later. In the disabilities context, a number of new technologies continue to challenge existing accessibility policies. Moreover, some existing policies may not provide disabled users with ample incentives to adopt and use new technologies since these innovations may be beyond the scope of established laws. An example is instructive.

Among many other applications it enables, the iPhone supports text-to-speech applications that are increasingly popular among people with speech impairments. In particular, many find the iPhone to be much more portable and affordable and less ponderous than most existing standalone text-to-speech devices.[248] However, despite this preference among disabled users, insurance companies and plans (e.g., Medicare) do not cover these devices. The reason cited for this lack of coverage is that the iPhone is not a medical device and can be used for a number of non-medical purposes.[249] As a result, many people with speech impairments have to "spend 10 to 20 times as much for dedicated, proprietary [text-to-speech] devices that can do far less."[250]

Insurance laws have generally been slow to recognize the impact of new technologies like broadband and smartphones on healthcare. Many agree that these laws need to be updated to reimburse for the use of efficient and effective new technologies (see Section IV).

With regard to accessibility laws, there is much disagreement over whether similar legislative change is required.

On the one hand, some argue that formal legislation will ensure a minimum level of accessibility in new technologies and services. To this end, legislation has been introduced to address issues like the accessibility of video content online.[251] The basic premise of those supporting legislation is that such laws are needed to "modernize disability accessibility mandates in the Communications Act."[252] However, this may create an expectation among some people with disabilities that, without legislation, new technologies will be inaccessible.

On the other hand, some argue that the dynamics of innovation and legislation dictate that formal laws will likely become outdated after a few years as networks, devices, and systems change, or that such laws will in fact stifle technology-based solutions to accessibility issues.[253] In its report to the Access Board, TEITAC observed that "The pace of technological advancement in [information and communication technology] is rapid and the level of innovation is high. In this environment, a static standard consisting of design specification and fixed checklists would tend to stifle innovation and to delay the availability of technology advancements to people with disabilities."[254] Thus, according to this view, market dynamics will push innovators to increasingly build accessibility into their products. However, this approach may create unrealistic expectations regarding the speed at which accessibility issues will be addressed by innovators.

These various perspectives evidence a tension between whether and how to update laws that directly and indirectly impact technology use among people with disabilities. This tension creates a general uncertainty that may contribute to the perception among people with disabilities that new technologies like broadband are inaccessible. This uncertainty may represent another barrier to further broadband adoption and use among people with disabilities.

* * * * * *

IV. TELEMEDICINE

For the purposes of this discussion, "telemedicine" refers to "the use of electronic communications and health information technology (HIT) to provide clinical services" for remote patients.[255] Telehealth, which encompasses a "broader application…of electronic communications and information technologies" that is used to "support healthcare services,"[256] is also implicated in this discussion.

Telemedicine is a rapidly emerging field of healthcare that provides doctors with a growing universe of tools for treating patients remotely and that enables a number of benefits for patients, including:

- The storing and forwarding of critical health information for analysis and diagnosis (e.g., MRI results) [257];
- The delivery of specialized care over long distances;
- The provision of always-on monitoring services both in and away from home; [258] and
- Expanded availability of health information to patients and care givers.

Part A provides an overview of how broadband is being used in the telemedicine sector and a discussion of its impacts.

Part B details key policy and non-policy barriers to further adoption and usage of broadband in the telemedicine sector. Barriers range from a lack of incentives (e.g., insurance reimbursement) for healthcare providers to use these tools to privacy concerns among patients who worry that their personal health information is vulnerable when placed on the Web.

A. An Overview of Broadband & Telemedicine

This part provides: (1) an overview of the impacts and uses of broadband-enabled telemedicine services and applications and (2) a summary of the cost savings enabled by these tools.

1. *Impacts and Uses of Broadband-Enabled Telemedicine*

Broadband is playing an increasingly important role in healthcare by enabling a universe of telemedicine services that, in turn, provide a number of life-enhancing, and potentially lifesaving, benefits. Among other benefits, broadband-enabled telemedicine and HIT services (e.g., electronic health records or EHRs) enable enhanced services in rural parts of the country, streamline the administration of healthcare, enable a wide array of cost savings, and empower individuals to have more control over medical decisions.[259] Table 8 provides an overview of the wide range of impacts that broadband has on telemedicine.

Table 8 - Overview of the General Impacts of Broadband-Enabled Telemedicine

Increases the Range of Healthcare	*Facilitates In-Home Care*	*Streamlines the Administration of Healthcare*	*Enhances Care for Children, Seniors & People w/ Disabilities*
▪ Broadband-enabled telemedicine tools extend the range of healthcare to rural and unserved parts of the country. ▪ Telemedicine tools assist in leveling the playing field vis-à-vis quality of care across all demographics and geographies. These tools can, for example, help to compensate for a lack of physicians in some rural areas.[260]	▪ The wide availability and increasing affordability of broadband enables the use of effective in-home diagnostic, monitoring, and treatment services. ▪ Seniors in particular will benefit from these tools by having the ability to receive more care at home.	▪ HIT systems, especially EHRs, create efficiencies in back-office operations and enable a number of cost-savings. ▪ Telemedicine, telehealth, and HIT services have proven to increase the quality of care[261] and decrease costly medical errors.[262]	▪ Broadband-enabled telemedicine provides effective and affordable care to rural and low-income children. ▪ Tools and services have been crafted for use by senior citizens and people with disabilities, leading to vast savings.

Actual usage of broadband-enabled telemedicine services continues to increase across the healthcare sector. Indeed, utilization of these tools has grown among rural and urban patients and healthcare providers even though many telemedicine deployments and a significant portion of federal funding have primarily targeted rural areas.[263] In addition, innovators across the private sector are increasingly using broadband – in particular wireless broadband – to enable and deliver a range of cutting-edge telemedicine services and applications. Table 9 provides an overview.

Table 9 - Overview of Current Broadband-Enabled Telemedicine Uses

Patients	*Healthcare Providers*	*Innovators*
▪ In 2000, more than half of all Internet users had used the Web to obtain medical or health information.[264] That number rose to 75% by the end of 2007.[265] Increased use of the Internet for health-related searches could spur demand for additional healthcare services delivered via the Web. ▪ A recent study of *patient satisfaction* with remote neurotology care found that patients held more positive perceptions of telemedicine interactions after receiving care.[266] Exposure to the direct benefits of broadband-enabled telemedicine may also increase demand.[267] ▪ Example: One study projects the market for *remote monitoring services* will become a $2 billion per year industry by 2010.[268] The same study estimates that 3.4 million seniors will be using networked sensor applications to monitor and improve their health by 2012.[269]	▪ By 2006, 46% of community hospitals reported moderate or high use of HIT, compared to 37% in 2005.[270] ▪ According to the U.S. Department of Health and Human Services, 4%of physicians have adopted fully functional EHR systems.[271] However, financial incentives (e.g., reimbursement bonuses), have worked to spur use of services like e-prescribing.[272] ▪ Example: American Well – a web-based physician consultation program – provides patients with the opportunity to have scheduled and unscheduled teleconsultations with doctors. An e-nurse application "triages" a patient and recommends a doctor.[273] Once the patient speaks remotely with a doctor via Web-cam, the patient has the ability to forward the results of the consultation – notes, test results, diagnoses, etc. – to his or her primary care physician.[274]	▪ A recent study estimated that "the market for telemedicine devices and services will generate nearly $3.6 billion in annual revenue within the next five years."[275] As a result, many innovators in the private sector are increasing their investment in broadband-enabled telemedicine tools. ▪ The market for mobile telemedicine applications, which use wireless broadband, appears to be the locus of much innovation. A recent survey found that nearly 80 percent of consumers expressed interest in these types of mobile health solutions.[276] ▪ Example: Over 2,000 mobile health applications are available for use on Apple's iPhone or iPod touch devices.[277] An example is the Mobile MIM Application for the iPhone, which "allows a referring physician or patient to view medical images remotely, without being tied to an imaging workstation."[278]

Despite these many gains and a general upward trend in use of broadband-enabled telemedicine services, a number of cultural, psychological, and cost barriers to further adoption and usage of these tools.

2. *Cost Savings Enabled by Telemedicine*

With healthcare costs soaring,[279] broadband-enabled telemedicine offers policymakers, healthcare providers, and patients a set of tools that have the potential to drastically cut costs and enhance the quality of care. Table 10 provides an overview of the potential cost savings facilitated by broadband-enabled telemedicine.

Table 10 - Overview of Cost Savings Enabled by Telemedicine

Remote Monitoring Reduces Healthcare Expenditures
▪ A recent study estimated that "a full embrace of remote monitoring alone could reduce healthcare expenditures by a net of $197 billion (in constant 2008 dollars) over the next 25 years with the adoption of policies that reduce barriers and accelerate the use of remote monitoring technologies."[280]
In-Home Chronic Disease Management Creates Efficiencies
▪ In 2002, the U.S. Veterans Affairs found that in-home chronic disease management tools (e.g., teleconsultations, remote diabetes monitoring) resulted in 40% fewer emergency room visits and a 63% reduction in hospital admissions.[281] ▪ In 2009, a U.S. Veterans Affairs telehealth pilot saw a 19% decrease in hospitalizations, a 25% decrease in bed days of care, and a 27% decline in 4-year diabetes mortality rate. The decrease in hospitalizations, alone, totals $2.2 billion per year in cost savings.[282]
Early Disease Detection Can Save Money in the Long Term
▪ Using remote monitoring tools to recognize and intervene in the early onset of diseases like Alzheimer's and other dementia could delay their development. It was recently estimated that "interventions that could delay the onset of Alzheimer's disease by as little as one year would reduce prevalence of the disease by 12 million fewer cases in 2050."[283] ▪ Early intervention for people at risk of congestive heart failure (CHF) (the leading cause of hospitalization in the U.S.), could save from $5 to $7 billion per year.[284]
Reduction of Unnecessary or Redundant Consultations, Tests & Transfers
▪ A recent study estimated that broadband-enabled real-time video consultations could replace upwards of 45% of in-person visits regarding heart-related matters.[285] ▪ Computerized physician order entry could save up to $1.1 billion nationally through a 13% decline in duplicate tests.[286] ▪ One study estimates that telemedicine "could save the U.S. healthcare system $4.28 billion [annually] just from reducing transfers of patients from one location, such as a nursing home for medical exams at hospitals, physicians' offices, or other caregiver locations."[287]
EHR-Related Cost Savings Have the Potential to be Enormous
▪ Studies have estimated that EHRs could lead to annual cost savings of between $77 billion[288] and $80 billion.[289]

Broadband-enabled telemedicine services are expected to provide enormous benefits to rural users and to user groups that require more acute care. *For example, one study estimates that broadband-enabled health and medical services can save some $927 billion in healthcare costs for seniors and people with disabilities over the next few decades.*[290] With the senior population expected to double by 2050,[291] and with senior care accounting for nearly 60 percent of healthcare spending,[292] broadband-enabled telemedicine holds much immediate and long-term promise for this user group in particular. However, further adoption and usage of broadband-enabled telemedicine services is poised to increase rapidly as the many barriers discussed in the next part are eliminated by policy and cultural changes.

B. Barriers to Broadband Adoption

This part outlines the wide array of policy and non-policy barriers to further adoption and usage of broadband in the telemedicine sector. As an overview, these barriers include:

1. Inadequate reimbursement mechanisms for most telemedicine services
2. Outdated and fragmented privacy policies for the electronic transmission of health data
3. Lack of security standards for data generated from telemedicine services
4. Patchwork of state-by-state physician regulation
    a. Licensing
    b. Credentialing
5. Uncertainty regarding the scope of tort laws
6. Negative perceptions and inadequate value propositions for using telemedicine services by patients
7. Inadequate value propositions and high costs associated with telemedicine applications for physicians
8. Concerns related to the outsourcing of certain medical functions
9. Limited scope of federal telemedicine funding
10. Lack of standards to guide the interoperability of new telemedicine services
11. Lack of available spectrum for the deployment of new telemedicine services and applications
12. Institutional inertia among some physicians

1. *Inadequate reimbursement mechanisms for most telemedicine services*

An antiquated set of reimbursement mechanisms in many public and private health plans do not provide adequate economic incentives for healthcare providers to adopt and use broadband-enabled telemedicine services.[293] A reimbursement scheme that fails to compensate doctors for both "real" and "virtual" medical consultations and procedures will likely keep healthcare rooted in traditional face-to-face encounters and preclude the realization of many of the cost savings and benefits previously noted (see Section IV.A).[294]

Healthcare in the United States is financed by two streams of funding: (1) the collection of money for healthcare (e.g. insurance premiums and taxes), and (2) the reimbursement of health service providers for healthcare (e.g., money to doctors from insurance carriers or the government).[295] Telemedicine cost issues are primarily concerned with the latter. The mechanics of most private health plans typically mirror those of government at both the state and federal level, especially on issues of reimbursement.[296]

Government healthcare is largely disbursed via Medicare and Medicaid. Medicare is a single-payer program that covers some 44.7 million Americans – 37.4 million of whom are "aged" and 7.3 million of whom are "disabled."[297] It is financed by federal income taxes, a payroll tax shared by employers and employees, and individual enrollee premiums.[298] Medicaid, on the other hand, is operated at the state level and covers approximately 62 million low-income Americans.[299] Medicaid programs are financed jointly by the states and federal government through taxes so that every dollar spent by a state on Medicaid is matched by the federal government by at least 100 percent.[300]

Given the broad reach of these programs, Medicare and Medicaid account for substantial percentages of healthcare providers' revenues. However, under the current reimbursement structure for these programs, many advanced telemedicine services generally are not reimbursable. Further, Medicaid funding has historically favored the use of institutionalized care for the elderly, thereby discouraging in-home treatment.[301] States are required by federal law to provide nursing home services, but no law mandates community or home-based care.[302] As a result, healthcare providers often lack a financial incentive to adopt and use alternative types of services like in-home monitoring or other such telemedicine services.[303]

Over the past few years, however, Medicare has begun to alter its reimbursement structure vis-à-vis telemedicine services, but its scope remains limited.[304] For example, Medicare recently announced a pilot program in Arizona and Utah that allows beneficiaries to maintain and manage electronic health records (EHRs).[305] Beneficiaries, though, can only choose from among a limited list of participating EHR providers.[306] In addition, Medicare will only pay for telemedicine services that are provided via videoconference.[307] Medicare has a much narrower and less inclusive view of in-home telemedicine; it does not cover in-home medical service provided via a telecommunications service.[308] "Store and forward" services like teleradiology are covered but only certain certified healthcare facilities are eligible to provide Medicare-supported telemedicine services.[309]

Medicaid has also changed its policies to potentially facilitate telemedicine. To this end, it recently began working with 29 different states to finance remote care for the elderly.[310] The program, called Money Follows the Person, allows older adults to age in place, potentially saving costs associated with institutionalized care.[311]

Some private insurers have also begun providing reimbursement to some patients utilizing telemedicine services. United Healthcare, for example, updated their reimbursement policy to include a variety of telehealth services.[312] United Healthcare defines telehealth services somewhat narrowly as, "live, interactive audio and visual transmissions of a physician-patient encounter from one site to another [site] using telecommunications technology."[313] Asynchronous telemedicine services, such as those utilizing store-and-forward technologies, are not included, however, as they do not provide direct, in-person contact.[314] This excludes a number of telemedicine services, such as on-line medical consultations and evaluations that do not use videoconference technology.[315]

While there are a number of other examples where private insurers are beginning to cover broadband-enabled telemedicine service (e.g., the American Well program described above[316]), most insurance plans still do not reimburse for the full range of telemedicine and do not provide adequate incentives for the provision of alternative services.

2. *Outdated and fragmented privacy policies for the electronic transmission of health data*

An outdated set of privacy policies that may not provide adequate protection to sensitive medical information is a challenge to more robust adoption and use of telemedicine services. Indeed, the security of personal health information is paramount to doctors and patients as more advanced telemedicine services and devices collect and transmit an increasingly large volume of medical data over the Internet. Although transferring personal health information electronically via e-mail or an EHR may be efficient, it raises important issues regarding the confidentiality of patient data and the possibility of private medical information being illegally viewed or stolen by a third-party.[317] Privacy laws, however, have largely failed to keep pace with technological change and afford suboptimal protections for patients.

Patient medical data is protected by both state and federal law. To this end, most states have enacted laws of general applicability regarding the electronic transmission of health information. However, these were crafted in response to the mostly intrastate nature of many modern telemedicine services that have been launched and may be inadequate in a world where broadband-enabled telemedicine services allow for the transmission of health data in real-time manner across state lines and international borders. This patchwork system of privacy standards forged to address intrastate services increases compliance costs in a borderless digital world, and it decreases the incentive for doctors to share data with healthcare providers in other states.[318] As a result, usage of telemedicine services may be negatively impacted by inconsistent state-level privacy laws.

With regard to the federal component, the current set of health privacy policies is largely out of date as it relates to telemedicine. In 1996, Congress passed the Health Insurance Portability and Accountability Act (HIPAA) to, among other things, streamline electronic medical record systems while protecting patients, improving healthcare efficiency, and reducing fraud and abuse.[319] HIPAA requires healthcare providers, health plans, and business associates to adopt security and privacy standards for electronic communications, medical records, and medical transactions.[320] Prior to HIPAA, a "comprehensive personal right to privacy in one's medical affairs did not exist."[321] The HIPAA privacy component, which creates standards for maintaining the integrity of protected health information, is applied to information that is transmitted for healthcare operations, as well as financial or administrative purposes.[322] Covered entities, which include all health plans, healthcare clearinghouses, and healthcare providers who conduct electronic healthcare transactions, are responsible for ensuring HIPAA compliance from their business associates who receive protected health information in the process of providing services to the covered entity.[323]

HIPAA, however, does not address all of the privacy concerns related to broadband-enabled telemedicine services, which raises several privacy issues that are not typically encountered during conventional medical practice.[324] First, there is a concern that some telemedicine services could be regarded as a healthcare operation and therefore fall under the "treatment, payment, or healthcare operations" categorization, which permits the use and disclosure of protected health information without patient consent. Second, teleconsultations may require additional non-clinical personnel (e.g., technicians, camera operators, etc.) who do not participate in traditional healthcare but who nonetheless would be required to comply with all HIPAA regulations.

Third, in traditional healthcare scenarios, providers typically have existing relationships with the medical specialists whom they consult. However, in the telemedicine arena, patients and their on-site medical providers often will not know which clinical and non-clinical personnel will be involved at the distant site. HIPAA does not directly address this or many other situations arising from the use of broadband-enabled telemedicine tools.

3. *Lack of security standards for data generated from telemedicine services*

In addition to outdated privacy protections vis-à-vis telemedicine, there is a general lack of standards to ensure the security of medical data being transferred via the Internet.

The amount of data generated from telemedicine services is substantial. Indeed, telemedicine enables the use of devices such as video, audio, sensors, and various health meters to send patient information over a broadband network in real time.[325] At a time when harmful content like spam and malware continues to threaten the general user experience,[326] more robust policies that protect sensitive medical data are especially needed.

In addition, enhancing the security of networks could increase more regular usage of these services. Issues continue to arise when data is sent over an unencrypted network or is accessed by unauthorized personnel. A string of cyber-attacks against epileptic patients in 2008 is illustrative of how certain parts of the Web remain vulnerable to criminals who use networks to inflict harm. In one case, a group of hackers "descended on an epilepsy support message board…used JavaScript code and flashing computer animation to trigger migraine headaches and seizures in some users."[327] At first, the hackers "used a script to post hundreds of messages embedded with flashing animated gifs."[328] However, subsequent attacks used a similar tactic to "redirect users' browsers to a page with a more complex image designed to trigger seizures in both photosensitive and pattern-sensitive epileptics."[329] Other such attacks have targeted visually impaired users.[330]

Other security concerns arise from the increased use of Wi-Fi networks for in-home monitoring. These types of networks tend to be less secure than wire-based ones, but their relative affordability and ability to interact with other wireless technologies (e.g., wireless sensors) have made them very attractive to researchers and patients.[331] As one article recently observed, "If patients are not confident that their information is acquired, transmitted and stored in a secure and confidential way, they will probably not be keen to reveal accurate and complete information."[332] Consequently, the overall quality of telemedicine care may diminish as a result of improper data security controls.[333]

The Civic Research Institute has found that four key factors determine electronic data security. These include: (1) the authentication of users requesting access to data, (2) the authorization of users before providing access, (3) the confidentiality of data while it is sent over the network, and (4) the integrity of the sent data.[334] These factors protect the network from service disruptions (denial of service), the destruction or changing of data (viruses or worms), and the theft of data (copying from the network or server).[335] Passwords, cryptography, and biometrics are used for the authentication and authorization of users, and log files track user access to data files.[336] Unauthorized communications can be filtered out through the use of firewalls, and secure networks, such as Virtual Private Networks, are utilized to protect data confidentiality and integrity.[337] While such technologies provide enhanced network security from external threats, the risks arising from internal negligence are another critical concern.

Internal threats resulting from employee and patient activity may also compromise network security.[338] The Computer Security Institute and the FBI recently found that half of all security breaches are the result of internal errors.[339] Employees may unintentionally expose networks to attack by misplacing passwords, leaving confidential files open, failing to update the list of authorized employees, opening unsafe email attachments, and losing critical data.[340]

Training of personnel is an often neglected aspect of system implementation, and may result in complications if employees are unprepared to properly operate the network and secure patient data.[341] A 2005 survey of computer security practitioners found that the vast majority of participants believed security awareness training was important.[342] However, respondents from all industry sectors believed that their organization failed to invest enough resources in it.[343] When security measures are overly complicated and difficult to use, both employees and patients may have difficulty complying with the system requirements. For example, if safety alerts are provided too frequently, users may ignore the warnings and become unresponsive.[344] Older adults in particular may experience difficulty when operating complicated interfaces and may abandon the system all together.[345]

Security threats vary significantly by type of network and the requirements of users. However, a lack of data security standards for telemedicine services, for telemedicine practitioners, and for other stakeholders creates an important barrier towards further usage of these services.

4. *Patchwork of state-by-state physician regulation*

The practice of medicine has traditionally been local in nature. Individual states have implemented discrete regulatory requirements for resident medical practitioners, meaning that doctors must be licensed to practice medicine in a state before they can provide medical services. Similarly, more fragmented policies exist for credentialing. These regulations were devised in a world characterized by the intrastate practice of medicine. Broadband-enabled telemedicine, however, enables doctors and specialists to be available to patients regardless of geographic location. Thus, the state-by-state regulation of doctors is a formidable barrier to realizing the full potential of broadband-enabled telemedicine services.

a. *Licensing*

Physician licensure requires that physicians be licensed by the individual state in which they practice. According to the American Medical Association, "Licenses are granted to ensure the public that the physician who presents himself/herself for licensure has successfully completed an appropriate sequence of medical education… and has demonstrated competence through successful completion of an examination or other certification demonstrating qualification for licensure."[346] The historical basis for state regulation of the practice of medicine is rooted in the Tenth Amendment, which delegates to states the power to, among other things, preserve the public health, welfare and safety of their residents.[347] As a result, states have created licensing requirements and oversight boards to monitor health and medical practices across their territories. But in the modern healthcare marketplace, such laws are not reflective of the borderless nature of many telemedicine services.[348] Thus, licensure laws that limit the practice of medicine to one state might unduly decrease the reach of telemedicine.

In 1997 and 2001, Telemedicine Reports to Congress identified licensure as a major barrier to the development and use of telemedicine services.[349] Additional reports also recommended a more consistent framework to encourage interstate telemedicine.[350] Thus far, only incremental progress has been made as a number of alternative licensure models have been offered and considered. Many of these proposals are based on the notion of reciprocity, a system that permits one state to recognize a license in good standing that a practitioner holds in another jurisdiction.[351] These and other models limit the pool of doctors who are allowed to use telemedicine services in the treatment of patients regardless of geographic location. Having to comply with myriad licensure rules could delay treatment and deny a patient the services of a specialist who does not reside in an eligible state under the home state's reciprocity rules.[352]

b. *Credentialing*

Credentialing refers to the process of verifying a physician's "license, experience, certification, education, training, malpractice and adverse clinical occurrences, clinical judgment, technical capabilities, and character by investigation and observation."[353] In addition, credentialing "defines a physician's scope of practice and the clinical or review services she may provide, and ensures that physicians provide services within the scope of privileges granted."[354] Established credentialing methods create uncertainty when applied to the practice of telemedicine.[355]

The traditional model requires that medical facilities gather "information regarding a physician's qualifications for appointment to the medical staff."[356] Credentialing traditionally falls under the responsibility of the hospital where medical services are provided.[357] However, since telemedicine enables physicians to deliver services to multiple hospitals across the country, there is a potential for confusion as to whether the remote facility where services are provided or the physician's originating site is responsible for the credentialing.[358] Traditional credentialing requirements may create potential difficulties for physicians and, thus, diminish the use of telemedicine.[359]

In 2001, the Joint Commission (JC) presented institutional credentialing standards for telemedicine providers.[360] These standards proposed that a physician credentialed in a JC facility could provide telemedicine services to any other JC facility.[361] The JC also specified that the originating site be provided evidence of internal review of the practitioner's performance of services delivered.[362] However, the Centers for Medicare and Medicaid Services (CMS) have specified that the JC credentialing rules are not sufficient to ensure compliance with the Medicare "conditions of participation."[363] Further, the CMS has stated that any physician who provides a "medical level of care" should be credentialed by the facility providing the care.[364] According to the Center for Telehealth and E-Health Law, "This means that telehealth providers might be forced to be credentialed by multiple hospitals nationwide, creating an administrative challenge for hospitals and providers."[365]

The tension between two major medical standards institutions – the JC and the CMS – has created much uncertainty among practitioners regarding the credentialing process for telemedicine, which could be slowing further usage of these services.

5. *Uncertainty regarding the scope of tort laws*

The number of medical malpractice suits and settlements continues to increase each year. Indeed, the cost of medical malpractice torts, which include expenses related to formal litigation, jury awards, and settlements, had the largest growth among U.S. tort costs, totaling $28.7 billion in 2004, having increased an average of 11.7 percent annually since 1975.[366] In 2008, the Congressional Budget Office estimated that "health care providers likely spen[t] more than $30 billion to defend against and pay medical malpractice claims."[367] Telemedicine, by its nature an emerging and innovative medical service, expands the reach of healthcare and thus increases the possibility of medical malpractice suits.[368] As a result, many physicians are hesitant to adopt broadband-enabled telemedicine applications for fear of exposing themselves to greater liability.

As with licensure, tort laws are largely state-specific. And in tort cases, an important jurisdictional determination is where a tort occurred.[369] Telemedicine complicates this determination because the doctor and patient are physically separated, which muddies the traditional perception of the doctor-patient relationship.[370] While federal tort law generally holds that the law of the patient's home state controls the determination, telemedicine injects some uncertainty because doctor and patient are connected only by a broadband connection.[371] The possibility exists that a telemedicine provider could be exposed to a number of different tort laws should a claim of negligence occur. The uncertainty regarding the application of tort law in the telemedicine context may discourage healthcare providers from adopting broadband-enabled telemedicine devices and services and using them to provide interstate care.

6. *Negative perceptions and inadequate value propositions for using telemedicine services by patients*

A significant number of patients, many of whom are older adults, remain wary of telemedicine services generally. This skepticism often stems from an unawareness of the true value of using these types of tools or a preference to continue using traditional healthcare methods (e.g., face-to-face consultations).[372]

Studies have shown that, while patient satisfaction with telemedicine services is generally positive, patients express negative concerns both before and after receiving treatment. A recent study of remote monitoring patients found that "[a]lthough the response to the home telehealth service [for congestive heart failure] was overwhelmingly positive, respondents remained undecided regarding the perceived benefits of telehealth versus in-person care."[373] Though the majority of patients advocated its future use, most still favored the in-person visit over the tele-visit.[374] Moreover, while significant advantages were identified by patients, the most common disadvantages cited include confusion with the technology, the monotony of repetitive processes, and disruption of activities.[375] In addition, research suggests that patients are more willing to use telemedicine services as a supplement to, rather than a replacement for, traditional face-to-face consultations "as long as privacy safeguards are maintained."[376]

The current baby boomer and senior populations are especially wary of one type of telemedicine application: in-home health monitoring services.[377] Two-thirds of both groups currently see little to no value in such technologies.[378] According to AARP, "Older adults often find little of interest to convince them of the value of making the change, and very frequently, poor design makes technology products very hard to learn or use."[379] More specifically, many older adults fear that remote home health monitoring will reduce the personal relationships they have built with their doctors and their social interaction overall.[380] Indeed, many older patients see "aging in place" with the help of home health monitors as a negative aspect of telemedicine and would rather "age in community" without losing social interaction.[381] Sufficient interpersonal contact is not only beneficial to an older patient's health, but also a critical aspect to an older adult's quality of life.[382] In addition, a perceived stigma towards aging and disease may cause seniors to resent the monitoring devices and view them as a constant reminder of their poor physical condition.[383] Wearing a health monitor in public may cause older adults to feel old and weak in the eyes of others.[384] Anecdotal evidence also supports the observation that many older adults may resent the lack of privacy afforded by in-home monitoring technologies,[385] and they may dislike ceding authority over their medical state to their children, who often assume control over the monitoring system.[386]

Thus, a primary barrier to further adoption and utilization of these services by all patients, especially older adults, is overcoming initial negative perceptions associated with telemedicine, shifting preferences away from traditional medical care, and providing adequate value propositions to spur use.

7. *Inadequate value propositions and high costs associated with telemedicine applications for physicians*

High costs and administrative burdens deter many physicians from making initial investments in telemedicine and health IT (e.g., EHRs). Implementing an EHR system, for example, can cost anywhere from $20,000[387] to $33,000 per doctor, with an additional monthly cost for maintenance.[388] In addition, the time required for integrating existing in- and outpatient data can be a daunting task for many organizations.[389] At a time when many healthcare providers are struggling to cut costs, such an investment may seem unnecessary. Smaller practices, in particular, are faced with higher implementation costs and have difficulty justifying the risk in making an investment that has little support for a positive short-term return.[390] According to the U.S. Department of Health and Human Services, "the most-commonly cited barrier [to adoption of EHRs] is insufficient resources and a perceived lack of evidence for a positive return on investment. Non-financial issues like training demands and changes in working practices are especially important."[391] Further, many small medical practices lack the technical expertise to invest confidently.[392] One study found that larger healthcare organizations (i.e., those with 500 beds or more) are more likely than smaller organizations to have begun planning for the implementation of unified communications technologies by a margin of 66 percent to 50 percent.[393]

Despite the initial burden and negative perceptions of implementing EHR systems, the long-term benefits may outweigh the costs. One study found that the net benefit of implementing a full electronic medical record system totals $86,400 per provider for a 5-year period.[394] Sources of cost savings include: savings in drug expenditures (33 percent), decreased radiology utilization (17 percent), decreased billing errors (15 percent), and improvements in charge capture (15 percent).[395] One study found that hospital EHR use could reduce costs by $394,000 per year, recouping the initial $484,577 investment in the first 16 months.[396] Further, net benefits may potentially total one-half trillion dollars over the next five years, in addition to the societal benefits of lower mortality and increased quality of life.[397]

The healthcare industry, as a whole, has been slow to adopt many HIT tools. According to the American Consumer Institute, hospitals have little incentive to implement EHR systems due to a perception of limited short-term benefits for health care providers.[398] Most of the initial cost savings flow to patients and payers, rather than to healthcare providers. This results from more successful and efficient treatment. To this end, one study found that the benefits of computerized ordering provided physicians with only 11 percent of the benefit.[399] Moreover, the full cost benefits to both physicians and payers can only be realized in the event of widespread adoption of health IT in the healthcare industry. Thus, negative perceptions of the potential for cost savings abound among healthcare providers and represent another barrier to further adoption of broadband-enabled telemedicine services.

8. *Concerns related to the outsourcing of certain medical functions*

Broadband enables the instantaneous transmission of critical medical data for processing and diagnosis to almost anywhere in the world. In addition, outsourcing certain functions to foreign countries via broadband has become widespread in an effort to drive down costs and speed the delivery of healthcare. However, even though researchers have found that the outsourcing of healthcare services has helped to increase efficiency, service quality and competitiveness, while maximizing the return on IT investment,[400] a host of concerns regarding legal liability, quality control, and privacy, among others, may hold back further outsourcing of medical services via broadband.

The increasing popularity of teleradiology services (i.e., outsourcing x-rays for diagnosis) provides a useful case study regarding the barriers to further utilization of these tools and the benefits that these tools can enable.

A number of potential liability issues are associated with teleradiology. For example, the misreading of x-ray images could result in delayed prognosis and serious physical harm for the patient and [401] extensive damages for the radiologist since courts often hold the radiologist liable, as the treating physician relies on the radiologist's expertise. Despite the increased liability of radiologists, jurisdiction loopholes make it very difficult to file a lawsuit against radiologists practicing outside the United States.[402] As a result, hospitals are likely to be sued since they are responsible for selecting the radiologist.[403] These types of suits and the uncertainty of the scope of liability could increase costs for healthcare providers and for patients (see also Barrier #5).

Other concerns related to the outsourcing of medical services (e.g., IT services like EHR management) via broadband include quality control, adequate training of non-U.S. technicians, and possession of proper licenses.[404] Privacy issues and concerns regarding compliance with U.S. laws and regulations also abound.[405] And patient consent may be difficult to attain since many "have traditionally regarded healthcare as intensely personal, making them wary of the relative anonymity of outsourcing."[406] Yet despite these concerns, outsourcing, especially of radiology services, remains popular among a growing percentage of healthcare providers.

By one estimate, at least 300 hospitals in the U.S. and some two-thirds of radiology practices use some form of teleradiology.[407] As a result, "Remote reading of radiology images is now the most widespread, economically successful model for global telemedicine in the United States."[408] Since many hospitals in the United States are required to staff radiologists in emergency departments at all hours, and since there is a general shortage of radiology experts, a growing number of hospitals employ "nighthawking" models, which involve outsourcing diagnostics to U.S.-trained physicians in time zones that are eight to ten hours away.[409] Hospitals are also offshoring radiology data for diagnosis by U.S. born and trained radiologists residing in countries such as India, Australia, Israel, and Lebanon.[410] This model, however, increasingly involves the use of physicians not licensed in the U.S., who charge much lower prices.[411] This model significantly lowers the cost of specialists, but such cost-savings may be offset by the previously discussed risks of increased medical malpractice liability.[412]

Overcoming these perceptual, administrative, and legal barriers is important since more robust usage of medical outsourcing services could help to drive down America's rising healthcare costs and create efficiencies through increased price competition.[413] However, continued uncertainty regarding the scope of legal liability, quality assurance, and the propriety of outsourcing certain medical functions could impede further adoption and use of these services, thus delaying the realization of the cost savings and efficiencies described above.

9. *Limited scope of federal telemedicine funding*

Federal funding for telemedicine deployments is generally allocated to projects that seek to bring medical services to rural areas. As a result, federal funding mechanisms may be underfunding or ignoring promising pilot projects for enhancing broadband-enabled telemedicine services in other areas of the country, potentially limiting the scope of innovation and slowing more robust adoption and use of these services.

To date, the federal government has played an important role in spurring innovation and use of telemedicine services. Hundreds of millions of dollars have been allotted over the past few decades to a variety of agencies and programs that support state and local telemedicine initiatives.[414] The FCC Rural Healthcare Pilot Program, HHS's Office of Health IT Adoption, and the USDA Rural Development Telecommunications programs, in particular, have recognized the critical role that broadband plays in the delivery of advanced telemedicine services and actively encouraged the deployment and use of high-speed networks in order to expand their reach.[415]

The FCC's Rural Healthcare Pilot Program, for example, is a key driver of telemedicine innovation. The Pilot Program is designed to facilitate the creation of a nationwide broadband network dedicated to "healthcare, connecting public and private non-profit healthcare providers in rural and urban locations."[416] Under this pilot project, "selected participants [are] eligible for universal service funding to support up to 85 percent of the costs associated with the construction of state or regional broadband healthcare networks and with the advanced telecommunications and information services provided over those networks."[417] This initiative will help to spur the development and deployment of statewide broadband networks dedicated to facilitating the delivery of broadband-enabled telemedicine applications.[418] These systems can also be used to create a robust healthcare network among hospitals, clinics, and other care providers within the state and among different states in a region. The pilot will also increase the availability of quality healthcare to patients, regardless of geographic location or socioeconomic background.

Despite these many gains, federal telemedicine funding is generally restricted to rural deployments. Indeed, while telemedicine was originally developed, and is still primarily used, for the provision of healthcare to remote patients, these types of services are increasingly being used in, and hold much promise for, urban and suburban communities as well. Limiting federal funding to telemedicine providers serving rural areas has created a barrier to greater telemedicine adoption in non-rural markets.

10. *Lack of standards to guide the interoperability of new telemedicine services*

Telecommunications systems often operate on networks that do not facilitate the interoperability of telemedicine services.[419] In particular, interoperability is a significant issue for EHRs, the vast majority of which do not interoperate well with other applications.[420] If advanced telemedicine applications (e.g., various proprietary EHR programs) are unable to work with one another, then their value will be limited.[421]

A variety of standards-setting bodies have been established to help ensure interoperability. HHS, for example, launched the Healthcare IT Standards Panel (HITSP) in 2005. This panel "serve[s] as a cooperative partnership between the public and private sectors for the purpose of achieving a widely accepted and useful set of standards specifically to enable and support widespread interoperability among healthcare software applications, as they will interact in a local, regional, and national health information network for the United States."[422] A number of other such efforts have been launched in recent years, including the Nationwide Health Information Network,[423] the National Institute for Standards & Technology,[424] and the Certification Commission for Health IT,[425] among others. As doctors and hospitals across the country migrate from paper-based medical records to EHRs, and as innovative new broadband-enabled telemedicine tools like the Microsoft HealthVault continue to be deployed, these efforts will be essential to ensuring that these new services are interoperable and thus of value to all stakeholders.[426]

However, until robust and widely accepted standards are developed and adopted by the vast array of service providers, innovators, and other stakeholders in the market, broadband-enabled telemedicine tools may remain fragmented in nature and unable to leverage true economies of scale to provide efficient and effectives services.

11. *Lack of available spectrum for the deployment of new telemedicine services and applications*

With telemedicine services increasingly using wireless broadband for transmission, service providers must have ready access to ample spectrum to facilitate the deployment of these services. Additional swaths of spectrum are needed to support the range of wireless broadband-enabled services that are available and emerging in a number of sectors. A number of stakeholders, including FCC Commissioners and members of Congress, have noted that spectrum allocation and usage policies need thorough reexamination.[427] In addition, other policies (e.g., tower siting) may need to be readjusted in order to speed the deployment of these services (see Section I.A.3). To this end, the FCC has committed itself to spectrum policy reform.[428] Congress has also acted by passing a spectrum inventory bill that would catalogue current spectrum availability and use.[429] However, the pace of innovation in the telemedicine sector will likely move faster than legislative or regulatory efforts to modernize spectrum allocation policy. Thus, there is risk that innovators in the telemedicine space (e.g., wireless carriers and third-party application developers), who rely on wireless broadband to transmit services and applications, may face a spectrum shortage.

Ensuring that ample spectrum is available to innovators is essential since wireless broadband will be a key component of many advanced telemedicine services. For example, in-home monitoring systems that track the vital signs of patients will depend on robust wireless connections to upload patient information in real-time. In the near-term, text messaging is being used to provide a primitive platform for the transmission of personal health data like blood sugar to a doctor for monitoring purposes.[430] Wireless broadband is also being used to enable a variety of systems and devices for use in hospitals.[431] Uses include providing real-time test results to doctors and nurses working in different parts of a hospital.[432]

In the long-term, wireless telemedicine services are poised to become seamlessly integrated into everyday life. According to a recent report issued by OfCom, the British regulator of communications, wireless telemedicine applications will likely include services that can monitor personal information in real-time and automatically send emergency alerts when a person gets into an accident or suffers a sudden health event like a heart attack.[433]

Additional spectrum is needed to accommodate such rapid innovation. Yet current spectrum allocation methods create a significant barrier to freeing up additional portions of the airwaves.

12. *Institutional inertia among some physicians*

HIT adoption among healthcare providers has been slow, owing largely to the low perceived value of these systems (see Barriers #1 and #7). However, a number of less quantifiable but persistent cultural barriers exist to further adoption of these advanced services by healthcare providers.

The reluctance of many physicians to adopt HIT systems and other broadband-enabled telemedicine services may stem from three key non-monetary factors: (1) resistance to change, (2) complexity of information, and (3) fear.[434] The implementation of EHRs and other health IT applications greatly reshape the work environment, disrupting daily routine and forcing physicians and office personnel out of their comfort zone.[435] Older physicians in particular, who may be ready to retire in coming years, do not see the value in putting forth the large-scale effort to convert from the traditional way of doing business, which has been successful throughout their careers.[436] Moreover, many physicians believe that "writing with pen and paper still accomplishes [most] tasks better than electronic systems."[437]

In addition, the complexity of new systems is a major concern. There is a general lack of expertise among physicians with regards to implementing and using HIT systems.[438] Both the implementation and maintenance processes are often time consuming and complex, demanding significant technical expertise from office staff.[439] Concerns related to the complexity of these new systems gives rise to numerous fears for healthcare providers. Many physicians fear being unable to choose the right vendor, and that the vendor might go out of business, cutting them off from their patients' data.[440] In addition, some providers fear that if technology overtakes medicine, it will become impersonal and automated.[441] Finally, the fear that undertaking a risky investment with emerging applications might result in failure leads to significant physician resistance.[442]

For these and other reasons, and despite numerous success stories and supporting research, physicians are generally unwilling to invest the necessary time, money, and effort into HIT and telemedicine implementation.

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V. ENERGY

This section focuses on the energy sector and barriers to further adoption and usage of broadband in this space.

Broadband is emerging as a key platform for innovation and the delivery of new services in the energy sector. Its ability to transmit data in real-time provides energy companies with a number of ways for integrating this technology into various aspects of the energy business. Indeed, broadband can play an important role in transforming the traditional patterns of energy generation, transmission, distribution, and consumption. In addition, broadband is being used by individuals and companies to conserve energy, reduce carbon footprints, and make consumption more efficient. At a time when energy and environmental policy reform top the agendas of many state and federal policymakers, broadband is poised to be a critical element of innovation in the energy sector.

Part A provides an overview of the uses and impacts of broadband in the energy sector, particularly on enhancing the electric grid and driving innovations centered on energy conservation and efficiency.

Part B identifies key policy and non-policy barriers to further adoption and usage of broadband in the energy sector. These range from a variety of regulatory challenges at the state and federal levels to a lack of focused policies to guide continued innovation.

A. An Overview of Broadband & The Energy Sector

Broadband is a vehicle for enabling energy-saving activities and a platform for launching wide-scale improvements across the energy distribution network. This Part provides an overview of two areas where broadband is already being used to affect change: (1) modernizing the electric grid and (2) enhancing energy conservation and efficiency efforts.

1. *Electric Grid Enhancements*

There is widespread agreement that the electric power grid in the United States is in need of modernization. Increasing demand for energy has put enormous strain on an infrastructure that is antiquated in many respects, leading to, among other things, inefficient transmission and distribution. Indeed, according to the U.S. Department of Energy, "electricity losses in the transmission and distribution systems exceed 10 percent of total energy generated."[443] These losses cost rate payers hundreds of millions of dollars per year; reducing them via a smart grid could result in better energy efficiency and cost savings (see below).

Outdated electric grid infrastructure can also result in power outages, which have devastated small towns and, on occasion, large swaths of the country. Over the past forty years, five massive blackouts have occurred, three of which have taken place in the past nine years.[444] These blackouts have had enormous economic impacts. For example, the Northeast blackout of 2003 resulted in $6 billion in economic losses in the region.[445] A single blackout in Silicon Valley resulted in $75 million in losses.[446] In 2000, a one-hour outage that hit the Chicago Board of Trade resulted in $20 trillion in trades delayed.[447] With energy demand continuing to outstrip energy transmission capacity growth,[448] policymakers are examining a number of ways to upgrade the grid and create efficiencies in both the demand for and supply of energy. A key focus of policymakers and market participants is on using broadband technologies to modernize the grid and make it "smart."

A broadband-enabled "smart grid" would provide a number of benefits to energy companies, customers, and the economy. Table 11 summarizes key impacts.

Table 11 – Impacts of a Broadband-Enabled Smart Grid

Reduces Energy Consumption & Carbon Emissions
▪ The real-time transmission of usage data accommodates generation and storage options that avoid productivity losses of downtime. As a result, energy will be used more efficiently. A Congressional Report estimated that a 4% peak load reduction could be achieved using Smart Grid technologies.[449] Reduction of energy consumption will also translate into lower bills for consumers, saving about $135 billion.[450] ▪ The U.S. Department of Energy estimates that robust use of the smart grid could equate to eliminating fuel and greenhouse gas emissions from 53 million cars.[451] ▪ Use of the smart grid will save between 60 and 480MM tons of carbon emissions per year, while annually creating $6 to $40 billion in value.[452]
Enables New Ranges of "Smart" Technologies
▪ A smart grid enables new innovations like plug-in hybrid electric vehicles. According to the Pacific Northwest National Laboratory, existing U.S. power plants could meet the electricity needs of 73% of the nation's light vehicles (i.e. cars and small trucks) if the vehicles were replaced by plug-ins that recharged at night. Such a shift would "reduce oil consumption by 6.2 million barrels per day, eliminating 52% of current imports."[453]

Facilitates Incorporation of Renewable Fuel Sources into Fuel Supply
▪ An intelligent grid that can monitor and react to changes in consumer usage in real-time will enable the incorporation of key renewable energy fuel sources – e.g., wind and solar – that are also intermittent in nature. This will boost the energy supply and cut carbon emissions.[454] ▪ According to one study, "integrating wind or solar power into the grid at scale – at levels higher than 20% - will require advanced energy management techniques and approaches at the grid operator level. The Smart Grid's ability to dynamically manage all sources of power on the grid means that more distributed generation can be integrated within it."[455]
Enhances Reliability
▪ The smart grid is capable of meeting increased consumer demand by shifting resources in real-time in order to reduce distortions of power supply. The U.S. Department of Energy estimates that "Smart Grid enhancements will ease congestion and increase utilization (of full capacity) sending 50% to 300% more electricity throughout existing energy corridors."[456]

2. *Energy Conservation & Efficiency*

Broadband is also being used in a variety of ways to conserve energy and to make energy use more efficient. In combination with other "holistic" approaches "executed at scale," *widespread and coordinated energy efficiency programs, which would include broadband-enabled smart grid services and devices, could result in over $1.2 trillion in gross energy savings thru 2020.*[457] This approach is expected to "reduce end-use energy consumption in 2020 by 9.1 quadrillion BTUs, roughly 23 percent of projected demand, potentially abating 1.1 gigatons of greenhouse gases annually."[458]

A broadband-enabled smart grid will play a key role in energy efficiency and conservation efforts going forward for the more than 140 million residential and small-business electricity customers in the United States.[459] For example, the smart grid enables a variety of services and devices that will help consumers decrease their energy consumption. Table 12 provides an overview of some of these tools.

Table 12 - Overview of Smart Grid-Enabled Consumer Tools

Consumer Empowerment	*Smart Meters*	*Smart Appliances*	*Smart Buildings*
▪ The smart grid enables a variety of *Demand Side Management* tools. The constant flow of real-time usage data, and a consumer's ability to access that data via an online portal, will allow the customer to alter usage patterns, lower their bills via responsive pricing programs,[460] and decrease their carbon footprint. ▪ FERC estimates that the potential reduction in consumption due to demand-response programs is approximately 41,000 MW per year.[461] ▪ An example of this type of service is the Tendril Residential Energy Ecosystem service, which "empower[s] consumers to better understand their energy usage, impact and control their cost of consumption and actively promote the health of the electricity grid."[462]	▪ The smart meter is the primary information conduit between energy consumer and energy provider. It relays transmission and usage information in real-time to the consumer and provider, allowing for instantaneous adjustments to transmission and usage patterns. ▪ Eventually, smart meters will allow customers to "set temperature preferences for their thermostats…or opt in or out of programs that let them use cleaner energy sources, such as solar or wind power."[463] ▪ Deployment of smart meters is rapidly increasing, with penetration estimated to be around 5% at the end of 2008.[464] Deployments are likely to rise from the current level of 8 million meters to 80-141 million by 2019.[465]	▪ Appliances and a number of other in-home devices will soon communicate with smart meters and the smart grid in order to adjust energy usage and become more efficient.[466] In theory, smart appliances will allow consumers to set their appliances to respond to energy pricing fluctuations and allow them to "temporarily shut[] off [a] hot water heater or rais[e] the thermostat slightly on hot days."[467] ▪ GE has entered into a partnership with Tendril whereby GE will "incorporate monitoring and reporting capabilities into its consumer appliances and ensure that they communicate properly with Tendril's software."[468]	▪ Buildings contribute 43 percent of the carbon emissions in the U.S.[469] One study found that typical heating, ventilation and air conditioning systems are only half as efficient as fully integrated systems.[470] ▪ The smart grid could allow buildings to be fitted with technologies that allow internal systems (e.g., heating and cooling) to seamlessly communicate with the electric grid.[471] ▪ Cisco provides a number of smart building services, which have been installed by Boston Properties (BP) in a number of their buildings. These tools allow BP to remotely monitor 40 buildings at once.[472]

Some have estimated that "better use of this sort of real-time information across the entire electrical grid could allow at least a 20 percent improvement in energy efficiency in the United States."[473] With energy demand expected to increase by 30 percent by 2030, and with electricity prices projected to increase by 50 percent over the next several years, widespread adoption and use of smart grid-enabled consumer tools is critical to more efficient energy distribution and more affordable consumption for both individual customers and large institutions.[474] For example, President Obama recently issued an Executive Order that, among other things, established a preference for energy efficient products and services in the federal government's procurement process.[475]

Another example of how broadband can be used to conserve energy is telecommuting. Telecommuting is increasingly popular among many public and private sector entities. Gartner estimates that 12 million people telework more than eight hours per week, double the amount in 2000.[476] By the end of 2009, Gartner expects this number to reach 14 million.[477] With regard to its impact on energy conservation, one study estimates that "[e]ach Internet telecommuter saves about… 3500 kilowatt hours a year."[478] Another study has found that "[t]elecommuting will reduce greenhouse gas emissions by 247.7 million tons due to less driving, 28.1 million tons due to reduced office construction, and 312.4 million tons because of energy saved by businesses."[479]

There are a number of other ways that broadband can assist in energy conservation. For example, companies can use broadband to shift a portion of their operations online, thus saving on corporate building energy consumption. One study has estimated that "[b]usiness-to-Business and Business-to-Consumer e-commerce is predicted to reduce greenhouse gases by 206.3 million (U.S.) tons."[480] A comparison of online book retailers and bricks-and-mortar book sellers, based on a report of Amazon.com's operations, suggests that the bricks-and-mortar seller consumes 16 times more energy per book sold than the online seller.[481]

An important ancillary benefit of deploying new infrastructure, retrofitting existing infrastructure, and otherwise investing in national-scale energy efficiency is job creation. *McKinsey estimates that, "assuming roughly $290 billion is invested in deployment of labor-intensive efficiency measures in residential and commercial sectors between 2009 and 2020," approximately 500,000 to 750,000 jobs could be created.*[482]

B. Barriers to Broadband Adoption

This part identifies key policy and non-policy barriers to further adoption and usage of broadband in the energy sector. These barriers include:

General Barriers to Broadband Adoption in the Energy Sector

1. Lack of better coordination among stakeholders and regulators in the energy and advanced communications sectors
2. Lack of an "ecosystem of innovation" due to prevailing regulatory paradigm and resulting business model
    a. Prevailing regulatory paradigm

    b. Resulting business model

3. Fragmented nature of energy regulation

Barriers to Broadband Adoption for Smart Grid Deployments

4. Lack of consumer awareness of and demand for smart grid applications and devices
5. Lack of generally applicable, consensus-based standards for the development of interoperable smart grid technologies
6. Spectrum needs for the deployment of smart grid technologies
7. Unresolved security concerns
    a. Network security
    b. Network reliability
8. Uncertainty regarding the privacy and storage of customer data collected via the smart grid
    a. Privacy
    b. Data storage

Barriers to Using Broadband for Energy Efficiency Initiatives

9. Lack of incentives for employers to encourage telecommuting
10. Lack of clear policies regarding sharing and usage of consumption information

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General Barriers to Broadband Adoption in the Energy Sector

1. *Lack of better coordination among stakeholders and regulators in the energy and advanced communications sectors*

There is wide agreement among many stakeholders, policymakers and regulators, in both the energy and advanced communications sectors, that broadband is an essential platform for enabling the smart grid and other energy efficiency initiatives.[483] However, while there has been much discussion of and work towards deploying a broadband-enabled smart grid, there has been a lack of meaningful coordination among stakeholders and regulators in the energy and advanced communications sectors.

Collaboration among stakeholders (i.e., utilities, broadband providers, policymakers, regulators, innovators, etc.) from both sectors is critical to the development of a smart grid that is interoperable, reliable, and national in scope. A number of task forces, working groups, and other such efforts have been organized and launched over the past few years to work towards this goal. The Smart Grid Task Force, composed of members from the U.S. Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC), among others, is one example of interagency collaboration. Despite this initiative, however, a number of agencies and organizations have launched their own programs for smart grid development, raising the possibility of conflicting, redundant, and inefficient policymaking.

For example, the Federal Communications Commission, as part of its mandate by Congress to develop a National Broadband Plan by February 2010, has included smart grid issues within the plan's purview.[484] To this end, the FCC issued a notice seeking comment for ways to support communication networks and technologies suitable for smart grid applications and to determine whether wireless spectrum can be used for smart grid applications.[485] In addition, the FCC has hosted a workshop on smart grid issues in order to explore how broadband can contribute to the rollout of this technology.[486] This marked one of the first times when representatives from both the energy and advanced communications sectors, under the aegis of an official federal gathering, spoke about the developments in their fields and how each sector might work together.

Another effort is the standard-setting initiative being spearheaded by the National Institute of Standards and Technology (NIST). NIST has the responsibility of identifying and evaluating existing standards, measurement methods, technologies, and other support in service to smart grid adoption.[487] Over the past year, NIST has examined the potential use of broadband and supporting standards as the network infrastructure for proposed smart grid applications.[488] Its "Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0" was released in September 2009.[489] The Framework "identifies 77 initial standards as the basis for utilities and vendors to follow as they deploy smart grid projects. The standards should support interoperability of a smart grid system from utilities to individual homes and electronic devices."[490] The public will have 30 days to comment on the report, after which time the final framework will be presented to FERC for approval.[491]

FERC is also pursuing a number of smart grid issues. In July 2009, it issued a Policy Statement that set out the parameters for the development of smart grid standards.[492] In particular, the Policy Statement proposed key priorities for standard development including two cross-cutting issues – system security and inter-system communication – and four key grid functionalities: (1) wide-area situational awareness, (2) demand response, (3) electric storage, and (4) electric transportation.[493] FERC also made clear that, by adopting these standards for smart grid technologies, it will not interfere with a state's ability to adopt whatever advanced metering or demand response program it chooses.[494] It has also announced an intention to implement "incentive rates" for utilities to incorporate advanced technologies, including those that facilitate smart grid deployment, into new transmission projects.[495] The goal of these policies is to ensure that 50 percent of new transmission projects include advanced technologies by 2014.[496]

In addition to its proclamation regarding federal-state jurisdictional concerns, FERC has entered into a Smart Grid Collaborative with the National Association of Regulatory Utility Commissioners (NARUC).[497] The collaborative is a forum for state and federal regulators to jointly learn about the technologies that currently support the smart grid and how these will benefit consumers.

In the private sector, most major smart grid deployments, including two of the largest – the "Smart Grid City" in Boulder, Colorado[498] and the "Pecan Street Project" in Austin, Texas[499] – are collaborative efforts among energy companies and technology vendors. Advanced communication companies have not yet played a significant role even though they have deployed and have experience in maintaining broadband networks that could speed deployment.

Each of these efforts demonstrates that stakeholders and regulators are actively working towards advancing the deployment of a smart grid. However, without structured, purposeful collaboration amongst existing stakeholders and working groups – and without collaborating with advanced communications companies and availing themselves of existing broadband networks and existing expertise in managing a communications infrastructure – the impacts of existing efforts will be limited.[500]

2. *Lack of an "ecosystem of innovation" due to prevailing regulatory paradigm and resulting business model*

The energy sector lacks, in many respects, the type of innovative ecosystem that characterizes other sectors – like the advanced communications market. The heavy regulation of the energy sector, which requires close scrutiny and regulatory approval of most infrastructure investments, rate adjustments and an array of other business decisions, means that change will be largely incremental. Many aspects of the regulated energy sector are unable to support or foster the type of rapid innovation that broadband makes possible.[501]

A useful counterpoint is the market for wireless telephony and related services, where each major link in the "value chain" has been strengthened by a relatively hands-off regulatory approach.[502] As a result of this approach, an ecosystem of innovation has been created, allowing innovators in a variety of market segments – handset manufacturers, network owners, application developers, etc. – to contribute to the overall robustness of the sector.[503] In the energy sector, however, the prevailing regulatory paradigm has resulted in a business model that is, in many respects, based on regulatory mandates rather than primarily on market dynamics.

a. *Prevailing regulatory paradigm*

The prevailing regulatory paradigm for much of the energy industry in the United States is one that requires exacting regulatory scrutiny of virtually all aspects of a utility's business. State public utility commissions (PUCs) have primary jurisdiction over the state's investor owned utilities. PUCs are tasked with reviewing and approving an energy company's rate structure and many other aspects of its business before rates are implemented. Rates are based on a number of factors, including investment in new and existing infrastructure and the cost of inputs (e.g., fuel sources). The value of many of these factors (e.g., property and infrastructure) constitutes the "rate base", which is a benchmark that regulators use to determine a reasonable rate of return for a particular company.[504] Energy companies will typically invest in new services and infrastructure only if they are able to recoup their costs via an approved rate of return schedule. This approach, which is commonplace in many states, parallels the regulatory framework for basic telecommunications services that was used until the early 1980s. A brief overview is instructive.

For most of the twentieth century, the regulatory approach to telecommunications centered on ensuring that a regional monopolist provided affordable, basic telephone service to every consumer across the country. This regulatory *quid pro quo* recognized that the goal of universal service required a market leader that was willing and able to deploy its network to under-served and unserved areas.[505] This approach was largely successful in spurring network deployment and increasing household penetration,[506] yet competition was limited because of the federally-approved monopoly model of regulation. As a result of a carefully managed regulatory relationship, which facilitated its ability to acquire or merge with many of its competitors, "Ma Bell" was relatively undisturbed by new entrants or new technologies.[507] Such an environment, while superficially beneficial to consumers who were guaranteed stable rates and reliable service, was not conducive to innovation outside of the Bell Laboratories. Indeed, for most of the twentieth century, basic telephone service remained just that: *basic*. Innovation is generally stifled in a highly regulated, monopoly market.[508] However, once the telephone monopoly was dismantled and new competitors entered the market, competition flourished, creating a vibrant ecosystem of innovation that has driven advancements all along the value chain of various segments of the market.

A highly regulated, monopoly-based approach in the energy sector has a direct impact on the incentives for, and ability of, many energy companies to innovate. Even though there are already a large number of smart grid partnerships and deployments, only a very few have been widely scaled out. *Thus, there is a tension between where energy companies are willing to go and where broadband can take them*.

b. *Resulting business model*

The prevailing regulatory paradigm has a direct impact on many energy companies' business models, which are the key determinants of levels of investment and innovation across the sector.

The U.S. Department of Energy has observed that the traditional regulatory paradigm in the energy sector "can discourage [investments in] energy efficiency, demand reduction, demand response, distributed generation, and asset optimization."[509] More specifically, the DOE states that "expanded peak demand has driven the need for additional capital projects, which increase the rate base. As energy sales grow, revenues increase. Both factors run counter to encouraging smart grid investments."[510] In other words, since energy companies are usually unable to make the case for a rate increase in order to save energy, they may be reluctant to invest in smart grid technologies that will reduce consumption of the product they sell.[511]

The current regulatory approach may also explain why many energy companies are endeavoring to build their own broadband networks to support the smart grid instead of collaborating with established network providers. Rather than outsource these functions to companies with a proven track record, many energy companies are opting to include these costs in their rate base and thus increase revenues. As a general matter, however, utilities lack the expertise and a demonstrated ability to build and maintain broadband-enabled networks. Moreover, it may be more affordable (and more reliable) to use an existing broadband infrastructure (and another company's expertise for network management) than it is to start from scratch.[512] Yet the lack of clear incentives to collaborate with advanced communications companies, which flow in large part from a rigid business model, deters further innovation and experimentation in the sector.[513]

3. *Fragmented nature of energy regulation*

The fragmented federal-state nature of regulation in the energy sector challenges smart grid innovations.

The various components of the energy business – from generation to transmission to distribution – are regulated by a variety of regulatory bodies. States generally oversee distribution networks, retail rates, cost recovery, and installations, while interstate power transmission falls under federal jurisdiction. *The multiple layers of regulations lead to overlapping obligations and potential conflicts between federal energy statutes and rules, on the one hand, and state statutes and results, on the other hand*. One possible conflict that might arise during the deployment of the smart grid is which regulatory entity – FERC or state PUCs – will determine which costs should be considered transmission related and which should be considered distribution related.[514] Recently introduced federal legislation on this point, which would give federal regulators the authority to override states and mandate new transmission lines,[515] could deepen the tension between the federal government and the states.

Regulatory federalism – shared regulatory oversight between states and the federal government – has long been a major issue of contention in both the energy and advanced communications sectors.[516] The intersection of these two sectors in the smart grid context presents a fundamental policy challenge, namely how to marry the less regulatory and more federal regime in the advanced communications sector with the more regulatory and more heavily state-centric regime in the energy sector. Broadband and wireless services are generally regulated at the federal level; states usually retain oversight of purely intrastate aspects of traditional voice service.[517] In view of the interstate nature of such technologies, a national approach to regulation has helped to spur competition and innovation across the sector. The provisioning of electric service is local in many respects and is highly regulated. Yet the shift towards a smart grid, which could become a national, interoperable network that connects many different individual networks across state lines, will entail an enhanced level of state and federal cooperation and oversight of an array of issues. Thus, a fundamental reassessment of the state-federal regulatory dynamic may be necessary in order to provide innovators along the smart grid "value chain" with guidance regarding the scope of regulation. Extracting what works from both regulatory models - and avoiding what does not work – will be critical as policymakers move forward.

Barriers to Broadband Adoption for Smart Grid Deployments

4. *Lack of consumer awareness of and demand for smart grid applications and devices*

Traditionally, energy consumption has been considered a passive purchase. With respect to add-on services like the smart grid and other smart devices, it remains to be seen whether consumers are demanding these services on a large scale. Indeed, the mechanics of the smart grid are complex, and with devices and software continuing to evolve, it may be difficult for consumers to grasp what these new technologies can deliver to them.[518]

Consumers generally are amenable to adjusting usage patterns in order to decrease their energy bills. A recent survey by IBM found that nearly 80 percent of consumers "would change the times at which they do energy-consuming housework in exchange for [halving their energy bill]."[519] However, a significant percentage of consumers – 45 percent – are unaware of renewable energy programs offered by their energy provider.[520] In addition, IBM found a correlation between demand for many of these types of conservation services and income level.[521] Moreover, recent economic turbulence has greatly reduced demand for "green" services that cost more in the short-term.[522] Usage rates of the current generation of demand response tools, which allow customers to dynamically alter energy consumption, are low. A 2008 FERC survey found that only eight percent of "U.S. energy customers have any form of time-based or incentive-based price structure that would enable customers to reap the benefits associated with load shifting behavior," up from five percent in 2006.[523]

Even assuming that consumers become more aware of smart grid technologies, addressing concerns regarding the high upfront costs of deploying these services will be a challenge. For example, a smart meter can cost upwards of $125 and can require several hundred dollars more to install once the necessary communications network and data-management software at the utility is taken into account.[524] Moreover, U.S. Secretary of Energy Steven Chu recently highlighted the negative impact of high initial costs for consumers regarding the deployment and implementation of smart grid infrastructure.[525] For these reasons, consumer education will be important to facilitating the deployment of these broadband-enabled devices and services.

One group has begun to consider potential impacts on consumers The National Association of State Utility Consumer Advocates (NASUCA) recently adopted a resolution that advocates for a reliable smart system that improves the efficiency, reliability and security of the electric grid.[526] Among other things, NASUCA recommends that state and federal agencies conduct a detailed analysis of the costs and benefits of smart grid proposals to make sure the benefits outweighs the costs before going forward with projects. This type of approach could ultimately provide essential information to customers and, thus, help spur additional demand for cost-effective smart grid services.

In the near term, consumer awareness of and demand for these services appears to be minimal.

5. *Lack of generally applicable, consensus-based standards for the development of interoperable smart grid technologies*

In light of the increasing number of smart grid deployments across the country and the high volume of innovation in this space, generally applicable, consensus-based standards are needed to ensure interoperability. Otherwise, as NIST has observed, "Without standards, there is the potential for these investments to become prematurely obsolete or to be implemented without necessary measures to ensure security."[527]

Failure to adopt meaningful standards for smart grid technologies raises a number of concerns. First, lack of identifiable standards hinders the development of smart grid technologies. Companies need to manufacture, buy, sell and utilize devices, services, and software with the knowledge that they work together.[528] Moreover, companies may be hesitant to "commit resources to design something that is not anchored into a technology that has some stability to it."[529]

Second, some technologies currently being developed may soon become obsolete.[530] Since the smart grid brings together a number of technologies (e.g. communications, power electronics, and software) at different stages of the technology maturity lifecycle, failure to standardize will lead to confusion and will risk interoperability. Limited interoperability also translates into limited choices for companies that want to install a particular type of technology.[531] The challenge then becomes to allow flexible regulation that leverages developing technology through policy that promotes positive economic outcomes.

A variety of federal entities are working to develop smart grid standards (see Barrier #1), and the Obama administration has such made standard-setting a priority.[532] Yet in the absence of a clear set of standards, company-specific deployments are continuing to increase. As a result, the possibility exists that these various deployments and initiatives will be unable to interoperate and thus fail to provide the type of national-scale benefits that a truly interoperable smart grid can produce.

6. *Spectrum needs for the deployment of smart grid technologies*

The expansive infrastructure of the smart grid, which includes generating stations, transmission lines, water pumping stations, gas pipelines and electric substations, requires maintenance, remote control, and remote monitoring to be effective, cost efficient, and reliable. Wireless broadband may be best positioned to enable many of these functions. *However, a lack of ample spectrum could slow the deployment of those smart grid components that operate most efficiently and cost effectively via wireless broadband*. Indeed, failure to allocate additional spectrum on a timely basis and without undue bureaucracy could lead to problems with interference, congestion, and interoperability at the network level.

As a result, a number of stakeholders have advocated for the allocation of additional swaths of spectrum to manage the increasing demands placed on smart grid networks.[533] Others, however, argue that existing commercial wireless networks should suffice since they are already widely deployed and are more robust than the wireless mesh networks that many utilities currently use to support some smart grid deployments.[534] More generally, federal policymakers, including FCC Commissioners and members of Congress, have recently noted that additional spectrum is necessary and that current spectrum allocation policies need a thorough reexamination.[535] While Congress has acted by passing a spectrum inventory bill that would catalogue current spectrum availability and use,[536] the lack of readily available spectrum in the near-to-medium term could slow the speed of smart grid deployment.

7. *Unresolved security concerns*

A number of concerns have arisen recently regarding the (a) security and (b) reliability of the smart grid network. This part examines both concerns.

a. *Network security*

The smart grid, by virtue of its ability to collect real-time information at a large number of points throughout the energy network, will produce enormous amounts of proprietary corporate and customer data. As a result, concerns regarding the security of this data will inevitably arise.[537] To this end, a number of commentators and researchers have observed that the smart grid and the smart meters it enables are vulnerable to attack from hackers.[538] Indeed, in their current form, smart meters require little authentication to carry out key functions, such as disconnecting customers from the power grid. These concerns are widespread. The White House has recognized the importance of implementing security standards for the smart grid in order to avoid opportunities for hackers to penetrate these systems or to engage in large-scale attacks.[539] The Department of Energy is also now requiring that grant applications for smart grid deployments take steps to prevent cyber attacks. The requirements come amid concern that many existing smart grid efforts do not have sufficient built-in protections against computer hacking.[540]

Network security expertise, however, is readily available. Advanced communications firms – i.e. broadband providers – have experience in managing and securing large, nationwide networks for a number of entities in both the public and private sectors. For example, the U.S. Department of Defense uses the broadband networks of advanced communications companies to transmit highly sensitive and classified material on a daily basis.

b. *Network reliability*

Closely related to network security issues are network reliability concerns. If a smart grid network is attacked by a hacker, energy services could be interrupted or caused to fail. As previously discussed, blackouts can have devastating human and economic impacts. Indeed, one study found that a hacker with $500 of equipment could take over an entire smart grid network and have free reign to manipulate its performance.[541] More generally, even slight interruptions in service, either as a result of a hacker or due to normal network congestion, could be problematic for end-users who rely on a constant flow of electricity. Uncertainty regarding the reliability of a smart grid network could chill demand for these services and ultimately slow deployment.

Companies are responding. For example, in order to make the smart grid more secure and reliable, defense contractors like Boeing and Raytheon are being brought into smart grid collaborations. Boeing, for instance, was named as a security partner on Southern California Edison's $60 million request to connect a 32-megawatt wind storage battery to the grid, and Raytheon plans to help Tucson Electric Power get a $25 million grant to link solar panels and in-home energy management systems.[542] These types of multi-sector collaborations are an important step forward but also underscore the need for collaboration with expert network managers (see Barrier #1).

8. *Uncertainty regarding the privacy and storage of customer data collected via the smart grid*

Customer usage data generated by the smart grid will provide utilities with a clear profile of individual energy usage patterns. While this data would be useful in helping to cut costs for the utility and the customer, policies regarding how this data will be kept have yet to be developed and adopted. Customer usage data may seem innocuous at first glance, but users may be wary of allowing an energy provider, and potentially third-party innovators (see Barrier #11), to know specific details of use. This section examines two related concerns stemming from this accumulation of user data: (a) privacy and (b) storage of this information.

a. *Privacy*

In general, if consumers believe that the smart grid is abusing (or could abuse) personally identifiable data, or that the utility accesses personal information that the customers deem unacceptable, then they are likely to refuse installation of smart grid applications in their homes. Utilities may also face potential customer liability claims or regulatory fines if eavesdroppers or hackers use smart grid data to the customer's detriment.[543] At present, a patchwork of state and federal privacy laws may contribute to uncertainty among utilities regarding adequate levels of compliance and could make this information vulnerable.[544]

A number of stakeholders have offered recommendations for addressing these concerns. NASUCA, for example, has suggested that federal and state policies be adopted to protect private information concerning a consumer's specific usage of electricity.[545] The Obama Administration, as part of its general cybersecurity strategy, has singled out "high-value activities" like the smart grid for the implementation of "an opt-in array of interoperable identity management systems to build trust for online transactions and to enhance privacy."[546] Despite these positive advancements, neither set of recommendations have yet to be formally adopted. With smart grid deployments increasing, a robust set of privacy policies is likely needed to assuage the concerns of customers and policymakers.

b. *Data storage*

Properly storing the vast amounts of data generated via the smart grid will also likely pose a problem for utility companies since many lack the requisite expertise and resources to effectively house this information. Indeed, most utility companies are accustomed to generating information at the one-month level (e.g., the data used to compile a customer's monthly bill). However, with smart grids able to capture user data in real-time, the amount of information coming into the utility will exponentially increase and likely overwhelm storage resources. The possibility exists that this mountain of data could cause data systems to crash, thus disrupting various components of the networked smart grid. A number of vendors, including Cisco, have developed network equipment to handle these storage tasks.[547] However, the cost of developing proprietary systems is likely prohibitive for some utilities and could potentially increase the upfront cost for customers. Moreover, high costs could deter some utilities from investing in these types of technologies, thus imperiling certain networks as the amount of data collected increases.

Barriers to Using Broadband for Energy Efficiency Initiatives

9. *Lack of incentives for employers to encourage telecommuting*

Historically, state and federal government have used a variety of incentives to spur employers to encourage the use of public transportation and other alternative transportation methods in order to reduce traffic congestion and pollution levels. Indeed, the U.S. Department of Transportation has issued a fairly comprehensive guide for employers to use in educating employees on the virtues of carpooling and other such alternative transport modes.[548] Incentives have included tax breaks to employers and other similar approaches that allow the employer to reimburse an employee for using public transportation.

Broadband-enabled telecommuting programs provide policymakers with a more effective and direct method for reducing traffic congestion and carbon emissions. But, to date, only a handful of states have provided employers with financial incentives for encouraging telecommuting.[549] There has yet to be widespread modernization of the system of incentives that previously encouraged alternative transportation at the state and federal levels. Unless and until these incentives are updated, most employers will continue to encourage carpooling and public transportation rather than broadband-enabled telecommuting.

10. *Lack of clear policies regarding sharing and usage of consumption information*

Utilities own the electricity meters and thus the data they generate. Moreover, utilities only share information about customer consumption once a month, with little concept or analysis that might help customers understand their home energy consumption.[550] Utilities are generally unwilling to use customer consumption information for other purposes, thus foreclosing opportunities for third-party innovators to access this information and use it to enable "smart" services. If this practice continues, smart grid deployments and educating consumers about energy use and energy savings will be hindered.[551]

A number of innovators are eager to tap into consumption data in order to provide consumers with new services. Google, for example, has created the PowerMeter, which gives consumers access to more detailed home energy data.[552] This service contains a graph that shows how the data can be used to help consumers identify the source of major power drains.[553] Another company – Opto – has created devices that bypass the meter and connect consumption monitoring tools directly to a customer's energy utility panel, allowing for the remote control of appliances via its Web portal.[554] These and other innovative approaches to using customer usage data exemplify the nearly limitless ways that this information can be transformed into something of value to customers and to utilities. Even though energy companies are reluctant to open customer consumption data to third-parties, Google has been successful in forging partnerships with an array of energy companies.[555] However, such a fragmented approach could slow the speed of similar deployments. In the absence of clear policies regarding the propriety of customer usage data, the development and deployment of "smart" devices and applications like the PowerMeter may stall.

* * * * * *

VI. EDUCATION

This section discusses key impacts of broadband on education in the United States and identifies major barriers to further adoption and usage of broadband in this space.

Broadband holds much potential for transforming the educational experiences of the approximately 56 million students enrolled in either a public or private primary or secondary school,[556] the 57 percent of children aged three to five currently enrolled in some sort of education program,[557] and the 54 percent of adults aged 16 to 64 who have participated in a formal educational class or program.[558] Indeed, with a significant number of Americans enrolled in some type of educational program at any one time, broadband has the potential to radically alter both where and how students learn. Broadband empowers students, teachers, and parents to take more control over the educational experience and to create increasingly individualized learning experiences. However, as discussed below, a number of barriers challenge more robust adoption and usage of broadband-enabled educational tools.

Part A provides an overview of how broadband is being used by educators, students, and parents to enhance the quality of the educational experience from pre-school through continuing education for adults.

Part B details the array of policy and non-policy barriers to further adoption and usage of broadband in the education space. These range from a variety of cost issues stemming from outdated funding mechanisms to organizational barriers among educators. Most schools are already connected to the Internet but, for a variety of reasons, many schools have not fully integrated broadband and broadband-enabled technologies into the classroom.

A. An Overview of Broadband & Education

This part provides an overview of (1) the impact of broadband on education and (2) current uses of broadband for educational purposes.

1. *The Impacts of Broadband on Education*

Broadband positively impacts the traditional education paradigm in a number of ways. Table 13 provides an overview.

Table 13 – Overview of Broadband's Impacts on the Traditional Education Paradigm

Distance Learning	*Online Learning*	*21st-Century Skill Development*
▪ Broadband facilitates a variety of distance learning programs, which provide valuable educational resources to rural students. ▪ Many schools are also using broadband-enabled distance learning programs to expand their catalogue of courses and cater to the unique needs of diverse student populations.[559] ▪ According to the U.S. Department of Education, 37 percent of public school districts and 10 percent of all public schools nationwide had students enrolled in technology-based distance education courses in 2004-2005.[560] ▪ In Alabama, for example, high school students are able to use the Internet to participate in distance learning programs including advanced placement courses and electives to which they may not otherwise have access.[561]	▪ Broadband enables a growing universe of online learning programs, tools, and other applications. These include courses, supplementary resources, research materials, and tutoring services, among many others. ▪ A recent survey estimated that more than 1 million K–12 students took online courses during the 2007-2008 school year.[562] ▪ Nearly 3.9 million students were taking online courses in the fall of 2007, 80 percent of whom undergraduates. According to the most recent data, the total number of students enrolled in higher education institutions that are taking online classes is increasing by nearly 13 percent annually.[563] ▪ A recent report by the U.S. Department of Education concluded that "On average, students in online learning conditions performed better than those receiving face-to-face instruction."[564]	▪ The Partnership for 21st-Century Skills has observed that "profound and accelerating changes in the [globalized] economy make it imperative for the [U.S.] to be much more strategic, aggressive and effective in preparing students to succeed and prosper."[565] Not only is the economy now global, but education has become global as well, and broadband enables education to reach resources overseas. ▪ Core skills include digital literacy and fluency in using basic and advanced Internet tools. Empowering students with these skills could have positive impacts on U.S. economic output.[566] ▪ Individual states have begun to implement programs focused on skill development. Maine, for example, is addressing 21st century skills statewide through its newly formed 21st-Century Skills Advisory Council, which brings together educators, business and government.[567]

Broadband is being used in a variety of other ways to bolster the administration of education and to empower students, teachers, and parents. For example, broadband facilitates a number of *administrative functions* for educators. Indeed, 89 percent of public schools use the Internet to provide data regarding instructional planning, while 87 percent "reported using the Internet to provide assessment results and data for teachers to use to individualize instruction."[568] Broadband also *enables professional development tools* for educators, which allow teachers to conveniently stay abreast of developments in various curricula and teaching methods.[569] In particular, broadband enables professional development to advance from the traditional method of lectures to a more two-way interactive model.

Broadband enhances the classroom experience by enabling a variety of advanced educational tools. For example, schools are using broadband to stream video, enable web 2.0 applications like blogs, facilitate collaborative learning, collect more granular data regarding student performance, and encourage a more individualized learning experience.[570]

Students are also using broadband as a supplement for in-class learning and as a resource to assist with assignments. Indeed, one study found that, in households with broadband connections, "children ages 6-17 reported that high-speed access affected both their online and offline activities, including schoolwork. *According to these children, since getting broadband, 66 percent spent more time online, 36 percent watched less TV, and 23 percent [improved their] grades."*[571] Broadband Internet access and regular computer access are also having positive impacts on overall student performance. To this end:

- Children who utilized the Internet more in general had higher scores on standardized tests of reading achievement and higher grade point averages than did children who used it less.[572]
- Additional studies have found a positive correlation between computer ownership and student performance, and have affirmed that computer use during early childhood is linked to cognitive development and school readiness.[573]

2. *Current Uses of Broadband for Educational Purposes*

Table 14 provides an overview of data regarding current levels of broadband adoption and usage for educational purposes.

Table 14 – Overview of Current Uses of Broadband for Educational Purposes

School Internet Connectivity
▪ Estimates of school Internet connectivity range from 98 percent[574] to 100 percent.[575]   ▪ 94 percent of instructional rooms are currently online.[576]   ▪ In 2005, 97 percent of public schools with Internet access used broadband connections to access the Internet. In 2001 and 2000, 85 percent and 80 percent of the schools, respectively, were using broadband connections.[577]   ▪ 88 percent of school districts[578] and 96 percent of higher education institutions provide wireless networks to students.[579]   ▪ 65 percent of schools without a wireless network are considering installation within the next year.[580]

Computers Access & Usage
▪ In the 2005-2006 school year, 14.2 million computers were available for classroom use, which provided one computer per every four students.[581] ▪ According to the U.S. Department of Education, in 2005, the average public school contained 154 instructional computers, compared with 90 in 1998.[582] ▪ A 2008 study found that over 54 percent of public school teachers reported having just two computers or less in the classroom.[583] Only 6 percent reported providing laptops to individual students.[584] ▪ Forty-four percent of students in higher education institutions report always getting a seat in a school computer lab.[585] ▪ Twelve percent of higher education institutions offer one-to-one laptop programs.[586]
Student Internet Usage
▪ 93 percent of teens aged 12-17 go online in general. 77 percent go online at school. 63 percent go online daily.[587] ▪ 55 percent of teens go online to search for information about colleges, while 27 percent maintain a blog or online journal.[588] ▪ 80 percent of parents say the Internet helps their children with schoolwork.[589] ▪ 71 percent of teens say the Internet has been a primary source for recent school project.[590] ▪ 95 percent of educators agree that "technology [e.g., computers; the Internet], when used properly, improved student learning."[591]
Teacher Internet & Technology Usage
▪ In 2005, 89 percent of public schools used the Internet for instructional planning, 87 percent used the Internet for assessment results and data for teachers to offer more individualized instruction, 87 percent provide digital learning materials to students through the Internet, and 51 percent used the Internet to provide professional development for teachers.[592] ▪ In 2008, 94.8 percent of K-12 educators reported using the Internet at school within the past 12 months.[593] ▪ In 2008, 76 percent of K-12 teachers reported using technology daily for administrative tasks, though less than half used technology for instruction-related tasks, and less than one-fifth use it to post student and class information online (16.9 percent) and to email parents (11.7 percent).[594]

Mobile Phones, Broadband & Education
▪ Cell phones are an increasingly important vehicle for getting online for many students. According to one estimate, "22 percent of young children own a cell phone (ages 6-9), 60 percent of tweens (ages 10-14), and 84 percent of teens (ages 15-18)."[595] Nielsen has observed that mobile Internet usage among teens aged 12-17 increased by nearly 50 percent in the year ending July 2009.[596]
▪ As an example, a program in North Carolina – Project K-Nect[597] – uses "smartphones with advanced mobile broadband technologies to deliver educational material to ninth-grade students...According to its project director, 75 percent of participating classes outperformed other cohorts in math subjects in the recently completed first phase of research. Students also displayed increases in average study time…[and] significant gains in parental involvement" were also reported.[598]
▪ 35 percent of teens have admitted to using a cell phone to cheat in class. Half admit to using the Internet to cheat.[599]
Online Degrees, Continuing Education & Professional Development
▪ 74 percent of higher education institutions offer distance learning programs.[600]
▪ According to a study by Vault.com, "85 percent of employers representing a variety of industries across the U.S. feel that online degrees are more acceptable today than they were five years ago."[601]
▪ A survey of several large corporations and organizations found that "technology was used to deliver 37 percent of formal training in 2005, up from 24 percent in 2003."[602]
▪ IBM's e-learning program, for example, "enables managers to learn five times as much material at one-third the cost of a classroom-only approach."[603]
▪ For a variety of reasons, including recent trends in the corporate e-learning market and the economic downturn, spending on formal e-learning programs decreased in 2008. According to one source, "the total amount of online training dropped from 30 percent of training hours in 2007 to 24 percent in 2008. This shift illustrates the industry's steady move toward informal learning and social networking."[604]

While data demonstrate a general upward trend in broadband usage for educational purposes, an array barriers challenge more robust adoption and usage of broadband and broadband-enabled educational tools.

B. Barriers to Broadband Adoption

Barriers to further adoption and usage of broadband in education include:

1. Costs of comprehensive utilization of broadband and broadband-enabled technologies
2. Lack of computer access
3. Outdated components of the E-rate program

4. Lack of a more targeted strategy for allocating federal funding
5. Inadequate teacher training on incorporating broadband technologies into the curriculum
6. Limited access to supportive software and technical assistance by educators
7. Demographic disparities in technology literacy
8. Cultural and organizational barriers among educators
9. Lack of adequate bandwidth within schools
10. Lack of national curriculum standards regarding use and integration of education technology

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1. *Costs of comprehensive utilization of broadband and broadband-enabled technologies*

While broadband can facilitate cost savings and increase learning opportunities for educators and students, the costs of broadband-based programs and services is a barrier for many schools and universities. These costs include purchasing the technology, installation, retrofitting buildings to accommodate new systems, training, and maintenance.[605] According to one estimate, technology integration programs can cost $15,000 per classroom and have a four-year lifespan.[606] In a classroom of 25 students, this totals $150 per student per year.[607] Many schools see these initial development and delivery costs of these tools as a significant barrier.[608]

Institutions have implemented a number of strategies, which include adopting a slower installation pace, outfitting a smaller number of classrooms per year, and gradually replacing older equipment with newer technology. Many universities are now equipping campus buildings with wireless Internet in order to reduce installation and retrofitting costs and are charging student technology fees to offset investments. In addition, schools are purchasing transport bandwidth and Internet access separately from service providers to lower costs.[609] This "decoupling" of Internet access "has enabled many districts to tap into local, regional, or statewide networks and to purchase 'raw' commodity Internet at rates that have been decreasing rapidly in recent years."[610] Large blocks of aggregate Internet access currently cost between $9 and $20 per megabit per second per month, and can be purchased through a regional or state master contract.[611] Transport pricing, however, has risen in recent years, due to increasing construction and easement costs.[612] Depending on the location, the initial nonrecurring costs for broadband access can vary from a hundred dollars to hundreds of thousands of dollars.[613] Some schools have "managed to save additional funds by starting out with minimal levels of broadband service and increasing bandwidth in the future as needed."[614]

In addition to the institutional costs of implementing education technology systems, students and their families also face significant financial constraints that are impeding more robust home adoption and use of broadband for educational purposes. Many online educational programs require a broadband connection, a computer, and other enabling technologies in order to complete Internet-based assignments. Though home broadband adoption has grown significantly in recent years, the adoption rate of low-income groups still lags behind the general population. [615] Many low-income families are unable to afford a monthly broadband subscription, particularly when combined with the costs of purchasing a home computer and any additional educational software.

2. *Lack of computer access*

Although computer availability and ownership rates have steadily increased over the past decade,[616] a significant number of students and schools remain unable to afford a computer.[617] In the 2005-2006 school year, 14.2 million computers were available for classroom use, which provided one computer per every four students,[618] up from a rate of 12.1 students per computer in 1998.[619] However, a 2008 study found that over 50 percent of public school teachers reported having just two computers or less in the classroom or primary work area for students, which prevented the effective integration of computers into teaching practices.[620]

A number of factors impact the ratio of students to computers. For example, "small schools had fewer students per computer than did medium-sized and large schools (2.4 to 1 compared with 3.9 to 1 and 4.0 to 1, respectively). Schools with the lowest level of minority enrollment had fewer students per computer than did schools with higher minority enrollments."[621] Further, certain demographics are more likely to use school computers for school-related activities. Low-income students, in particular, are more likely to restrict their Internet use to school computer labs.[622] African-American and Hispanic children ages 6-17 also utilize the Internet from school, versus from home, much more regularly than other children.[623] Indeed, one recent survey found that African-American households with children under the age of 18 were more likely to have used a public library in the past month for a school assignment than other ethnic households.[624] The same survey also found that African-American and Hispanic households were more likely than white households to go to the library to use a computer and the Internet.[625]

Many schools have begun implementing one-to-one laptop programs to overcome this technological barrier.[626] These programs allow students to use laptop computers during the school day and, in many cases, take the computers home as well.[627] As one commentator has observed, "[b]y eliminating obstacles of sharing computers, scheduling computer use, bringing students back and forth to computer laboratories, and unequal computer access, laptop programs seek to achieve a more natural integration of technology into instruction."[628] These programs have had a discernible impact on student performance. A 2005 study found that students with personal laptops "tended to earn significantly higher test scores and grades for writing, English-language arts, mathematics, and overall Grade Point Averages."[629] Another study compared schools with 4:1, 2:1, and 1:1 student-computer ratios, and found that a 1:1 ratio had many advantages.[630] For example, students with a laptop used the computer more frequently at home for academic purposes and received less large group instruction in a one-to-one learning environment.[631]

Lack of robust computer access thus represents a significant barrier to broadband adoption, as a significant number of students lack access both at home and in the school.

3. *Outdated components of the E-rate program*

Administered by the Universal Service Administrative Company under the direction of the FCC, the E-rate program provides critical support to schools and libraries for telecommunications and Internet access.[632] Discounts of between 20 and 90 percent are given to public and private institutions in need of telecommunications services, Internet access, internal connections, and basic maintenance of internal connections.[633] The award structure gives priority to disadvantaged institutions with low-income students and/or rural residence.[634] Over the last ten years, more than $22 billion has been awarded to help schools and libraries pay telephone and Internet bills and install network wiring and components.[635] Since the program began, "schools and districts have come to rely heavily on telecommunications networks to deliver educational content and to administer student achievement tests."[636] However, despite the program's successes over the past decade, concerns abound regarding its funding structure, rural preference, and application process, all of which may limit E-rate's ability to meet the technology needs of educators.

The E-rate program's lack of adequate funding is a much-cited barrier to further adoption and integration of broadband into everyday education.[637] One major factor is the program's inability to adjust funding amounts for inflation or changes in demand over the past ten years.[638] Funding amounts have remained constant, at $2.25 billion,[639] though the amount of requested funding consistently exceeded the allotted amount from 1998 to 2007.[640] Moreover, nearly 40,000 applicants requested a total of $4.3 billion from the E-rate program in 2008, exceeding the available amount by $2 billion.[641]

The E-rate program also provides smaller awards to low-income schools not located in a rural area. The discount rate is ten percentage points higher for rural schools than for urban schools with one to 49 percent of students eligible for the National School Lunch

Program.[642] This structure may prevent low-income urban schools and libraries from applying for the technology funding and support they need.

The application process for the E-rate program may also reduce the size of the funding pool.[643] To this end, 63 percent of the 150,000 eligible schools in the U.S. are currently taking part in the program, with 13 percent of eligible private schools applying for funding.[644] Nonparticipants state that the complexity of program requirements is a key barrier, though the process is becoming easier.[645] Typically, between 35 to 50 percent of applicants are new to the E-rate process, and must devote large amounts of time and resources to receive funding.[646] Moreover, funding has been denied to some participants in the past due to mistakes in the application process.[647] In order to address these concerns, the program has attempted to make the application process more user-friendly.[648] A new format has been developed, which focuses on educating new applicants on the complex program procedures.[649]

4. *Lack of a more targeted strategy for allocating federal funding*

Although many schools benefit from federal funding, a limited scope and a lack of targeted allocation mechanisms could slow further adoption and usage of broadband among low- and middle-income schools.

In general, schools receive federal funding from a variety of sources. Examples include:

- *The No Child Left Behind Title II, Part D (NCLB IID) – Enhancing Education Through Technology (EETT) Program.*[650] Even though $600 million were awarded annually in the first few years of the program, funding has steadily decreased since 2004;[651] $254.2 million were allocated in 2006.[652] NCLB IID legislation requires that each state provide a competitive grant program to distribute at least 50 percent of the available funds. In 2006, 1,094 competitive grants, totaling $148 million, were awarded by the states. However, this decreased to 1,047 grants and $135 million in 2007.[653]
- *Broadband-specific Stimulus Funds*. Schools stand to benefit from the $7 billion that has been allotted to support broadband penetration through the American Recovery and Reinvestment Act (ARRA).[654] These funds will be distributed by the USDA's Rural Utility Service (RUS) and the U.S. Department of Commerce's National Telecommunications and Information Agency (NTIA).[655]
- *Education-Specific Stimulus Funds*. The U.S. Department of Education has over $10 billion in funding to dedicate to bolstering schools across the United States.[656] Approximately $3.5 billion is dedicated to improving failing schools; $4 billion will be disbursed to states that

"pursue specific initiatives."[657] Another $650 million is dedicated specifically to enhancing education technology over the next two years.[658] This is in addition to the EETT's annual budget of approximately $267 million.[659]

Despite this surfeit of funding, several challenges remain.

First, with respect to the ARRA funding, a significant portion of these funds will likely be allocated to rural schools. RUS will administer $2.5 billion in funding for organizations that lack sufficient broadband access.[660] Historically, this program has provided little financial support for schools and has been largely under-funded.[661] Moreover, 75 percent of the area served by each recipient must be rural and lack access to adequate broadband service.[662] This further limits the funding opportunities for schools in suburban and urban locations in need of financial support.

Second, only $200 million of the over $4 billion in funds administered by NTIA are allocated for grants "to expand public computer center capacity, including at community colleges and public libraries."[663] An additional $250 million will fund a competitive grant program that encourages sustainable broadband adoption.[664] Schools that do not currently receive E-rate funds may benefit from this program, which will help schools "(1) acquire equipment, instrumentation, networking capability, hardware and software, digital networking technology, and infrastructure and broadband services and (2) construct and deploy infrastructure related to broadband service."[665] However, the eligibility of schools under this program is unclear, as the statute states that an applicant must be "a State or political subdivision thereof," without directly stating that school districts are eligible.[666]

Third, a general lack of targeted allocation mechanisms could result in overlapping, redundant, or skewed funding. For example, the additional $650 million for education technology can be used by states to "pay for things such as professional development to help teachers learn how technology can improve their lessons, software programs to enhance lesson plans, and computer labs."[667] ARRA funding will also support computer labs. In addition, some have argued that general stimulus disbursements for educational purposes might serve to prop up failing schools rather than creating incentives to change by, among other things, effectively incorporating technologies (e.g., computers and the Internet) into the curriculum.[668]

Fourth, others have argued that more federal funding is needed in order to ensure that all schools, including lower-income schools, have the same opportunity to bolster their education technology. One commentator has estimated that it would take approximately $10 billion in funding to ensure that all schools are "technology rich."[669] Stimulus funding is only available in the short-term and thus does not represent a viable, long-term outlet for additional school technology funding.

Legislation introduced in 2009 would bolster federal funding for education technology implementation and professional development and would help "ensure that every student is technologically literate by graduation, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability."[670] This bill has been endorsed by a number of stakeholders and is seen as a way to "focus[] resources on those practices known to best leverage technology for educational improvement."[671] In light of other funding cutbacks (see Barrier #3) and the various overlapping funding mechanisms described above, more targeted federal disbursements could enhance further adoption and use of broadband in a more efficient manner.

5. *Inadequate teacher training on incorporating broadband technologies into the curriculum*

Many educators have been slow to incorporate new information and communications technologies into their classrooms and to adjust their teaching methods in response to technological advances.[672] One commentator has observed that, "[w]hile policymakers, policy implementers, and education technology researchers have spared no effort in promoting the application of technology to teaching, teachers are relatively unwilling and unprepared to use computers within the classroom."[673] To illustrate, one study found that 57 percent of faculty members who teach in "smart" classrooms (i.e., classrooms outfitted with advanced information and communications technologies) fail to use the technology on a daily basis.[674] Moreover, even though most students state that technology is an important aspect of learning, only 33 percent of faculty members report that technology is fully integrated into the education experience.[675] While over 63 percent of students report using technology to prepare for class, just 24 percent actually use it during class.[676]

The low level of technology integration is due largely to a lack of relevant professional development for educators.[677] In 1999, half of public school teachers used computers or the Internet for class instruction and/or student assignments.[678] However, just one-third of teachers reported feeling "well or very well prepared to use computers and the Internet for instruction." [679] Further, in 2005, 83 percent of public schools with Internet access reported that their school or district trained teachers on how to integrate Internet technologies into the curriculum. Despite this, 34 percent of schools offering professional development had less than 25 percent of teachers attend the professional development courses within the previous year.[680]

The quality and effectiveness of technology-related professional development programs is also uncertain. A 2008 report by the National Education Association found that even when technology training is provided by school districts, educators believe that their training is more effective for administrative tasks, leaving them unprepared for instructional use.[681] Fifty-five percent of educators felt that their technology training prepared them for integrating technology into instruction, and 45 percent believed that they were prepared to design individualized lessons.[682] The method of technology instruction for educators further compounds this issue, as training courses often fail to serve as examples of technology implementation.[683] Technology training courses may simply tell teachers about education technologies without providing specific information for implementing the technology into the curriculum. Thus, a lack of proper professional development may be discouraging further adoption and integration of broadband-enabled technologies and tools in the classroom.

6. *Limited access to supportive software and technical assistance by educators*

Access to appropriate supportive software is one of the most important factors affecting computer use in classrooms and, thus, adoption and usage of broadband-enabled education tools.[684] Studies have shown that software tools designed specifically for educator needs "enhanced the motivation of teachers to use computers and promoted the emergence of innovative teaching practices."[685] Such software tools also assist teachers in developing technology literacy skills and help with the performance of routine tasks.[686] However, funding for the software used for lesson planning, preparation, and individual instruction is not provided for in many federal funding programs and is thus the responsibility of individual school districts and states.[687] Urban schools, which rely heavily upon E-rate funds for technical support, must find additional sources of funding to maintain and update supportive technologies for instructional use.[688] Urban educators are more likely than rural educators to report that their software was inadequate and are less likely to be involved in technology purchase decisions.[689] A 2007 report found that, throughout the education industry as a whole, "little effort has been invested to promote the maturity of educational software products, especially software designed to fulfill the instructional requirements of teachers."[690]

In addition, maintenance capabilities and technical support may also be in short supply. According to one study, 70 percent of educators report having sufficient technical assistance for technology set-up and use in their school, and just 67 percent report adequate help for troubleshooting or fixing problems with school technology.[691] Further, a 2008 study found that educators in urban schools are more likely to report poor working conditions of school computers and less technical support to help with repairs.[692]

A number of innovative nonprofit programs have been launched to support educators in the effective use of broadband-technologies in the classroom. MOUSE, for example, provides "the basic level of computer troubleshooting and maintenance support needed to assist teachers in their work to integrate technology into teaching and learning."[693] MOUSE empowers students to become resources for technical support, which provides them with essential employment skills and provides schools with a lost-cost alternative for computer-related troubleshooting.[694] This program has had discernible positive impacts on both students and schools. A Fordham University study of the MOUSE program found that participating students had higher rates of school attendance and increased academic performance.[695] A Citibank study found that "schools running the MOUSE program save an estimated $19,000 per year in technology support costs."[696]

According to the NEA, "technical personnel trained to assist teachers with setting up and troubleshooting computers and other equipment are essential to the successful implementation of school technology."[697] Innovative programs like MOUSE have proven to be successful in providing technical support to educators. However, a lack of widespread training and support systems represents a major barrier to further integration of broadband-enabled education tools for a majority of schools across the country.

7. *Demographic disparities in technology literacy*

Technology literacy skills are an essential prerequisite for nearly every profession and for effective usage of broadband-enabled educational programs.[698] The U.S. Department of Education recognizes that technology literacy "has become as fundamental to a person's ability to navigate through society as traditional skills like reading, writing, and arithmetic."[699] Information literacy is defined by the U.S. Department of Education as "computer skills and the ability to use computers and other technology to improve learning, productivity, and performance."[700] However, for a variety of reasons, there is a gap between those students with adequate technical literacy and those without.[701]

Certain demographic groups may experience varying levels of technology literacy due to the different levels of computer-based instruction received in school and the availability of broadband at home. The use of technology in classroom instruction varies significantly among different demographic groups. Rural educators are more likely than suburban and urban educators to complete administrative tasks, monitor student progress, and post class information with the use of computers.[702] Suburban instructors, on the other hand, are more likely to share information with other teachers and communicate with parents by email.[703] Urban educators, however, tend to use technology less frequently than rural and suburban educators for all four of the tasks.[704]

Since school computer access and classroom technology use are fragmented in schools across the country, many students are learning technology skills at home.[705] Studies have shown that children with home broadband access tend to spend more time online.[706] However, disparities in home computer and broadband adoption may prevent certain demographics from developing technology literacy skills. Though home computer and broadband adoption has grown significantly in recent years, the adoption rates of African-Americans and low-income families still lag behind the general population. Only 46 percent of African Americans and 35 percent of adults with household incomes under $20,000 have home broadband, compared to 63 percent of all adults.[707] Further, just 41 percent of students in the eighth grade who take part in the free and reduced lunch program had home Internet access in 2003, compared to 72 percent for those not participating.[708] Disparities in Internet and computer access create inequities in technology literacy for students who are unable to garner the necessary technology skills at home.

In addition, the application of accepted standards for technology literacy has made little progress in recent years. The No Child Left Behind Act calls for all students to be technology literate by the end of the eighth grade, but provides no requirements or accountability measures to ensure literacy levels. While 48 states currently offer technology standards for students, only four states test the technology literacy skills of students.[709] The low prevalence of technology literacy tests is largely due to the absence of a universally accepted and measurable definition of technology literacy.[710]

8. *Cultural and organizational barriers among educators*

Broadband and broadband-enabled education technologies have the power to shift the education paradigm to a more individualized learning environment. According to one commentator, "America is moving from the old mass production model of schooling to a model that engages individual students by offering them the opportunity to personalize their work and pursue the interests they develop."[711] The use of information technology and broadband in the classroom not only enhances conventional education, but also enables and empowers students to actively participate in the learning process.[712] However, even though there is much support for a new "culture of learning,"[713] acceptance of technology-centered education remains a concern among many educators.[714]

A number of cultural and organization barriers currently prohibit widespread adoption of technology in many educational institutions. Cultural barriers include "teachers' beliefs about the nature of teaching and learning, recognition and awareness of their role as teachers based on this philosophy, and a perception of the vision that technology may produce as they engage in instruction or promote learning."[715] Researchers have found that some teachers are hesitant to use technology in the classroom since traditional classroom dynamics may become reversed if students have more familiarity with technology than the educator.[716] In general, as one study has observed, teachers may be "accustomed to teaching within the traditional education model and are simply satisfied with the status quo."[717]

Online education may also be hindered by a lack of faculty acceptance.[718] One-third of academic leaders believe that their faculty "accepts the value and legitimacy of online education."[719] This number has remained relatively constant in past years, rising from

28 percent in 2002 and 31 percent in 2004. However, 62 percent of academic leaders of institutions already offering online education accept the value of online learning.[720] While institutions that currently offer online education do not see low value propositions as barrier for their organization, they do believe it will inhibit more widespread adoption of online education in general.[721]

9. *Lack of adequate bandwidth within schools*

Despite the fact that 97 percent of schools report having broadband access to the Internet,[722] the bandwidth associated with many of these connections is inadequate to support robust education applications.

The State Educational Technology Directors Association (SETDA) has found that most schools in the country are utilizing T1 (1.54 Mbps) connection speeds to accommodate the bandwidth-intensive needs of a school's many users.[723] This number is far below the national household average speed of 5 Mbps, which is shared only by a small group of Internet users in the home.[724] Further, one study estimated the national average access speed per student to be just 6.5 Kbps.[725] Many of the potential cost-savings, quality improvements and cutting-edge educational application are inaccessible at these speeds.[726]

School bandwidth needs continue to grow as new innovations in education technology become available. CoSN states that "demand on school networks…has never been greater."[727] For example, the size of an average web-page grew by 233 percent between 2003 and 2008, and the average number of objects per page doubled over the same time period,[728] putting further strain on any school connections. According to the School 2.0 Bandwidth Calculator, email, web browsing, online learning, audio streaming, and online assessments currently require 100 Kbps each.[729] Student-created content and school portals need 150 Kbps each, and the bandwidth requirements for virtual field trips and TV-quality video streaming amount to 250 Kbps.[730] Further, interactive video at a desktop can total 300 Kbps.[731] Each of these applications would likely overwhelm current Internet connections in many schools across the country.

As demand for bandwidth continues to grow, many schools may be faced with overuse penalties to service providers, lose critical information, or deal with highly congested traffic.[732] Schools will either opt to manage their traffic through software or purchase additional bandwidth to meet their needs. America's Digital Schools 2008 found that 67 percent of school districts utilized a restriction policy that bars students and teachers from using certain online applications, such as streaming video to conserve bandwidth.[733] However, when broadband-enabled resources become limited or difficult to use, many teachers respond by reducing the amount of technology they incorporate into their lessons.[734]

10. *Lack of national curriculum standards regarding use and integration of education technology*

Some stakeholders in the education sector have argued that a lack of national curriculum standards for education technology has hindered or slowed wider adoption and use of broadband-enabled tools and applications in the classroom.

Oversight of educational institutions is largely local in nature.[735] Many states retain oversight of the schools within their boundaries, delegating primary oversight of day-to-day operations to local school districts. However, federal standards have been imposed as part of national funding efforts (e.g., the No Child Left Behind Act). Funding is usually tied to certain performance benchmarks.[736] In addition, the federal government does assess student progress via its National Assessment of Educational Progress (NAEP) program. NAEP is "the only nationally representative and continuing assessment of what America's students know and can do in various subject areas."[737] However, major curriculum changes usually flow from the state.

Several federal funding mechanisms include technology requirements. For example, the NCLB IID competitive grants call for "systematic changes in policies, practices, and professional learning that increase or enhance a school's ability to use technology effectively in teaching and learning."[738] However, some have argued that a piecemeal, state-by-state, and possibly district-by-district, approach may delay further integration of technology into the curricula of many schools across the country.

Yet others argue that education technologies like broadband should be free of formal requirements and standards in order to fully realize the potential of these tools: individualized learning. Indeed, two commentators have argued that "even today, with education technology in its earliest stages…Curricula can be customized to meet the learning styles and life situations of individual students, giving them productive alternatives to the boring standardizations of traditional schooling…Teachers can be freed from their tradition-bound classroom roles, employed in more differentiated and productive ways."[739] Indeed, one of the major benefits of using broadband to aid education is the way in which it facilitates individualized learning by "outlier" students, such as those who are "gifted," those who are disabled, or those who are learning in a second language. According to this view, national curriculum standards for technology could blunt these potential impacts.

* * * * * *

VII. GOVERNMENT

This section focuses on how broadband impacts government processes and identifies barriers to further adoption and usage of broadband in this space.

A large amount of government information is already online and accessible by the public. Moreover, an increasing array of government services are migrating online in order to provide easy public access and to streamline certain internal administrative functions. However, as discussed in this section, most government entities face a complex array of legal and policy hurdles to further leveraging broadband to enhance transparency, offer services online, and maximize public participation.

Part A provides an overview of how broadband is being used by government to enhance the efficiency of administrative functions, bolster transparency, promote more citizen participation in decision-making processes, and engage the citizenry in collaboration and innovation. This part also analyzes how the public is using broadband to monitor government.

Part B details the array of legal, regulatory, policy, and non-policy barriers to further adoption and usage of broadband by various government entities. While the focus is primarily on the federal government, many states and municipalities face a similarly complex series of broadband barriers. Barriers at the federal level range from a variety of outdated laws that govern transparency to a lack of expertise on how to effectively integrate broadband into government processes.

A. An Overview of Broadband & Government

Broadband has multifaceted impacts on government. First, broadband enables advanced information technologies (IT), which allow government entities to enhance administrative functions. Second, broadband greatly expands the universe of information that government can make public, which in turn increases the number of opportunities for civic engagement and collaboration. Third, broadband is used by citizens to oversee government functions, providing a public check on state and federal institutions and policymakers. In sum, broadband is a critical tool for enhancing the democratic processes of government.

This part provides an overview of: (1) how government is currently using broadband and broadband-enabled technologies and (2) how citizens are using broadband to interact with government.

1. *How Government Uses Broadband & Broadband-Enabled Technologies*

The federal government is currently using broadband to achieve a number of core goals. Table 15 provides an overview.

Table 15 - Overview of How Government Uses Broadband

Administrative Efficiencies	*Enhanced Transparency*	*Civic Engagement*	*Public Collaboration*
▪ Broadband enables a variety of advanced IT systems, which provide enormous efficiencies and cost savings. ▪ Example: The federal government recently announced that it intends to use increasing amounts of cloud computing services via a new portal – Apps.gov. This is expected to result in millions of dollars in cost-savings.[740]	▪ Broadband allows state and federal government to make large amounts of information available in a more real-time manner via traditional means (i.e., posting online) and via new social media (e.g., Twitter). ▪ Example: A number of federal agencies, including the FCC,[741] have made updates available via RSS[742] and Twitter,[743] among other tools.	▪ In addition to enhanced transparency, broadband enables the widespread use of tools like blogs to engage the public in government activities.[744] ▪ Example: The FCC recently announced that comments submitted on its blog dedicated to the national broadband plan – Blogband – would be included in the formal record of this proceeding.[745]	▪ Broadband is also being using to solicit the input and expertise of the general public during rulemaking and decision-making processes. ▪ Example: The U.S. Patent & Trademark Office has launched an initiative – Peer to Patent – that uses wiki technologies to engage the public in gathering information for use in the review of patent applications.[746]

These efforts are being implemented across all levels of government and for a wide array of purposes. For example, the IRS utilizes electronic filing to increase administrative efficiencies and lower costs.[747] *The IRS has found that the processing costs for electronic tax returns are about one-eighth of that for paper returns, and if mandated, widespread use of electronic e-filing could save over $66 million.*[748] In addition, the number of federal and state government websites utilizing public outreach services online (e.g. e-mail updates, personalization, PDA access) has increased substantially since 2005.[749]

Many new initiatives are being driven by a focus on using technology to make government more accountable to the public.[750] Examples of recent efforts that leverage broadband-enabled technologies to make government more open include:

- *The White House's Open Government Initiative.* This initiative calls for the development of an open government plan that "instructs executive departments and agencies to take specific actions implementing" principles of openness[751] by collaborating directly with the public.[752] In particular, the Initiative consulted with the public during each of the plan's three phases – Brainstorming, Discussion, and Drafting.[753] Comments and feedback were solicited and organized via IdeaScale,[754] a community innovation tool.[755]

- *Open Government Innovations Gallery.* This gallery displays innovative programs and approaches for making government more open, transparent, and participatory.[756] Among the growing number of innovations is *Data.gov*, which provides the public with access to vast amounts of machine-readable government data and encourages the public to use the data to "build applications, conduct analyses, and perform research."[757]

- *E-Rulemaking*. Passage of the E-Government Act of 2002[758] signaled official recognition of the Internet as a primary means of communication between the government and the citizenry. In 2003, the federal government launched *Regulations.gov*, which is a centralized online repository of rules that invites the public to "search, view and comment on regulations issued by the U.S. government."[759] In addition to soliciting feedback from the public, e-rulemaking has the potential to engage the public in a dialogue regarding specific regulations and the regulatory process generally.[760]

- *Federal Register 2.0*. The White House recently announced the launch of the next generation of the Federal Register. Each day, the Federal Register publishes notices of new rules, rulemaking proceedings, and other announcements of the many Executive branch agencies. By the end of most years, nearly 80,000 pages of such announcements and notices are published.[761] However, the way in which these notices were published made them "more accessible in practice to avid government-watchers and experienced interest groups than the general public."[762] The 2.0 version will use XML, which is a "simple and flexible, machine-readable form of text that is easy to manipulate with software. By [using] XML, the federal government is for the first time allowing individuals to take control over how they want to read the Federal Register."[763] To this end, a new tool – *FedThread.org* – was recently launched that uses the new XML format to allow the public to annotate Register announcements, easily search the Register, and create customized news feeds.[764]

At the state level, a growing number of government entities are using similar broadband-enabled tools and approaches to make their processes more open and transparent. Indeed, a recent study found that three-quarters of responding cities and counties use RSS feeds to "provide news and updates to citizens," and "100 percent…are using wikis internally. Seventy-two percent are using, or will soon use, Twitter to push news -- especially emergency and safety alerts -- to citizens and the media."[765] Many of these tools allow government agencies to provide real-time information to the public in an affordable manner. For example, Twitter is increasingly popular among transportation agencies that want to alert residents of street closures.[766] In addition, many municipalities and states may follow the lead of the federal government in adopting and implementing new broadband-enabled applications and services.[767] However, much like the federal government, states and local municipalities face a number of barriers to further integrating broadband into everyday functions.

2. *How Citizens Use Broadband to Interact with Government*

An increasing number of people are using the Internet to participate in social discourse and avail themselves of online government services. A recent study found that nearly 20 percent of Internet users had "posted material about political or social issues or a used a social networking site for some form of civic or political engagement."[768] Of all Americans who have contacted a government official, signed a petition, or sent a "letter to the editor," 54 percent accomplished this online.[769] During the 2008 presidential campaign, nearly 75 percent of Internet users went online to "take part in, or get news and information" about the campaign.[770] Further, research shows that 31 percent of blogs have commented on political or social issues,[771] and that reading, commenting, and maintaining blogs have become one of the most popular online political activities.[772] In addition, the Internet became a primary conduit for campaign donations during the 2008 elections.[773]

Citizens are using broadband connections to the Internet for a number of other political activities. Table 16 provides an overview.

Table 16 - Overview of How Citizens Use Broadband to Interact with Government

New & Commentary	*Political Oversight*	*Political Organizing*
▪ Broadband enables an array of platforms for real-time political commentary. These include blogs, YouTube, news aggregating services, Twitter, and a variety of other services. Those who regularly participate in these types of activities are more likely to be involved in other civic-oriented activities.[774] ▪ Examples: Well-known examples of political blogs include *The Huffington Post* and *Politico.com*.[775] A search of "politics" via Technorati returns almost 300,000 blogs.[776] News aggregator sites like *Drudge Report* and *Real Clear Politics* provide users with a convenient forum for accessing political news. YouTube recently launched *CitizenTube*, which aggregates user-generated political videos.[777]	▪ Citizens are using broadband to contribute to political discourse and to monitor the actions of government. A growing number of "Watch" sites have been launched in recent years to provide checks on policymaker actions and on inaccurate information. ▪ Examples: *FundRace* tracks individual and corporate donations to political candidates.[778] *FactCheck* monitors "what is said by major U.S. political players" and filters what is true from what is not.[779] *Earmark Watch* tracks "spending provisions requested by individual members of Congress that target taxpayer dollars to specific projects and recipients."[780]	▪ Broadband enables social media tools for political organizing. *Facebook* is an increasingly popular service for aggregating "friends" and advancing political views. One recent poll found that nearly 40 percent of college students use Facebook to promote a political candidate.[781] ▪ Examples: Examples abound of formal and informal uses of broadband to facilitate political organizing. Candidates for office have successfully leveraged a variety of broadband-enabled tools to disperse information to local volunteers, who then circulated information via the web and via traditional means (e.g., door-to-door).[782] Similar tools also enable "flash crowds" to quickly gather and protest a given issue.[783]

The broadband-enabled tools described above provide citizens with a number of convenient outlets for participating in the processes of government. However, while these tools are increasingly relevant to the modern democratic process and to how government governs a number of barriers impede more robust and inclusive interactions between the citizenry and government.

B. Barriers to Broadband Adoption

This part identifies the key policy and non-policy barriers to further and enhanced broadband usage by government. These barriers include:

1. Inertia among many government agencies and government staff regarding the implementation of broadband-enabled e-government solutions

2. Lack of expertise regarding how to effectively use broadband for e-government purposes
3. Lack of coordination among federal agencies and departments regarding best practices for effectively using broadband
    a. Web design
    b. Interagency collaboration & information sharing
4. Cost concerns related to further integration of broadband into government functions
5. A complex array of laws and policies regarding transparency, administrative procedure, and e-government
6. Lack of public awareness regarding the value of using broadband to participate in deliberative e-government services
7. Unresolved privacy issues
8. Unresolved data security issues

* * * * * *

1. *Inertia among many government agencies and government staff regarding the implementation of broadband-enabled e-government solutions*

Despite the wide array of statutes and policies regarding e-government at the federal level (see Barrier #5), many agencies have yet to comply with these mandates. *A 2007 study found that nearly 80 percent of federal agencies had failed to comply with all the statutory requirements set forth in the Electronic Freedom of Information Act Amendments (EFOIA) of 2006.*[784] Among the federal websites currently online, many are poorly designed, cluttered, and inaccessible to the average reader.[785] In addition, many federal and state website quickly become outdated for a number of reasons discussed below. For example, the THOMAS web site that tracks federal legislation was launched in 1995 but was "so out of date by 2004 that seven senators cosponsored a resolution to urge the Library of Congress to modernize it."[786]

These trends signal either a general inability or reluctance by many federal agencies to harness the true potential of broadband. Despite promising gains in e-rulemaking,[787] government decision-making remains firmly rooted in 20th-century notions of relying on internal expertise rather than on using digital tools to better inform the process and citizens. As one commentator has observed, "Innovation is not emanating from Washington; instead, the practices of government are increasingly disconnected from technological innovation and the opportunity to realize great citizen participation – and therefore more expert information – in government. At the very least, this means that government institutions are not working as well as they might, producing declining rates of trust in government."[788]

Instances of institutional inertia abound at the local, state, and federal levels. For example, the New York City Council recently announced that it had webcast its first hearing in September 2009, two years after legislation was adopted that required such.[789] The main FCC website, though recently augmented by the addition of a series of interactive web 2.0 services, continues to frustrate users by being cluttered and lacking a number of features like a robust search feature.[790]

The Obama administration seeks to alter this mindset among federal institutions (see Section VII.A.1). Similar changes are also evident at the state and municipal levels. However, history has shown that, despite forward-looking laws and policies that seek to use broadband-enabled tools to open up government, institutional inertia is a powerful force that will likely impede more rapid adoption and use of these technologies in the short term.

2. *Lack of expertise regarding how to effectively use broadband for e-government purposes*

Lack of expertise regarding how to effectively implement and use broadband-enabled e-government tools at all levels of government is a key contributor to the institutional inertia described above. Indeed, the President tacitly acknowledged the absence of such expertise at the federal level with the appointment of a number of technology and innovation "czars" to ensure that the government is using these types of modern tools to hold government more accountable to the public. A federal Chief Information Officer (CIO) will "provide management and oversight over federal IT spending," and a federal Chief Technology Officer (CTO) will "provide vision, strategy and direction for using technology to bring innovation to the American economy. They will work together to support innovation inside and outside the Federal Government."[791]

A recent study by the Brookings Institution concluded that, "on most dimensions of technology innovation, the private sector outpaced the public sector."[792] Among the many reasons for this, the study noted that government agencies tend to lack the resources and incentives to implement the same type of interactive innovations that the private sector excels at.[793] In addition, even when the federal government has adequate resources, a combination of institutional inertia and lack of expertise stifles innovation. For example, even though the federal government owns the rights to a significant percentage of valuable wireless spectrum, much of it remains unused or underused.[794]

However, there is a growing consensus that public participation in the decision-making process, including in the formulation of policies for using technology for e-government purposes, could augment institutional expertise (see Barrier #6). Some have argued that more robust public participation in the decision-making processes of regulatory agencies via interactive collaborative tools (e.g., wikis) could bolster the quality of data and enhance the number of "experts" involved in a given rulemaking process.[795] As noted above, a number of initiatives that employ this approach are already underway (e.g., the USPTO's Peer-to-Patent pilot). However, the centralized expertise of the federal CIO and CTO, though already successful in affecting change within the various offices of the White House, will likely take some time to diffuse across the many Executive branch agencies and offices. Thus, more robust adoption and usage of the broadband-enabled tools discussed above will likely be slow because of a lack of expertise regarding how to properly implement these tools in the various agencies.

3. *Lack of coordination among federal agencies and departments regarding best practices for effectively using broadband*

Notwithstanding that many federal agencies share common goals, some tend to operate independently of one another even though closer collaboration and consultation could result in a more cohesive usage of broadband-enabled e-government tools.[796] A recent study observed that *"the biggest barrier to innovation is unwillingness to work together. Too many agencies do not align their management structures and design teams in a way that encourages people to work together."*[797] Indeed, the FCC has observed that there is a lack of coordination and priority alignment among government agencies, resulting in inefficient and duplicative deployment and adoption programs and improper implementation of broadband policy.[798] Lack of coordination among the various agencies has raised barriers to (a) a more cohesive approach to federal website design and (b) more robust interagency collaboration and information sharing, both of which negatively impact broadband adoption and usage efforts.

a. *Web design*

Even a review of various federal agencies' websites demonstrates a lack of a cohesive, overarching approach to web design. Websites are largely inconsistent with regard to readability, organization, and the number and type of services available.[799] The many websites affiliated with the FCC provide a useful case study.

The new FCC Chairman has vowed to launch a new website in the near future.[800] This is an important dimension of reforming government. The current version of the FCC's main website has been widely criticized as antiquated, cluttered, and organized in such a way as to be "an exercise in obscurantism."[801] Recently, however, the FCC has launched a number of issue-specific websites that many agree are more user-friendly and conducive to public input. For example, *Broadband.gov* is the primary web portal for the FCC's National Broadband plan.[802] This site contains, among many other features, a blog – Blogband – that is being used to solicit public comment on the plan.[803] More recently, the FCC launched another website – *OpenInternet.gov* – which is described as "a place to join the discussion about the important issues facing the future of the Internet."[804] These new websites offer unprecedented levels of public access and outlets for participation. Yet their designs – from look and feel to actual functionality and user-friendliness – vary greatly. The inconsistencies of websites housed within one federal agency are instructive of the universe of inconsistencies across all federal agency websites.

To promote enhanced consistency, the federal government has established a Federal Web Managers Council, which is an "interagency group of senior federal government web managers who collaborate to share common challenges, ideas, and best practices, and improve the online delivery of U.S. Government information and services."[805] The Council has, among other things, devised a set of rules governing federal website design.[806] These rules, however well-intentioned, have resulted in what some commentators have described as a "compliance minefield that makes it hard for [web managers] to avoid breaking the rules – while diverting energy from innovation into compliance."[807]

Federal website design remains is fragmented, inconsistent, and, in some cases, poor. Indeed, poor design may deter more robust usage by target audiences. For example, as previously discussed, the Medicare Part D website was found to be difficult to navigate by senior citizens and frustrating to use, which likely prevented some older adults from fully benefitting from the site (see Section II.B.2.b). These inconsistencies and the current compliance framework create a formidable barrier to experimentation with broadband and broadband-enabled tools. Some agencies, like the FCC, have successfully experimented with modern web design techniques. But there are no established channels for exporting these or other successes – and lessons learned from failures – among other agencies and organizations.

b. *Interagency collaboration & information sharing*

Broadband and broadband-enabled systems could be used to facilitate better information sharing and collaboration across federal agencies. Moreover, broadband and broadband-enabled tools could allow those agencies that have implemented user-friendly sites (e.g., the IRS) or that have successfully deployed collaborative tools (e.g., the USPTO's Peer-to-Patent program) to share best practices with other, less tech-savvy agencies. However, a lack of policies or incentives to encourage such behavior creates a barrier to further adoption and usage of broadband and broadband-enabled tools.

Intra-agency collaboration may offer principles for enabling interagency collaborations. Perhaps the most notable example is the creation of Intellipedia by the Central Intelligence Agency (CIA). Intellipedia uses wiki technology to aggregate a searchable directory of intelligence and other such information for use by CIA employees.[808] To date, nearly one million pages have been created via this tool.[809] However, policies that facilitate these types of collaborations across agencies are still lacking, creating a barrier to further usage of broadband-enabled services like the wiki technology used in Intellipedia.

Interagency collaborations could generate a number of valuable efficiencies and useful services. To this end, the GAO has identified a number of instances where information sharing among agencies would result in discernible benefits for the government and the public. For example, the GAO recently recommended "a systematic approach…to shar[ing] information broadly across the federal government about agency-developed promising practices in recruitment and retention of older, experienced workers to meet their workforce needs."[810] Similarly, the GAO has recommended that federal agencies "establish an ongoing forum for government personnel from [various] agencies that sponsor [Federally Funded Research and Development Centers] (FFRDCs) to discuss their agencies' FFRDC policies and practices."[811] Broadband could facilitate the type of information sharing and collaboration recommended by the GAO in these specific instances and in a variety of other instances.

4. *Cost concerns related to further integration of broadband into government functions*

The U.S. government will spend approximately $75 billion on information technologies in 2009, representing a 2 percent increase from 2008.[812] *By 2014, IT spending is expected to reach $90 billion a year.*[813] *With regard to e-government services, the amount of money allocated to support interagency iniatives will increase fourfold over the next year.*[814] These trends signify not only the rising costs of IT generally but also the current administration's dedication to using advanced information and communications technologies for bolstering the openness and transparency of government. However, at a time when many agencies' budgets are being cut or frozen,[815] concerns regarding the many costs associated with integrating and deploying broadband-enabled e-government services may slow the adoption and usage of these tools at the agency level. Investment levels are important since it has been found that "successful innovators spend a significant amount of their overall budget on information technology."[816]

The costs associated with using broadband-enabled e-government tools are multiple and vary depending on the type of tool being used. For example, more bandwidth-intensive applications (e.g., video) will require the purchase of additional bandwidth from the government's broadband provider. Video is a particularly expensive application in terms of money spent on bandwidth. Consider that, in 2009, YouTube, the most popular video site on the Internet, could spend approximately $300 million on bandwidth to support its service.[817] Moreover, for a variety of reasons (e.g., compliance costs), the cost of implementing something as simple as a blog, usually free to the public, can cost the government upwards of $600,000.[818] Additional costs may stem from redesigning current versions of website, hiring additional staff to manage new tools and services, and a variety of other hardware and software costs. With agency budgets being cut, cost concerns associated with the deployment, management, and upkeep of the broadband-enabled tools described above could prove to be a formidable barrier to continued innovation and experimentation within government.

5. *A complex array of laws and policies regarding transparency, administrative procedure, and e-government*

The array of federal laws and policies that directly or indirectly impact the ability of a federal agency to solicit information from the public or to make information publicly available create a formidable barrier to using broadband to enhance these processes. Many of these laws are outdated and do not include provisions for using the Internet to streamline information gathering or data transparency. Moreover, many of the laws that do reference the Internet have not yet been updated to account for the growing universe of broadband-enabled social media tools that are increasingly popular across the federal government (e.g., blogs, Twitter, and YouTube). Indeed, a recent memo issued by members of the Federal Web Managers Council highlighted the antiquated nature of many government laws and policies as a major impediment to more robust use of social media.[819]

Laws and policies that impact the usage of broadband-enabled tools include:

- *Freedom of Information Act (FOIA).*[820] FOIA requires the disclosure of certain types of information to the public upon request. Under FOIA, any person "can request an agency record and, implicitly, can do so for any reason or no reason at all."[821] However, despite an increase in transparency and accountability, "not all government information is available to the public."[822] Thus the universe of government information is limited by FOIA's provisions.
- *Electronic Freedom of Information Act (EFOIA).* This Act, which was passed in 1996, sought to modernize the FOIA at a time when the Internet was emerging as an important medium for information sharing. As previously noted, compliance with the EFOIA's disclosure requirements has been slow. One commentator has identified a number of reasons for this, ranging from "a simple lack of available resources to the seeming reluctance on the part of lawmakers and agencies to treat the task of public records maintenance as an essential component of a transparent, democratic government."[823] In addition to these, an increase in the amount of compliance required by federal web designers may have added to the institutional inertia described above.[824]
- *Administrative Procedure Act (APA).*[825] Enacted in the mid-1940s, the APA guides the various processes of federal administrative agencies, including

the rulemaking process, which allows for public input during the notice-and-comment portion of the process. These provisions, though well intentioned, have been widely criticized as vulnerable to regulatory capture.[826] In addition, many agencies lack the resources to fully vet each public comment.

- *E-Government Act.*[827] Among other things, the E-Government Act legislated e-rulemaking to streamline the traditional rulemaking process under the APA and to "improve the quality of federal rule making decisions."[828] However, as one commentator has observed, using the web for e-rulemaking has "made it easier for machines, or bots – rather than people – to send electronic postcards, further deluging agencies with unusable information."[829] Moreover, some agencies have been more successful in leveraging broadband-enabled e-rulemaking tools than others. The FCC, as previously discussed, has been criticized by some for not making dockets fully searchable via keywords.[830] Lack of coordination and information sharing among agencies could be hindering further progress on this front (see Barrier #3).

- *Paperwork Reduction Act.*[831] This Act was passed to "maximize the utility of information created, collected, maintained, used, shared, and disseminated by the Federal Government"[832] by mandating the online publication of documents. However, not all data are "online or web-accessible,"[833] creating gaps in what the public has a right to access and what agencies have a right to keep confidential.

- *Procurement Policies.* In addition to formal laws regulating the actions of federal agencies and offices vis-à-vis using broadband-enabled technologies for e-government purpose, a number of more informal but enforceable policies have also been implemented. Some of these, like the laws previously discussed, are outdated. For example, as the Federal Web Managers Council recently observed, "Government procurement rules didn't anticipate the flood of companies offering free tools to anyone who wants to use them."[834] Agencies that wish to implement these types of services face uncertainty regarding various aspects related to their use, including the propriety of using a free service (e.g., whether use of the service is considered a gift under ethics rules).[835]

These laws and policies create a complex maze of compliance requirements for federal agency staff, which results in increased costs and likely more entrenched institutional inertia. As a result, many agencies may be reluctant to experiment with broadband-enabled e-government tools for fear of running afoul of one of these laws or policies.

6. *Lack of public awareness regarding the value of using broadband to participate in deliberative e-government services*

As discussed above, an increasing percentage of the population is using broadband to participate in some form of online political discourse or activity (see Section VII.A.2). For example, the IRS reported a 19 percent increase in e-filing via home computers in 2009, due, in part, to e-filers receiving refunds faster than other filers.[836] However, despite the many benefits of broadband-enabled e-government, many citizens have yet to participate in more deliberative e-government services (e.g., e-rulemaking), suggesting either a lack of awareness or skepticism regarding the utility and value of these types of tools. This barrier could result in a majority of Americans being left out of critical deliberations being conducted online.

A recent study highlights the importance of raising awareness of the value of these services in order to spur usage. The study found a direct correlation between the use of various broadband-enabled civic tools and income level.[837] Indeed, the study concluded that "those who are lower on the socio-economic ladder are less likely to go online or to have broadband access at home, making it impossible for them to engage in online political activity. Yet even within the online population there is a strong positive relationship between socio-economic status and most of the measures of internet-based political engagement we reviewed."[838] A similar gap in usage was observed among different age groups (younger users are more active).[839] These gaps limit the pool of participants in a given e-government exercise and thus raise the possibility of skewed or incomplete results.

For example, during the presidential transition, the Obama administration released a "Citizen's Briefing Book" online and asked the public "to submit ideas to the president" and vote on the submitted proposals.[840] Over 44,000 proposals and 1.4 million votes on the proposals were received.[841] Yet despite such overwhelming feedback, the top proposals included legalizing marijuana and online poker, not economic or social reforms.[842] Similar results flowed from the initial public comment cycle of the Open Government Initiative described above. A number of "fringe" proposals were among the top proposals and included revealing UFO secrets and verification of President Obama's birth certificate.[843]

Various experiments and pilot programs have shown that well-designed civic engagement exercises can yield useful results by empowering citizen users to "self-select" and to self-police an online forum, thus providing an environment that is more conducive to debate and deliberation.[844] Moreover, carefully designed programs that create "an ongoing collaboration between government and citizens" could spur more participation.[845] For example, *Apps for Democracy*, launched by the District of Columbia's CTO, engaged the public in a contest to design innovative applications for using public data released by the local government.[846] The first contest in late 2008 yielded “[seven] iPhone, Facebook and web applications with an estimated value in excess of $2,600,000 to the city.”[847] The second contest, held in May 2009, attracted 230 public “insightful ideas and innovative applications” for bolstering government feedback mechanisms.[848]

The underlying assumption of many of these government-implemented deliberative experiments is that participation will increase via a form of viral marketing among friends and colleagues. As one commentator has summarized: “Anyone interested in a particular rulemaking initiative could get involved, with a realistic belief that her input could make a difference; and the reasonableness of that belief could lead many others to get involved as well, producing an upward spiral of individual involvement that would change rulemaking into a truly participatory process.”[849] However, the results of some of the programs described above underscore the importance of increasing citizen participation generally and, more specifically, of properly structuring citizen participation via broadband-enabled e-government tools.

In general, a lack of awareness among the citizenry regarding the value of participating in deliberative e-government services could slow further implementation of these types of tools if federal officials become frustrated with low levels of public input or if they determine that results are representative of only a small segment of the population.[850] Moreover, if citizens are unable to see that their input is having a direct impact on decision-making (e.g., that their proposals are not being addressed in the process), then they may be further discouraged from participating.[851]

7. *Unresolved privacy issues*

The rapid adoption of broadband-enabled e-government and social media tools by the federal government raises a number of novel privacy issues. A recent example regarding the federal “cookie” policy is instructive.

A “cookie” is a “mechanism that allows a web site to record your comings and goings.”[852] In June 2000, the federal government’s Office of Management and Budget issued a memorandum that “prohibited Federal agencies from using certain web-tracking technologies, primarily persistent cookies, due to privacy concerns,” unless authorized due to a compelling need.[853] The Obama administration is now considering whether to allow for more use of cookies by the federal government in order for “agencies to be able to provide the same user- friendly, dynamic, and citizen-centric websites that people have grown accustomed to using when they shop or get news online or communicate through social media networks, while also protecting people’s privacy.”[854] Despite this justification, proposed changes have been met with fierce criticism from some privacy advocates who fear that a change to the cookie policy would “allow the mass collection of personal information of every user of a federal government website.”[855]

Similar concerns arise as the federal government begins to use more services and applications developed by private sector innovators. For example, the federal cookie controversy has been driven by concerns that the government is seeking to adjust its policies in order to use services like YouTube.[856] Some worry that third-party innovators could benefit from increased web traffic to federal sites.[857]

One commentator has succinctly summarized the array of privacy concerns stemming from the use of broadband-enabled e-government tools: "[T]he digital collection of personally identifiable information renders that data subject to the immense search and aggregation powers of technology systems, increases the capacity for repurposing and reuse, and provides increasingly attractive targets to hackers bent on misuse. These phenomena raise serious concerns about a surveillance capacity that can erode personal privacy."[858] Such uncertainty regarding how the federal government collects and uses personal information could impede further adoption and use of broadband-enabled e-government tools by citizens and could create political disincentives for policymakers to champion further use of these tools.

8. *Unresolved data security issues*

In addition to privacy concerns, increased use of broadband-enabled e-government tools raises a number of concerns regarding security of the data collected via these services.

Federal government websites are targeted daily by hacker attacks. Many of these are "denial of service" attacks, which seek to overwhelm websites and servers with a "blizzard of data."[859] Other attacks include attempts at hacking into secure systems. For example, in May 2009 the U.S. Department of Homeland Security had its "platform for sharing sensitive but unclassified data with state and local authorities…hacked."[860] Hackers have also successfully penetrated the U.S. electricity grid and have "left behind software programs that could be used to disrupt the system."[861]

Data security is a major concern among Internet users. The majority of Internet users are still hesitant about providing personal information online.[862] The vulnerability of federal government websites may dissuade already hesitant users from utilizing broadband-enabled e-government services for fear of having their personal information compromised. The Obama administration has acknowledged the seriousness of these types of security breaches and has developed a comprehensive plan for cybersecurity.[863] However, many issues remain unresolved.

For example, security concerns arise from the growing use of third-party services by government agencies and staff. For example, a number of security concerns have been raised ahead of Google's launch of cloud computing services for government use.[864] Chief among these concerns is whether the services offered by Google and other providers will be secure. Each service will be required to comply with security requirements set forth in the Federal Information Security Management Act.[865] However, a majority of potential cloud computing users have lingering concerns regarding the security of these services.[866]

The perception that broadband-enabled e-government services are unsecure could hinder further adoption and use of these services by the public. In addition, lower demand by the public for these services could slow experimentation and innovation by the federal government.

* * * * * *

VIII. CONCLUSION

This Report is a conversation starter. Its intended purpose is to spark discussions among policymakers, regulators, innovators, and users regarding best practices for spurring more robust adoption and use of broadband. *The over 60 barriers identified herein make clear that one policy will not fit all when it comes to maximizing the adoption rate across all demographic groups and sectors of the economy*.

Overarching themes, however, do emerge. These include:

- The need for further inquiry into the dynamics of demand, adoption, and use of broadband among certain groups. As discussed at length above, the demands of different user groups vary greatly and require a thorough examination.
- In order to complete a comprehensive examination of the unique needs of certain user groups, more precise and current data regarding these needs is required. For example, there is a dearth of granular data regarding the broadband needs of people with specific types of disabilities. In addition, many studies regarding computer and Internet availability and usage for educational purposes is based on census data from 2005 or earlier. A robust set of up-to-date data is necessary in order to develop policies that are of immediate value to all under-adopting user groups.
- A multifaceted approach to spurring broadband adoption will likely be the most effective way of bolstering utilization in the short-term. To this end, public-private partnerships will likely produce the best outcomes since they combine public resources with private sector innovation.
- Innovation is, in many cases, producing effective solutions to some of the most common barriers identified in this Report. Policies that foster an innovative environment could lead to more grassroots solutions to many facets of the adoption problem.

In sum, this Report provides stakeholders with a starting place for further analysis of the dynamics of broadband adoption in the six sectors described herein and many other sectors. It also invites stakeholders to submit specific recommendations for overcoming these and other barriers to broadband adoption.

Going forward, an open, interactive, and data-driven process that focuses on the specific needs of discrete user groups will likely produce effective policies for maximizing broadband adoption and use across all user groups.

ENDNOTES

[1] For example, President Obama "believes that modernized infrastructure is a necessary part of the foundation for long term economic stability and prosperity. That includes everything from a comprehensive national broadband plan, to new health care information technology, to a modernized electrical grid." *See* The White House, Issues: Technology, http://www.whitehouse.gov/issues/technology/.

[2] It is estimated that companies invested upwards of $60 billion in communications infrastructure in 2008. *See Statement of Jonathan Banks to the Subcommittee on Telecommunications and the Internet, Committee on Energy and Commerce*, U.S. House of Representatives, p. 2, July 22, 2008, *available at* http://energycommerce.house.gov/images/stories/Documents/Hearings/PDF/Testimony/TI/110-ti-hrg.072208.Banks-testimony.pdf (quoting a projection made by Yankee Group).

[3] The most recent FCC broadband data reported that there were nearly 1,400 broadband providers in the United States as of June 30, 2008 and that over 90 percent of zip codes reports having four or more broadband providers. *See High Speed Services for Internet Access: Status as of June 30, 2008*, at Table 8 & Chart 12, Industry Analysis & Technology Division, Wireline Competition Bureau (rel. July 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-292191A1.pdf.

[4] Over $7 billion have been allocated to support broadband deployment and adoption efforts. The majority of these funds - $4.2 billion – will be administered by the U.S. Department of Commerce's National Telecommunications & Information Association. The remaining $2.5 billion will be invested by the Rural Utilities Service of the U.S. Department of Agriculture. *See* Press Release, *Vice President Biden Launches Initiative to Bring Broadband, Jobs to More Americans*, July 1, 2009, USDA, *available at* http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB?contentidonly=true&contentid=2009/07/0276.xml.

[5] For data regarding the adoption rates of adults over the age of 65, African Americans, and people with annual incomes below $20,000, *see* John Horrigan, *Home Broadband Adoption 2009*, at p. 13-14, Pew Internet & American Life Project (June 2009), *available at* http://www.pewinternet.org/~/media//Files/Reports/2009/Home-Broadband-Adoption-2009.pdf ("*Home Broadband Adoption 2009*"). For data regarding the broadband adoption rate among people with disabilities, *see infra* at Section III.A.1.

[6] *See, e.g.*, FCC Chairman Julius Genachowski, Prepared Remarks: America's Mobile Broadband Future, Oct. 7, 2009, FCC, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293891A1.pdf ("*Genachowski Wireless Remarks - Oct. 7, 2009*").

[7] For example, a recent article observed that "The use of mobile information technology to assist healthcare professionals in making treatment decisions at the point of care is expected to improve the quality, safety, and value of care delivery. Added value from these applications is extremely important for the growing number of seniors who want to independently age in place in the least restrictive environment possible." *See* Gregory L. Alexander et al., *Mobile IT Applications*, at p. 21, Long Term Living (Jan. 2009), *available at* http://eldertech.missouri.edu/files/Papers/Alexander/LTL%20-%20Mobile%20IT%202009.pdf.

[8] *See In the Matter of Fostering Innovation and Investment in the Wireless Communications Market*, para. 20, FCC, GN Docket No. 09-157 (rel. Aug. 27, 2009) (noting that "The provision of innovative wireless services is critically dependent on having access to spectrum. Further, as wireless is increasingly used as a platform for broadband communications services, the demand for spectrum bandwidth will likely continue to increase significantly, and spectrum availability may become critical to ensuring further innovation and deployment in the wireless sector.") ("*FCC Wireless Innovation NOI*").

[9] *Genachowski Wireless Remarks – Oct. 7, 2009* (noting that a primary objective is "unleashing spectrum for broadband").

[10] *FCC Wireless Innovation NOI* at para. 25.

[11] *Id*. at para. 22 (observing that "the Commission has established rules governing non-Federal access to and use of the spectrum. The rules provide details as to how the spectrum may be used, how it will be licensed, who is eligible, technical standards, etc. The license provides the right to access and use the spectrum, usually over specific frequencies or frequency bands and at a particular location or geographic area.").

[12] Two bills were introduced in 2009 that address spectrum usage. S. 649 – The Radio Spectrum Inventory Act of 2009 – was introduced in March 2009 and calls on the NTIA and FCC to compile a report that " includes an inventory of each radio spectrum band, from 300 Megahertz to 3.5 Gigahertz, managed by each such agency." Text of this bill is *available at* http://thomas.loc.gov/cgi-bin/query/z?c111:S.649:. H.R. 3125 – The Radio Spectrum Inventory Act of 2009 – was introduced in July 2009 and calls on the NTIA and FCC to "create an inventory of each radio spectrum band of frequencies used in the United States Table of Frequency Allocations, from 225 megahertz to 10 gigahertz." In addition, this bill requires the report to include recommendations for the swaths of spectrum that should be reallocated. Text of this bill is *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-3125.

[13] *FCC Wireless Innovation NOI* at para. 52.

[14] *Genachowski Wireless Remarks – Oct. 7, 2009* (noting that "removing obstacles to [next-generation wireless network] deployment, like delays in tower siting" is another objective of the FCC).

[15] *See generally* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Senior Citizens*, A Report to the U.S. Chamber of Commerce (Dec. 2008), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/BroadbandandSeniors.pdf ("*Broadband & Seniors*").

[16] *See A Profile o f Older Americans: 2008*, at p. 1, U.S. Department of Health and Human Services, Administration on Aging (2009), *available at* http://www.aoa.gov/AoARoot/Aging_Statistics/Profile/2008/docs/2008profile.pdf ("*Statistical Profile*").

[17] *Id.* at p. 2.

[18] *See* Jeffrey S. Passel and D'Vera Cohn, *U.S. Population Projections: 2005-2050*, at p. 20, Pew Research Center (Feb. 2008), *available at* http://pewhispanic.org/files/reports/85.pdf ("*U.S. Population Projections: 2005-2050*").

[19] *See, e.g., Growing Older in America: The Health and Retirement Study,* at 4, Report of the National Institute on Aging, National Institutes of Health, U.S. Department of Health and Human Services (March 2007), *available at* http://www.nia.nih.gov/NR/rdonlyres/D164FE6C-C6E0-4E78-B27F-7E8D8C0FFEE5/0/HRS_Text_WEB.pdf ("*Growing Older*").

[20] *See* Press Release, *Oldest Baby Boomers Turn 60*, U.S. Census Bureau (rel. Jan. 3, 2006), *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/006105.html.

[21] *In the Matter of a National Broadband Plan for Our Future, Notice of Inquiry*, FCC GN Docket No. 09-51, para. 5.

[22] *Home Broadband Adoption 2009* at p. 13.

[23] *See* John Horrigan, *Home Broadband Adoption 2008*, Pew Internet & American Life Project, at p. 3 (July 2008), *available at* http://www.pewinternet.org/~/media//Files/Reports/2008/PIP_Broadband_2008.pdf.

[24] *Home Broadband Adoption 2009* at p. 15.

[25] *See Women, Teens, and Seniors Help Fuel 34% Mobile Web Spike,* Sept. 30, 2009, NielsenWire, *available at* http://blog.nielsen.com/nielsenwire/online_mobile/mobile-web-up-34-percent-july-09/ ("*Women, Teens, and Seniors – Mobile Web Use 2009*").

[26] *See* Sydney Jones, *Generations Online in 2009*, at p.5, Pew Internet & American Life Project (Jan. 2009), *available at* http://pewresearch.org/pubs/1093/generations-online.

[27] *Broadband & Seniors* at p. 11 (discussing the efforts of a nonprofit group in New York City that has been successful in spurring awareness, demand, and adoption broadband among seniors of all ages).

[28] *Statistical Profile* at p. 5.

[29] *See Senior Citizens who Master Computers Have Less Depression*, Aug. 18, 2005, SENIOR JOURNAL, *available at* http://seniorjournal.com/NEWS/Aging/5-08-18MasterComputers.htm.

[30] *See generally* T.E. Seeman, *Social Ties and Health: The Benefits of Social Integration*, 6 Annals of Epidemiology 442-451 (1996).

[31] *See* Richard W. Johnson and Corina Mommaerts, *Unemployment Rate Hits All-Time High for Adults Age 65 and Older*, at p. 1, Urban Institute (March 2009), *available at* http://www.urban.org/uploadedpdf/411846_recessionandolderworkersfactsheetmarch2009.pdf.

[32] *Id.*

[33] *See Overlooked and Underserved: The Crisis Facing America's Older Workers*, at p. 4 Executive Summary, Experience Works (September 2009), *available at* http://www.experienceworks.org/site/DocServer/EW-ExecSummary_09-Final.pdf?docID=10381 (*"Older Workers 2009"*).

[34] *Id.* at p. 3.

[35] As AARP concluded, broadband will play a major role in extending the careers of seniors. *See* AARP Policy Book, Ch. 10, Utilities: Telecommunications, Energy and Other Services, at p. 10-40, *available at* http://assets.aarp.org/www.aarp.org_/articles/legpolicy/10_utili07.pdf ("*AARP Policy Book*").

[36] *See, e.g.*, Jonathan L. Willis, *What Impact will E-Commerce have on the U.S. Economy?* at p. 53, Economic Review, Second Quarter 2004, Federal Reserve Bank of Kansas City, *available at* http://www.kc.frb.org/publicat/Econrev/PDF/2q04will.pdf.

[37] *Id.* at p. 60-61.

[38] *See Prescription Drugs: Smart Shopping Yields Big Savings*, CONSUMER CHECKBOOK.ORG (2004), *available at* http://www.checkbook.org/cgi-bin/free/drug.pdf.

[39] *See* Walgreens, AARP partnership, https://www.walgreenshealth.com/whc/aarp/jsp/aarp_home.jsp.

[40] *See* Older Adults Technology Services, *Medicare Peer Counseling Saves Bronx Seniors Thousands in Drug Costs, available at* http://www.oatsny.org/medicare.htm

[41] *See* Robert E. Litan, *Great Expectations: Potential Economic Benefits to the Nation From Accelerated Broadband Deployment to Older Americans and Americans with Disabilities*, New Millennium Research Council (Dec. 2005) ("*Great Expectations*").

[42] *See generally* Charles M. Davidson & Michael J. Santorelli, *The Impact of Broadband on Telemedicine*, A Report to the U.S. Chamber of Commerce (April 2009), at p. 12-18, *available at* http://www.nyls.edu/user_files/1/3/4/30/83/BroadbandandTelemedicine.pdf ("*Broadband & Telemedicine*").

[43] *See Aging Services: The Facts*, General Facts, American Association of Homes and Services for the Aging, *available at* http://www.aahsa.org/aging_services/default.asp.

[44] *Id.*

[45] *Id.*

[46] *See* Robert Litan, *Vital Signs via Broadband: Remote Health Monitoring Transmit Savings, Enhances Lives,* at p. 2, White Paper of Better Healthcare Together (Oct. 2008), *available at* http://betterhealthcaretogether.org/SitesResources/bhctv2/Resources/Documents/VITAL%20SIGNS%20via%20BROADBAND%20FINAL%20with%20FOREWORD%20and%20TITLE%20pp%2010%2022.pdf ("*Vital Signs*").

[47] *Home Broadband Adoption 2009* at p. 3.

[48] *Home Broadband Adoption 2009* at p. 42-43.

[49] *Id.*

[50] *See* Amanda Lenhart, *The Ever-Shifting Internet Population: A New Look at Internet access and the Digital Divide,* at p. 16, Pew Internet & American Life Project (June 2003), *available at* http://www.pewinternet.org/Reports/2003/The-EverShifting-Internet-Population-A-new-look-at-Internet-access-and-the-digital-divide.aspx

[51] *See Luxury or Necessity?* Dec. 14, 2006, Pew Research Center, Social & Demographic Trends, *available at* http://pewsocialtrends.org/pubs/323/luxury-or-necessity.

[52] *See* Comments of Susannah Fox, Associate Director, Digital Strategy, Pew Internet & American Life Project, FCC Workshop #7a – Adoption/Utilization- Building the Fact Base, Transcript p. 78-79 (August 19, 2009), a*vailable at* http://www.broadband.gov/ws_adoption_fixed.html ("*Fox FCC Comments*").

[53] *See* Susannah Fox, *Older Americans and the Internet*, Pew Internet & American Life Project at p. 11 (March 2004), *available at* http://www.pewinternet.org/~/media//Files/Reports/2004/PIP_Seniors_Online_2004.pdf.pdf ("*Older Americans").*

[54] *See* William G. Korver, *Broadband Adoption and Not Availability is Key Challenge, Says One Economy*, July 31, 2008, BroadbandCensus.com, *available at* http://broadbandcensus.com/blog/?p=225; *Home Broadband Adoption 2008* at p. 12-14 (noting that "one-third (33%) of non-internet users say they are simply not interested in the internet" whereas "just 7% say it is too expensive.").

[55] A recent study estimated that "by 2050 the number of people with early age-related macular degeneration will double in the United States to more than 17.8 million. Without treatment, these patients would be expected to result in approximately 1.6 million cases of visual impairment and blindness in 2050, compared to between 400,000 and 600,000 cases today." *See Visual Impairments will Increase as Population Ages, but Treatment can Mitigate Effects,* April 13, 2009 News-Medical.net, *available at* http://www.news-medical.net/news/2009/04/13/48292.aspx (citing a study by researchers at RTI International and the Centers for Disease Control and Prevention, published in the April 2009 issue of Archives of Ophthalmology).

[56] *See* Mark Notess and Lesa Lorenzen-Huber, *Online Learning for Seniors: Barriers and Opportunities*, eLearn Magazine, *available at* http://www.elearnmag.org/subpage.cfm?section=research&article=7-1. ("*Online Learning for Seniors"*).

[57] *See* Emily Shartin, *Designing Websites with Senior Citizens in Mind*, April 3, 2005, Boston Globe, *available at* http://www.boston.com/business/technology/articles/2005/04/03/designing_websites_with_senior_citizens_in_mind/.

[58] *See* Jack Nielsen, *Usability for Senior Citizens,* April 28, 2002, UseIT, *available at* http://www.useit.com/alertbox/seniors.html (citing *Web Usability for Senior Citizens,* Nielsen Norman Group, *available at* http://www.nngroup.com/reports/seniors/ [*"Usability for Senior Citizens"*]).

[59] *Id.*

[60] *Home Broadband 2009* at p. 43.

[61] *Usability for Senior Citizens.*

[62] *See* Traci A. Hart, *Evaluation of Websites for Older Adults: How "Senior-Friendly" Are They?* Usability News, vol. 6, Issue 1 (Feb. 2004), *available at* http://www.surl.org/usabilitynews/61/older_adults.asp (*"Website Evaluation"*).

[63] *Usability for Senior Citizens.*

[64] *Id.*

[65] *See Making Your Website Senior Friendly*, National Insitute on Aging, U.S. National Institutes of Health, *available at* http://www.nia.nih.gov/HealthInformation/Publications/website.htm.

[66] *See* Usability.gov, About Us, http://www.usability.gov/about/index.html.

[67] *Website Evaluation.*

[68] *See* Steve Reinberg, *Medicare Web Site Confounds Many Seniors*, Aug. 19, 2008, HealthDay, *available at* http://health.usnews.com/articles/health/healthday/2008/08/19/medicare-web-site-confounds-many-seniors.html?PageNr=1.

[69] *Id.*

[70] *See, e.g.,* Comments of Link Hoewing, Vice President, Verizon Communications, FCC Workshop #7a – Adoption/Utilization- Building the Fact Base, Transcript p. 26 (August 19, 2009) (citing a study by Forrester Research, Inc.), *available at* http://www.broadband.gov/ws_adoption_fixed.html ("*Hoewing FCC Comments*").

[71] *See* Debra Donston, *IRS Makes Less Taxing Web Site,* December 23, 2005, eWeek.com, *available at* http://www.eweek.com/c/a/Government-IT/IRS-Makes-Less-Taxing-Web-Site/.

[72] *Id.*

[73] *See Press Release, IRS e-File Up Sharply in 2008*, May 28, 2008, IRS.gov, *available at* http://www.irs.gov/newsroom/article/0,,id=183321,00.html.

[74] *See* Press Release, *E-file Hits Record 90 Million; 30 Million Filed from Home Computers,* April 30, 2009, IRS, available at http://www.irs.gov/newsroom/article/0,,id=207293,00.html (*"IRS E-file Record – 2009").*

[75] *See* Ann Chadwick-Dias et. al, *Web Usability and Age: How Design Changes can Improve Performance*, Fidelity Investments (2002), *available at* http://portal.acm.org/citation.cfm?id=957212&dl=GUIDE&coll=GUIDE&CFID=11110647&CFTOKEN=22497669.

[76] *See Connected Tennessee Residential Technology Assessment*, at p. 2, Connected Nation (Jan. 2009), *available at* http://www.broadband.gov/docs/ws_adoption_mobile/ws_adoption_mobile_noriega.pdf.

[77] *Older Americans* at p. 3.

[78] *See Broadband in America: Access, Use and Outlooks*, at p. 6, Consumer Electronics Association (July 2007), *available at* http://www.ce.org/PDF/CEA_Broadband_America.pdf ("*CEA Report*").

[79] *Broadband & Seniors* at p. 10

[80] *Statistical Profile* at p. 10.

[81] *Id.*

[82] *See* Carmen DeNavas-Walt, Bernadette D. Proctor, and Jessica C. Smith, *Current Population Reports*: *Income, Poverty, and Health Insurance Coverage in the United States: 2007*, at p. 15, U.S. Census Bureau (2008), *available at* http://www.census.gov/prod/2008pubs/p60-235.pdf.

[83] *Home Broadband Adoption 2009* at p. 14.

[84] *Id.* at p. 29.

[85] *See Consumer Discounts on Telephone Service Under Federal Universal Service Programs,* Lifeline Across America, *available at* http://www.lifeline.gov/lifeline_Consumers.html.

[86] *See* John Eggerton, *Hill Ponders Adding Broadband to USF*, March 12, 2009, Broadcasting & Cable, *available at* http://www.broadcastingcable.com/article/189856-Hill_Ponders_Adding_Broadband_To_USF.php.

[87] *See* H.R. 3646 – The Broadband Affordability Act of 2009 (introduced Sept. 24, 2009), *available at* http://thomas.loc.gov/cgi-bin/query/z?c111:H.R.3646: (charging the FCC to "to establish a broadband lifeline program that enables qualifying low-income customers residing in urban and rural areas to purchase broadband service at reduced charges by reimbursing providers for each such customer served.").

[88] *See* John Horrigan, *Online Shopping,* at p. 8, Pew Internet & American Life Project (February 2008), *available at* http://www.pewinternet.org/~/media//Files/Reports/2008/PIP_Online%20Shopping.pdf.pdf ("*Online Shopping*").

[89] *Id* at p. 10.

[90] *See OATS "Family Link" Program,* Older Adults Technology Services (Jan. 2008).

[91] *See* S.L. Gatto & S.H. Tak, *Computer, Internet, and e-mail use among older adults: Benefits and barriers.* Educational Gerontology: An International Journal, *34(4),* 800-811 (2008) ("*Computer, Internet, and E-mail Use Among Older Adults*").

[92] *Id.*

[93] *Id.*

[94] *See* Sharon O'Brien, *Why Older Adults are More Vulnerable to Scams*, About.com, *available at* http://seniorliving.about.com/od/manageyourmoney/a/scamsolderadult.htm.

[95] *Id.*

[96] *See Internet Safety: Understanding the Risks*, Web Wise Washington, Washington State Office of the Attorney General, *available at* http://www.atg.wa.gov/InternetSafety.aspx.

[97] *Id.*

[98] AARP has teamed up with Google to help keep users safe online. *See* AARP, Online Safety, http://www.aarp.org/money/consumer/online_safety/.

[99] *See In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996*, Fifth Report, GN Docket No. 07-45, para. 36 (rel. June 12, 2008) (finding that broadband deployment has been "reasonable and timely").

[100] *See* David P. McLure, *Deployment of Broadband to Rural America,* at p. 15, USIIA Report (rel. Mar. 4, 2008), *available at* http://www.usiia.org/pubs/Rural.pdf ("*Rural Broadband Deployment*").

[101] *See* Comments of Peter Stenberg, Ph.D., Senior Economist, Economic Research Service, U.S. Department of Agriculture, FCC Workshop #7a- Building the Fact Base, August 19, 2009, at Transcript p.10, a*vailable at* http://www.broadband.gov/ws_adoption_fixed.html.

[102] *Id.*

[103] *See Rural Population and Migration: Trend 6 – Challenges From an Aging Population*, USDA Economic Research Service, Briefing, *available at* http://www.ers.usda.gov/Briefing/Population/Challenges.htm.

[104] *Id.*

[105] *Statistical Profile* at p. 5.

[106] *Id.*

[107] *Id.*

[108] *Fox FCC Comments* at Transcript p. 92.

[109] *See* Comments of Karen Archer Perry, Director of the Connected Communities Team, Knight Center of Digital Excellence, FCC Workshop #7a – Adoption/Utilization - Building the Fact Base, Transcript p.32 (Aug. 19, 2009), a*vailable at* http://www.broadband.gov/ws_adoption_fixed.html.

[110] *Home Broadband Adoption 2009* at p. 38.

[111] *Fox FCC Comments* at Transcript p. 92.

[112] *See* AARP Policy Book, Ch. 10, Utilities: Telecommunications, Energy and Other Services, at p. 10-40, *available at* http://assets.aarp.org/www.aarp.org_/articles/legpolicy/10_utili07.pdf ("*AARP Policy Book*").

[113] *Older Workers 2009* at p. 3-4.

[114] *AARP Policy Book*.

[115] *See* Report of the Taskforce on the Aging of the American Workforce (Feb. 2008), at p. 9, *available at* http://www.doleta.gov/reports/FINAL_Taskforce_Report_2-11-08.pdf ("*Aging Taskforce*").

[116] *AARP Policy Book.*

[117] *Aging Taskforce* at p. 3.

[118] *See* ROB SALKOWITZ, GENERATION BLEND: MANAGING ACROSS THE TECHNOLOGY AGE GAP 67 (Wiley 2008) (noting that "Workers in their sixties and seventies not only have the potential to remain productive, thanks to increasing life spans and health improvements, but are also the custodians of irreplaceable knowledge, relationships, and cultural lore.") ("GENERATION BLEND").

[119] According to the Medicare website: "Medicare eligibility is not based on income or resource levels. Your Medicare eligibility will not be affected by how much income you earn after retirement. However, your Medicare Part B monthly premiums [covering medical insurance] will be higher if you file an individual tax return and your annual income is more than $85,000, or if you are married (file a joint tax return) and your annual income is more than $170,000." *See* Medicare.gov, FAQ: "I am retired and on Medicare. If I go back to work, will my earnings affect my Medicare eligibility? Is there a ceiling on how much I can earn and still keep Medicare?", http://tiny.cc/WU7l8.

[120] *See* Toddi Gutner, *Pitfalls of Working Past Retirement Age,* April 29, 2008, Wall St. J., *available at* http://www.huntalternatives.org/download/1137_04_29_08_pitfalls_of_working_past_retirement_age.pdf.

[121] The U.S. Social Security Administration (SSA) provides a full explanation. *See* SSA.gov, How Work Affects Your Benefits, http://www.ssa.gov/pubs/10069.html.

[122] *See Perceived Benefits and Barriers of Computer, Internet, and E-mail Use by Older Adults*, Arkansas Geriatric Education Center, AGEC VISION, vol. 9, no. 2, *available at* http://www.agec.org/news/news_app.asp?id=178.

[123] *See, e.g.*, GENERATION BLEND at p. 67 (noting that many members of the "Silent generation" [i.e., those born between 1925 and 1945] are "the most likely generation to have avoided digital technology in their work and lives. Even the youngest were well into their careers when general-purpose computers appeared in the workplace, ad older still when they became affordable as consumer devices. Many Silents express an initial fear or reluctance to experiment with technology.").

[124] *Fox FCC Comments* at Transcript p. 78-79.

[125] *Computer, Internet, and E-mail Use Among Older Adults.*

[126] *Id.*

[127] *Id.*

[128] *See* Joy Goodman et al., *Older Adult's Use of Computers: A Survey,* Department of Computing Science, University of Glasgow (2003), *available at* http://www.dcs.gla.ac.uk/~joy/research/2003_bcs_hci/paper.pdf.

[129] Interview with Bob Lunaburg, retired IBM employee and Lead Volunteer Computer Instructor, Computers4Seniors, Marietta, GA, Sept. 15, 2009 (conducted by ACLP staff).

[130] *See generally Broadband & Seniors.*

[131] *Id.* at p. 31-32.

[132] *Id.* at p. 34.

[133] *See* Press Release*, Americans with Disabilities: July 26¸* May29, 2007, U.S. Census Bureau, *available at* http://www.census.gov/Press-Release/www/releases/archives/facts_for_features_special_editions/010102.html.

[134] *See* Matthew Brault, *Disability Status and the Characteristics of People in Group Quarters: A Brief Analysis of Disability Prevalence Among the Civilian Noninstitutionalized and Total Populations in the American Community Survey*, U.S. Census Bureau, American Community Survey, 2006 Data (Feb. 2008), *available at* http://www.census.gov/hhes/www/disability/GQdisability.pdf ("*Census ACS 2008*").

[135] *Id.*

[136] *See 2007 Disability Status Report – United States*, at p. 16, Rehabilitation Research and Training Center on Disability Demographics and Statistics, Cornell University, *available at* http://www.ilr.cornell.edu/edi/disabilitystatistics/StatusReports/2007-PDF/2007-StatusReport_US.pdf?CFID=7676403&CFTOKEN=73912389&jsessionid=f030ad698d2ccb1a9bcc34517277762361b1 ("*2007 Disability Status Report*").

[137] According to the ACS, a physical disability is defined as condition that substantially limits one or more basic physical activities such as walking, climbing stairs, reaching, lifting, or carrying." *Id.* at p. 44.

[138] According to the ACS, a sensory disability is defined as someone who experiences "blindness, deafness, or a severe vision or hearing impairment." *Id.*

[139] *Id.* at p. 7.

[140] *See* National Spinal Cord Injury Statistical Center, University of Alabama, Facts and Figures at a Glance (April 2009), http://images.main.uab.edu/spinalcord/pdffiles/FactsApr09.pdf ("*Spinal Cord Stats*").

[141] *See* National Center for Health Statistics, Disabilities/Limitations, http://www.cdc.gov/nchs/FASTATS/disable.htm.

[142] *Id.*

[143] *See Special Report on Aging and Vision Loss*, American Foundation for the Blind, September 2008, *available at* http://www.afb.org/Section.asp?SectionID=15&DocumentID=4423 ("AFB uses the term "vision loss", which is the equivalent of the term "vision trouble" on the 2006 National Health Interview Survey. Investigators should also note that, as mentioned, the 2006 NHIS estimates pertain to the non-institutionalized civilian population."); *see also* National Center for Health Statistics, National Health Interview Survey 2006, www.cdc.gov/nchs/nhis.htm.

[144] *See Health Status and Routine Physical Activities in Adults by Hearing Status*, Center of Disease Control, *available at* http://www.cdc.gov/Features/dsHearing-Disparities/, *citing* Pleis JR, Lethbridge-Cejku M. Summary health statistics for U.S. adults: National Health Interview Survey, 2006; National Center for Health Statistics. Vital Health Stat 10(235), 2007; and Pleis JR, Benson V, Schiller JS. Summary health statistics for U.S. adults: National Health Interview Survey, 2000. National Center for Health Statistics. Vital Health Stat 10(215), 2003.

[145] The Coleman Institute for Cognitive Disabilities at the University of Colorado defines a cognitive disability as "a substantial limitation in one's capacity to think, including conceptualizing, planning, and sequencing thoughts and actions, remembering, interpreting subtle social clues, and understanding numbers and symbols. Cognitive disabilities include intellectual disabilities and can also stem from brain injury, Alzheimer's disease and other dementias, severe and persistent mental illness, and, in some cases, stroke." *See* David Braddock et al., *Emerging Technologies and Cognitive Disabilities*, at p. 1, J. Special Education Tech., Vol. 19, No. 4 (Fall 2004), *available at* http://www.colemaninstitute.org/article_braddock_1.pdf ("*Emerging Technologies & Cognitive Disabilities*").

[146] *Id.*

[147] Percentages are derived from using 2004 U.S. Census Bureau Data. *See* National Institute of Mental Health Website, *available at* http://www.nimh.nih.gov/health/statistics/index.shtml.

[148] *See* Alzheimer's Association, Facts & Figures, http://www.alz.org/alzheimers_disease_facts_figures.asp.

[149] *See* Cerebral Palsy Facts, Statistics, http://www.cerebralpalsyfacts.com/stats.htm.

[150] Community Partnerships for Adult Learning, *How Serious *are* Learning Disabilities? – How bad can it be?* Basics of Adult Literacy Eduction Module, *available at* http://www.c-pal.net/course/module1/pdf/LDstats.pdf (*citing* statistics from the National Institute for Literacy, http://www.nifl.gov/).

[151] National Information Center for Children and Youth with Disabilities, *available at* http://www.nichcy.org/pubs/factshe/fs7txt.htm, *citing* 23rd Annual Report to Congress, Department of Education (2001).

[152] *See Criteria for Determining Disability in Speech-Language Disorders*, Agency for Healthcare Research and Quality (AHRQ) Summary, Evidence Report/Technology Assessment, No. 52, AHRQ Publication No. 02-E009 (Jan. 2002), *available at* http://www.ahrq.gov/clinic/epcsums/spdissum.htm.

[153] *See* Autism Society of America, About Autism, http://www.autism-society.org/site/PageServer?pagename=about_home.

[154] *In the Matter of a National Broadband Plan for Our Future, Notice of Inquiry*, FCC GN Docket No. 09-51, para. 5.

[155] *See Consumer Insights to America's Broadband Challenge*, at p. 5, Connected Nation, *available at* www.nga.org/Files/pdf/0812broadbandchallenge.pdf ("*Consumer Insights*").

[156] *See* Susannah Fox, *E-patients with a Disability or Chronic Illness*, at p. 2, Pew Internet & American Life Project (Oct. 2007), *available at* http://pewresearch.org/pubs/608/e-patients ("*E-patients 2007*").

[157] A 2000 study found that only 24 percent of people with disabilities had a computer at home, compared to nearly 52 percent for people without a disability. *See* H. Stephen Kaye, *Computer and Internet Use Among People with Disabilities*, at p. 5, National Institute on Disability and Rehabilitation Research, U.S. Department of Education (Mar. 2000), *available at* http://dsc.ucsf.edu/pdf/report13.pdf. By 2006, the number of people with disabilities who had a home computer had risen substantially, to nearly 40 percent, but this number was still lower than people without disabilities. *The Disability Divide* at p. 322. By 2008, slightly more than half of people with disabilities – 51 percent – reported having a computer at home. *Consumer Insights* at p. 5.

[158] *See generally* Kerry Dobransky & Eszter Hargittai, *The Disability Divide in Internet Access and Use*, at p. 325, Information, Communication & Society, Vol. 9, No. 3, pp. 313-334 (June 2006) ("*The Disability Divide*").

[159] *E-patients 2007* at p. 3 (finding that 89 percent of people with disabilities and chronic diseases send and receive email) ("*E-Patients*"); *see also The Disability Divide* at p. 328 (observing that in 2006 nearly 84 percent of people with disabilities used email or instant messaging services).

[160] *E-Patients* at p. 3 (observing that nearly 40 percent of people with disabilities and chronic diseases use their Internet connection to send instant messages).

[161] *See, e.g.,* American Association of People with Disabilities, Summary Fact Sheet: High Speed Internet and People with Disabilities, www.aapd.com/TTPI/AAPD_CWA_High_Speed_Internet_Access_WORD.doc ("*High Speed Fact Sheet*").

[162] *The Disability Divide*, at p. 315.

[163] *2007 Disability Status Report*

[164] *See* Carol Wilson, *Telecommuting Interest Soars*, Aug. 28, 2008, Telephony Online, *available* at http://telephonyonline.com/access/news/telecommuting-increases-0828/.

[165] *See* U.S. Dept. of Labor, Office of Disability Employment Policy, Small Business and Self Employment for People with Disabilities, http://www.dol.gov/odep/programs/promotin.htm.

[166] *See* Michael J. Copps, *Bringing Broadband to Rural America: Report on a Rural Broadband Strategy*, at para. 19, FCC (rel. May 22, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291012A1.pdf ("*Rural Broadband Strategy*").

[167] *See* Diana Spas, *Update on the Demography of Rural Disability, Part One: Rural and Urban*, April 2005, Research and Training Center on Disability in Rural Communities, The University of Montana Rural Institute, *available at* http://rtc.ruralinstitute.umt.edu/RuDis/RuDemography.htm.

[168] *See Briefing, Rural Population and Migration: Trend 6 – Challenges From an Aging Population,* USDA Economic Research Service, *available at* http://www.ers.usda.gov/Briefing/Population/Challenges.htm.

[169] *See, e.g., NTCA 2008 Broadband/Internet Availability Survey Report*, National Telecommunications Cooperative Association, *available at* http://www.ntca.org/images/stories/Documents/Advocacy/SurveyReports/2008ntcabroadbandsurveyreport.pdf (observing that 91 percent of customers in its 2008 Survey area had access to broadband.)

[170] *Home Broadband Adoption 2009* at p. 16-17.

[171] *See* Jenifer Simpson, *Factors Promoting Broadband Use by People with* Disabilities, at p. 1, Telecommunications and Technology Policy, American Association of People with Disabilities (2008), *available at* www.aapd.com/TTPI/Broadband_Policies_and__PWDs_by_Jenifer_Simpson.pdf.

[172] *See*, e.g., *Broadband in America: Access, Use and Outlooks,* Consumer Electronics Association, at p. 6, July 2007, available at http://www.ce.org/PDF/CEA_Broadband_America.pdf (finding that half of the U.S. households without broadband lack a computer. The other half has not adopted broadband for a wide variety of reasons.).

[173] *See* H. Stephen Kaye, *Computer and Internet Use Among People with Disabilities*, at p. 5, National Institute on Disability and Rehabilitation Research, U.S. Department of Education (Mar. 2000), *available at* http://dsc.ucsf.edu/pdf/report13.pdf ("*Computer & Internet Use – 2000*").

[174] *The Disability Divide* p. 322.

[175] *Consumer Insights* at p. 5.

[176] A 2007 study found that working-age people with disabilities earned approximately $6,500 less per year than people without disabilities. *2007 Disability Status Report.*

[177] *See ComReg Trends Survey 2007*, at p. 28, Amarach Consulting (Oct. 2007), *available at* http://www.comreg.ie/_fileupload/publications/ComReg0778.pdf.

[178] *The Disability Divide* at p. 321.

[179] *See* Jenifer Simpson*, Comments of the Coalition of Organizations for Accessible Technology*, *In the Matter of A National Broadband Plan for Our Future*, GN Docket No. 09-51, COAT &American Association of People with Disabilities, June 8, 2009, at p. 8-9 ("*National Broadband Plan*").

[180] *Id*.

[181] *Id*.

[182] *See Notice of Funds Availability,* at p. 33113, Federal Register, Vol. 74, No. 130 (July 9, 2009), *available at* http://www.ntia.doc.gov/frnotices/2009/FR_BBNOFA_090709.pdf.

[183] *See, e.g*., Washington Secretary of State, Broadband Stimulus Funding: Public Computing Centers, http://wiki.secstate.wa.gov/broadband/%28S%28jhf31mr1pj3kwi45u4hxmj55%29%29/PCC.ashx.

[184] *See Letter from Jill Nishi, Deputy Director – U.S. Libraries, Bill & Melinda Gates Foundation, to Marlene Dortch, Secretary*, FCC, GN Docket No. 09-51 (submitted Oct. 5, 2009), http://fjallfoss.fcc.gov/prod/ecfs/retrieve.cgi?native_or_pdf=pdf&id_document=7020040706 (estimating 17,000 public libraries currently open in the United States).

[185] *See* John Horrigan, *Obama's Online Opportunity II: If You Build It, Will They Log On?,* p. 2, Pew Internet & American Life Project (Jan. 2009), *available at* http://www.pewinternet.org/pdfs/PIP_Broadband%20Barriers.pdf ("*If You Build It*").

[186] *The Disability Divide* at p. 317.

[187] *See, e.g., The Economic Impact of Stimulating Broadband Nationally*, at p. 16, A Report from Connected Nation (rel. Feb. 21, 2008), *available at* http://connectednation.com/_documents/Connected_Nation_EIS_Study_Full_Report_02212008.pdf; *See also Broadband & Seniors* at p. 10-11 (discussing a unique program for spurring demand for and use of computers and broadband among senior citizens).

[188] *Fox FCC Comments* at Transcript p. 92.

[189] *See* Susannah Fox, *Digital Divisions*, at p. 3, Pew Internet & American Life Project (October 5, 2005), *available at*

http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Society_and_the_Internet/PIP_Digital_Divisions_1005.pdf.

190 In February 2009, the unemployment rate of people with disabilities reached 14%, compared to just 8.7% for people without disabilities. *See* Bureau of Labor Statistics (March 6, 2009), *available at* http://www.bls.gov/cps/cpsdisability.htm.

191 *E-Patients 2007* at p. 3.

192 *Home Broadband 2009* at p. 14.

193 *The Disability Divide* at p. 325.

194 *See*, e.g., Jack Gillum, *A Third of Adults Without Internet Don't Want It*, Feb. 3, 2009, *available at* http://www.usatoday.com/printedition/life/20090203/internetusage03_st.art.htm (noting that "A report last month by the Pew Internet & American Life Project finds that although price is a barrier for dial-up users in switching to broadband, one-third of those without a Net connection simply aren't interested in e-mailing or exploring the Web.")

195 *Home Broadband 2009* at p. 41.

196 *Id.*

197 *National Broadband Plan* at p. 8.

198 *See The Need for Federal Legislation and Regulation Prohibiting Telecommunications and Information Services Discrimination*, National Council on Disability (2006) at p. 33-34, *available at* http://www.ncd.gov/newsroom/publications/2006/pdf/discrimination.pdf ("*Telecommunication and Information Services*").

199 *Id.*

200 *Id.*

201 *See, e.g.,* D. D'Amour, *Technology upgrade boosts access for blind Canadians*, at. p. 23, Reading Today, vol. 21, no. 5 (2004).

202 The World Wide Web Consortium released updated accessibility guidelines for Web 2.0 in December 2008. These guidelines articulate "a wide range of recommendations for making Web content more accessible. Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these." *See* W3C, Web Content Accessibility Guidelines 2.0, http://www.w3.org/TR/WCAG20/#guidelines.

203 *See New Captions Feature for Videos*, Aug. 28, 2008, YouTube Blog, *available at* http://www.youtube.com/blog?entry=mi8D3ntPgFQ.

204 *See* Hulu, Programming Info, http://www.hulu.com/support/content_faq.

205 *See How people with disabilities use the Web*, in W3C Working Draft, World Wide Web Consortium, (10 December 2004), *available at http://www.w3.org/WAI/EO/Drafts/PWD-Use-Web/20041210#tools*.

206 *See*, e.g., Beth A. Loy, *Deciphering Access for People with Disabilities*, Oct. 1, 2001, Digital Divide Network, *available at* http://www.digitaldivide.net/articles/view.php?ArticleID=204.

207 *See generally* Frank G. Bowe, *Broadband and Americans with Disabilities*, Report of the National Association of the Deaf and the New Millennium Research Council (2002) at p. 20, *available at* http://www.newmillenniumresearch.org/archive/disability.pdf ("*Broadband & Disabilities - 2002*")

208 *Home Broadband Adoption 2009* at p. 29.

[209] *Id*. at p. 14.

[210] *Disability Status* at p. 30.

[211] *Id*. at p. 34.

[212] *See* Erik Eckholm, *Last Year's Poverty Rate Was Highest in 12 Years*, Sept. 11, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/09/11/us/11poverty.html.

[213] *See* Bureau of Labor Statistics (August-September 2009), *available at* http://www.bls.gov/cps/cpsdisability.htm.

[214] *National Broadband Plan* at p. 7-8.

[215] *See*, e.g., Web Accessibility in Mind (WebAIM), Assistive Technologies for Motor Disabilities, http://www.webaim.org/articles/motor/assistive.php; WebAIM, Introduction to Web Accessibility, http://www.webaim.org/intro.

[216] *National Broadband Plan* at p. 7-8.

[217] *Id*.

[218] *Id*.

[219] *See Comments of Jim Fruchterman, CEO, Benetech*, FCC Workshop 8 – Broadband Opportunities for People with Disabilities, at transcript p. 63 (Aug. 20, 2009), *available at* http://www.broadband.gov/ws_disability.html ("When you get people developing closed systems that don't interoperate, that don't allow assistive technology vendors to make something accessible, that's when people with disabilities are most left out, most let down, most locked out of the opportunities that the technology builds in.").

[220] *See* Comments of Mary Brooner, Chairperson, Accessibility Working Group, Telecommunications Industry Association, during FCC Workshop 8 – *Broadband Opportunities for People with Disabilities*, Transcript p. 38, August 20, 2009, *available at* http://www.broadband.gov/ws_disability.html.

[221] *Id*.

[222] *Telecommunication and Information Services* at p. 26-31.

[223] *Id*.

[224] *Id*.

[225] *Id*.

[226] Public Law 100-394, codified at 47 U.S.C. 610.

[227] *See* FCC, Hearing Aid Compatibility for Wireless Telephones: FAQs, http://www.fcc.gov/cgb/consumerfacts/hac_wireless.html.

[228] *Id*.

[229] *See, e.g.,* Larry Brethower, *Cell Phone and Hearing Aid Compatibility, 2008*, Sept. 3, 2008, The Hearing Review, *available at* http://www.hearingreview.com/issues/articles/2008-09_03.asp (observing that "the industry has quickly achieved and surpassed the [FCC's] standards. It currently offers more than 90 models of phones with an acceptable M-3 emissions rating.").

[230] *See* TEITAC*, Report to the Access Board: Refreshed Accessibility Standards and Guidelines in Telecommunications and Electronic and Information Technology* (April 2008), *available at* http://www.access-board.gov/sec508/refresh/report ("*TEITAC Report - 2008*").

[231] *See* Microsoft, Accessibility: Mission, Strategy & Progress, http://www.microsoft.com/enable/microsoft/mission.aspx.

[232] *Emerging Technologies & Cognitive Disabilities* at p. 4.

[233] For example, nearly 20 years ago Verizon became the first telecommunication company to "embrace a set of Universal Design Principles," which are now "part of [its] product design process." *See* Verizon, Universal Design Principles, http://responsibility.verizon.com/home/information/design-principles. In the wireless realm, universal design principles are also increasingly prevalent. AT&T, in 2008, released its Universal Design methodology "in an effort to encourage application developers and handset manufacturers to consider the needs of seniors and customers with disabilities when creating new mobile products and services." *See AT&T Opens Universal Design Methods to Developers,* Mar. 18, 2008, Fierce Developer, *available at* http://www.fiercedeveloper.com/story/att-opens-universal-design-methods-to-developers/2008-03-18.

[234] *See* John Horrigan et al., *The Ever-Shifting Internet Population: A New Look at Internet Access & the Digital Divide*, at p. 31, Pew Internet & American Life Project (April 2003), *available at* www.pewinternet.org/pdfs/PIP_Shifting_Net_Pop_Report.pdf.

[235] *E-Patients 2007* at p. 9.

[236] A study conducted in 2001 found that most adults with disabilities had little to no knowledge about assistive technologies. *See Assistive Technology Survey Results: Continued Benefits and Needs Reported by the Americans with Disabilities, available at* http://www.ed.gov/offices/OSERS/NIDRR/. In 2007 a survey found that many individuals with disabilities experience difficulty while getting information about the equipment and services available or contacting customer service representatives for assistance, which may be a significant factor in their low adoption rate of advanced technologies. *See New booklet on choosing phone and broadband for people with disabilities,* NCBI, October 27, 2007, *available at* http://www.ncbi.ie/news/press-releases/2007-10-26_new-booklet-on-choosing-phone-and-broadband-for-people-with-disabilities.

[237] *See Assistive Technology*, United Cerebral Palsy of Central Pennsylvania (2009), *available at* http://www.ucp.org/ucp_localsub.cfm/132/9397/9409.

[238] *See School Leaders: Lack of Teacher Training Holds Back Special Ed Computer Use*, Jan. 15, 2000, SpecialEdNews.com, *available at* http://www.specialednews.com/technology/technews/NCEScomputeruse011500.html.

[239] *See* Maria Aliza et al, *Increasing Accessibility of PAComputing for Patrons with Disabilities*, August 19, 2005, The Bill and Melinda Gates Foundation, Washington Assistive Technology Alliance, *available at* http://www.webjunction.org/computer-accessiblity/-/articles/content/432184 ("*PAComputing*").

[240] *Id.*

[241] *Rural Broadband Strategy* at p. 13.

[242] *See Ruralfacts, Rates of Computer and Internet Use: A Comparison of Urban and Rural Access by People with Disabilities*, University of Montana, RTC Rural Institute (Aug. 2006), *available at* http://rtc.ruralinstitute.umt.edu/TelCom/computer.htm ("*Ruralfacts*").

[243] *Disability Divide* at p. 318.

[244] *Id.*

[245] *Home Broadband Adoption 2009*.

[246] *PAComputing.*

[247] *See News Release, National Council on Disability Calls for Federal Legislation to Prohibit Telecommunications Discrimination for People with Disabilities*, December 29, 2006, *available at* http://www.ncd.gov/newsroom/news/2006/r06-529.htm.

[248] *See* Ashlee Vance, *Insurers Fight Speech-Impairment Remedy,* Sept. 15, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/09/15/technology/15speech.html?_r=1.

[249] *Id.*

[250] *Id.*

[251] For example, Representative Edward Markey introduced a sweeping new law in 2008 that sought to modernize a number of telecommunications laws. However, that law did not pass and was recently re-introduced. *See H.R. 3101 – The 21st Century Communications and Video Accessibility Act*, introduced June 26, 2009, *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-3101.

[252] *TEITAC Report – 2008*.

[255] *See* Issue Paper, *Telemedicine, Telehealth, and Health Information Technology*, at p. 3, American Telemedicine Association (May 2006), *available at* http://www.americantelemed.org/files/public/policy/HIT_Paper.pdf ("*ATA HIT Paper*").

[256] *Id.* Examples include videoconferencing, transmission of images, and remote monitoring of a patient's vital signs.

[257] *See Telemedicine for the Medicare Population: Update*, Agency for Healthcare Research & Quality, U.S. Dept. of Health & Human Services, No. 131 (Feb. 2006), *available at* http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=hstat1b.section.28721 ("In store-and-forward telemedicine, clinical data are collected, stored, and then forwarded to be interpreted later. A store-and-forward system eliminates the need for the patient and the clinician to be available at either the same time or place.").

[258] Mobile monitoring includes the "extension of monitoring even outside the home." *See FCC Broadband Taskforce Presentation,* at Slide 98, Sept. 29, 2009, Federal Communications Commission, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293742A1.pdf ("*FCC Broadband Taskforce Presentation - Sept. 29, 2009*").

[259] *See generally Broadband & Telemedicine*.

[260] For example, the number of pediatricians in rural parts of the United States remains low relative to the percentage of the population that lives in these areas. A 2001 study found that only 8 percent of pediatricians are located in rural parts of the country. *See* Greg Randolph, et al., *Trends in the Rural-Urban Distribution of General Pediatricians*, Pediatrics, Vol. 107, No. 2 (2001), *available at* http://pediatrics.aappublications.org/cgi/reprint/107/2/e18.pdf. More generally, a 2005 study found that only three percent of medical students expressed a desire to work in rural areas. *See* Myrle Crosdale, *Admissions Process Aims to Boost Rural Doctors*, Feb. 7, 2005, American Medical Association AmedNews.com, *available at* http://www.ama-assn.org/amednews/2005/02/07/prsb0207.htm. The Association of American Medical Colleges has also observed that a lack of primary care doctors in unserved and under-served areas is a major problem facing the United States, especially since rural residents have a "higher incidence of illness and disability." *See The Complexities of Physician Supply and Demand: Projections Through 2025*, p. 41-41, Association of American Medical Colleges (Nov. 2008), *available at* www.tht.org/education/resources/AAMC.pdf.

[261] According to the Agency for Healthcare Research and Quality's 2007 *National Healthcare Quality Report*: "The average annual rate of improvement reported across the core measures included in this year's fifth annual NHQR is 2.3%, based on data spanning 1994 to 2005. An analysis of selected core measures, which

cover data from 2000 to 2005, shows that quality has slowed to an annual rate of 1.5%," at p. iv. This report, released in February 2008, is *available at* http://www.ahrq.gov/qual/nhqr07/nhqr07.pdf.

[262] For example, it has been argued that the adoption of Computerized Physician Order Entry systems, which allow doctors to prescribe medicine electronically, can "substantially decrease the overuse, under use, and misuse of healthcare services." *See* Gilad J. Kuperman & Richard F. Gibson, *Computer Physician Order Entry: Benefits, Costs, and Issues*, at p. 31, Annals of Internal Medicine, Vol. 139, No.1 (2003), *available at* http://www.annals.org/cgi/reprint/139/1/31.pdf. Studies have also found that this type of technology enables cost-savings for patients by "allowing doctors to check, with a patient's consent, the relative cost of co-payments for generic, formulary, and non-formulary drugs in a patient's health plan." *See* Laura Landro, *Incentives to Push More Doctors to e-Prescribe*, Jan. 21, 2009, Wall St. J.

[263] The FCC's Rural Healthcare Pilot Program, for example, is designed to facilitate the creation of a nationwide broadband network dedicated to "healthcare, connecting public and private non-profit healthcare providers in rural and urban locations." Under this pilot project, "selected participants [are] eligible for universal service funding to support up to 85 percent of the costs associated with the construction of state or regional broadband healthcare networks and with the advanced telecommunications and information services provided over those networks." The goal of this program is to "bring the benefits of telehealth and telemedicine to areas where the need for these benefits is most acute; allow patients to access critically needed specialists in a variety of practices; and enhance the healthcare community's ability to provide a rapid and coordinated response in the event of a national healthcare crisis." Total funding for the program is approximately $417 million over three years. *See* FCC, Rural Healthcare Pilot Program, http://www.fcc.gov/cgb/rural/rhcp.html; *See In the Matter of Rural Healthcare Support Mechanism,* WC Docket No. 02-60 (rel. Nov. 19, 2007), at para. 2, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-279101A1.pdf.

[264] *See* Susannah Fox & Lee Rainie, *The Online Healthcare Revolution: How the Web Helps Americans Take Better Care of Themselves,* at p. 3, Pew Internet & American Life Project (Nov. 2000), *available at* http://www.pewinternet.org/pdfs/PIP_Health_Report.pdf.

[265] *See* Susannah Fox, *The Engaged e-Patient Population*, at p. 1, Pew Internet & American Life Project (Aug. 2008), *available at* http://www.pewinternet.org/pdfs/PIP_Health_Aug08.pdf.

[266] *See* Amy G. Rabalais, MD and Moises Arriaga, MD, *Patient Satisfaction with Telemedicine Neurotology Care*, at p. 88-89, Otalaryngology-Head and Neck Surgery, Vol. 141, No. 3S1, (Sept. 2009), *available at* http://download.journals.elsevierhealth.com/pdfs/journals/0194-5998/PIIS0194599809007219.pdf.

[267] IBM has observed that "as consumers become more directly accountable for their health and healthcare choices, they can also become wiser, more value-based purchasers, improve their health through better choices, and at the same, exert pressure to keep system costs in line." *See Healthcare 2015: Win-Win or Lose-Lose? A Portrait and a Path to Successful Transformation*, at p. 26, IBM Institute for Business Value (2006).

[268] *See Senior Citizens to See High Tech Sensors in Homes, on Bodies to Monitor Health*, Dec. 6, 2007, Senior Journal, *available at* http://www.seniorjournal.com/NEWS/Features/2007/7-12-06-SenCit2See.htm.

[269] *Id.*

[270] *See Continued Progress: Hospital Use of Health Information Technology,* at p. 1, American Hospital Association (2007), *available at* http://www.aha.org/aha/issues/HIT/resources.html ("*Continued Progress*").

[271] *See* Press Release, *Large Survey of Physicians Show Size and Setting Continue as Major Factors Influencing EHR Adoption Rates*, June 18, 2008, U.S. Dept. of Health & Human Services, *available at* http://www.hitadoption.org/index.php?module=News&id=cntnt01&cntnt01action=detail&cntnt01articleid=4&cntnt01returnid=30.

[272] In January 2009, "Medicare began paying physicians a bonus if they switched their patients over to e-prescribing. The bonus amounts to 2% of charges billed to Medicare for 2009 and 2010, 1% in 2011 and 2012 and 0.5% in 2013, the program's last year…Physicians who don't e-prescribe will have their Medicare reimbursements cut by 1% starting in 2012, rising to 1.5% in 2013 and by 2% in 2014 and beyond." This system has worked. According to recent data, "As of [October 2009], 143,000 - or one in four physicians and other prescribers who are office based - are e-prescribing, up from 74,000 in 2008. Through the end of August, 110 million of the more than 3.7 billion prescriptions dispensed annually by U.S. retail pharmacies were sent electronically." *See* Victoria E Knight, *Medicare Bonuses Motivate More Physicians to E-Prescribe*, Oct. 5, 2009, Dow Jones Newswire, *available at* http://online.wsj.com/article/BT-CO-20091005-700024.html (citing data from Surescripts, a private company that runs the network that routes prescriptions between physicians and pharmacies).

[273] *See* American Well, *How it Works*, http://www.americanwell.com/how_american_well_works.html.

[274] *Id.*

[275] *See* Bernie Monegain, *New research projects swelling telemedicine market*, Oct.8, 2009, HealthcareITNews.com, *available at* http://www.healthcareitnews.com/news/new-research-projects-swelling-telemedicine-market (citing a recent study by Pike & Fisher).

[276] *See National Study Reveals mHealth has Vast Appeal in America*, Oct. 8, 2009, CNBC Business Wire, *available at* http://www.cnbc.com/id/33227645 (citing a recent study by CTIA – The Wireless Association).

[277] *See* Sarah Jane Tribble, *Downloadable phone apps put a healthy lifestyle in the palm of your hand*, Oct. 5, 2009, The Cleveland Plain Dealer, *available at* http://www.cleveland.com/healthfit/index.ssf/2009/10/downloadable_phone_apps_put_a.html.

[278] *See* MIM Vista, Mobile MIM for the iPhone, http://www.mimvista.com/iphone.

[279] In 2007, healthcare costs represented 16 percent of U.S. GDP, or approximately $2.1 trillion, and are expected to rise to nearly 20 percent of GDP by 2017. *See* Dept. of Health & Human Services, Centers for Medicare & Medicaid Services, *National Health Expenditure Fact Sheet*, http://tiny.cc/OZJt6.

[280] *Vital Signs* at p. 2.

[281] *See* Marlis Meyer, Rita Kobb & Patricia Ryan, *Virtually Healthy: Chronic Disease Management in the Home*, at p. 1, *Disease Management* Vol. 5, No. 2 (June 2002), *available at* www1.va.gov/visn8/v8/clinical/cccs/articles/virtually.doc.

[282] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 100 (citing: Chumbler NE et al, *Mortality risk for diabetes patients in care coordination, home-telehealth program,* Journal of Telemedicine and Telecare 2009:15:98-01; Bates DW et al, *Veteran senate hearings,* http://veterans.senate.gov.)

[283] *See* Press Release, *Alzheimer's Disease to Quadruple Worldwide by 2050*, June 10, 2007, Johns Hopkins University Bloomberg School of Public Health, *available at* http://www.jhsph.edu/publichealthnews/press_releases/2007/brookmeyer_alzheimers_2050.html (announcing a study by Ron Brookmeyer et al. entitled *Forecasting the Global Burden of Alzheimer's Disease*).

[284] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 102 (citing: Chumbler NE et al, *Mortality risk for diabetes patients in care coordination, home-telehealth program,* Journal of Telemedicine and Telecare 2009:15:98-01; Bates DW et al, *Effect of computerized physician order entry and a team intervention on*

prevention of serious medical errors, JAMA 280(15): 1311-1316 October 21, 1998. Jencks SF, et al, *Rehospitalizations among Patients in the Medicare Fee-For-Service Program*, Health Affairs, New England J. of Medicine 2009, 360 1418-28).

285 *See* Mark Terry, *Three Modalities of Cardiovascular Telemedicine*, 14 J. Telemed. & e-Health 1031, 1032 (Dec. 2008).

286 *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 102.

287 *See* Alexander H. Vo, *The Telehealth Promise: Better Healthcare and Cost Savings for the 21st Century*, at p. 8, Univ. Texas Medical Branch, *available at* http://attcenter.utmb.edu/presentations/The%20Telehealth%20Promise-Better%20Health%20Care%20and%20Cost%20Savings%20for%20the%2021st%20Century.pdf

288 *See* Sharona Hoffman & Andy Podgurski, *Finding a Cure: The Case for Regulation and Oversight of Electronic Health Records Systems,* 22 Harv. J. L. & Tech. 104, 116 (2008) (citing Jan Walker et al., *The Value of Health Care Information Exchange and Interoperability*, 25 Health Affairs W5-10, W5-16 (2005)) ("*Finding a Cure*").

289 *See* Richard Hillestad et al., *Can Electronic Medical Record Systems Transform Healthcare? Potential Health Benefits, Savings, and Costs*, at p. 1103, Health Affairs, Vol. 24, No. 5 (2005). It is estimated, however, that implementing EHRs across the entire U.S. healthcare system could cost upwards of $100 billion. *See* David Goldman, *Obama's Healthcare Challenge*, Jan. 12, 2008, CNN MONEY, *available at* http://money.cnn.com/2009/01/12/technology/stimulus_health_care/index.htm.

290 *Great Expectations.*

291 *U.S. Population Projections: 2005-2050*.

292 *See* Majd Alwan, Devon Wiley & Jeffrey Noble, *State of Technology in Aging Services,* at p. 1, Center for Aging Services Technology (Nov. 2007), *available at* http://www.agingtech.org/documents/bscf_state_technoloy_phase1.pdf.

293 *See Innovation, Demand, and Investment in Telehealth*, at p. 70-71, Office of Tech. Policy, U.S. Dept. of Commerce (2004), *available at* https://www.ncsbn.org/2004Report.pdf.

294 *Broadband & Telemedicine* at p. 41.

295 *See* Kao-Ping Chua, *Overview of the U.S. Healthcare System*, at p. 3, American Medical Student Association (Feb. 2006), *available at* http://www.amsa.org/uhc/HealthCareSystemOverview.pdf.

296 *Broadband & Telemedicine* at p. 41.

297 *See* U.S. Dept. of HHS, Centers for Medicare & Medicaid Services, Data Compendium: 2008 Edition, Populations Table IV.1, http://www.cms.hhs.gov/DataCompendium/downloads/2008Populations.zip.

298 *See Medicare at a Glance,* Kaiser Family Foundation (April 2005), *available at* http://www.kff.org/medicare/upload/Medicare-at-a-Glance-Fact-Sheet.pdf.

299 *See* U.S. Dept. of HHS, Centers for Medicare & Medicaid Services, Data Compendium: 2008 Edition, Populations Table IV.8, http://www.cms.hhs.gov/DataCompendium/downloads/2008Populations.zip

300 *See Medicaid: A Primer,* at p. 17, Kaiser Family Foundation (Mar. 2007), *available at* http://www.kff.org/medicaid/upload/Medicaid-A-Primer-pdf.pdf.

301 *See* John Leland, *Helping Elderly Leave Nursing Homes for a Home*, Sept. 18, 2009, *available at* http://www.nytimes.com/2009/09/19/health/policy/19aging.html?_r=2&ref=todayspaper ("*Home Care for Elderly*").

302 *Id.*

[303] *Broadband & Telemedicine* at p. 41.

[304] *See, e.g., Medicare Payment of Telemedicine & Telehealth Services,* at p. 5-6, American Telemedicine Association (Dec. 2008), *available at* http://www.americantelemed.org/files/public/policy/Medicare_Payment_Of_Services.pdf ("*Medicare Payment*"). Additional information can be found in a Fact Sheet made available by the U.S. Department of HHS. *See Fact Sheet: Telehealth Services*, Centers for Medicare & Medicaid Services (July 2009), *available at* http://www.americantelemed.org/files/public/membergroups/TeleICU/TelehealthSrvcsFctSht.pdf.

[305] *See Medicare Pilot to Maintain PHRs,* Aug. 13, 2008, Federal Telemedicine News, *available at* http://telemedicinenews.blogspot.com/2008/08/medicare-pilot-to-maintain-phrs.html.

[306] *Id.*

[307] *Medicare Payment* at p. 1-4.

[308] *Id.* at p. 4-5.

[309] *Id.* at p. 2, 4.

[310] *Home Care for Elderly.*

[311] *Id.*

[312] *See Telemedicine Policy,* United Healthcare (2009), *available at* https://www.unitedhealthcareonline.com/b2c/cmaIndexResult.do?channelId=422fe7a1e193b010VgnVCM100000c520720a____&htmlFilePath=/ccmcontent/ProviderII/UHC/en-US/Assets/ProviderStaticFiles/ProviderStaticFilesHtml/ReimbursementPolicies/TELE_0046C_081709.htm.

[313] *Id.*

[314] *Id.*

[315] *Id.*

[316] American Well, for example, has begun partnering with insurance companies to provide healthcare services through an online marketplace, utilizing state-of-the-art technologies in Web communications and digital telephony. *See* American Well, About Us, http://www.americanwell.com/aboutus.html. This online service "allows credentialed healthcare providers to [be] available to consumers for online and phone consultations at their discretion, any time, from any location, as long as they choose." *See Press Release, American Well launches the Online Healthcare Marketplace,* American Well, AHIP Institute, June 18, 2008, *available at* http://www.americanwell.com/pressRelease_Launch.html. Blue Cross Blue Shield is among the first providers to participate, and will begin by providing online care to 10,000 of its employees and family members. *See Blue Cross and Blue Shield of Minnesota and American Well Join to Bring Online Care to Minnesota,* April 15, 2009, Medical News Today, *available at* http://www.medicalnewstoday.com/articles/146012.php. Members of the plan will provide co-pay to American Well, and insurers will pay a license fee per member to use the software, in addition to a $2 transaction fee per consult. *See* Claire Cain Miller, *The Doctor Will See You Now – Online*, Nov. 19, 2008, N.Y. Times Bits Blog, *available at* http://bits.blogs.nytimes.com/2008/11/19/the-doctor-will-see-you-now-online/?scp=58&sq=telemedicine&st=cse.

[317] *See* Robert Pear, *Privacy Issue Complicates Push to Link Medical Data*, Jan. 17, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/01/18/us/politics/18health.html?_r=2&ref=health (describing recent discussions regarding the need for more robust privacy safeguards in the use of EHRs and other electronic transmissions of medical data).

[318] *Broadband & Telemedicine* at p. 43.

[319] *See* Glenn W. Wachter, *HIPAA's Privacy Rule Summarized: What Does It Mean For Telemedicine?*, Feb. 23, 2001, Telemedicine Information Exchange, *available at* http://tie.telemed.org/articles/article.asp?path=legal&article=h ipaaSummary_gw_tie01.xml.

[320] *Id.*

[321] *See* Jonathan Bick, *Emerging Internet Telemedicine Issues*, N.J. Law J., December 24, 2007, *available at* http://www.bicklaw.com/Telemed.htm.

[322] *Id.*

[323] *Id.*

[324] *Id.*

[325] *See* Vaibhav Garg, *CERIAS Tech Report 2009-11, Security Concerns in Telecare and Telemedicine* at p.11, Center for Education and Research, Information Assurance and Security, Perdue University (2009), *available at* https://www.cerias.purdue.edu/assets/pdf/bibtex_archive/2009-11.pdf (*"CERIAS Report"*).

[326] Pew has found that "Spam continues to plague the Internet as more Americans than ever say they are getting more spam than in the past." However, users are increasingly adept at adopting tools to manage spam and similar applications. Indeed, Pew found that 71 percent of Internet users use spam filters on their emails accounts. *See* Deborah Fallows, *Data Memo: The Volume of Spam is Growing in Americans' Personal and Workplace Email Accounts, but Email Users are Less Bothered By It*, at p. 1, Pew Internet & American Life Project (May 2007) ("*Pew Spam Study*"). Recent data from MessageLabs estimates that approximately 151 billion unsolicited messages (i.e. spam) are sent across the web each day. *See MessageLabs Intelligence: Q3/September 2009*, at p. 1, MessageLabs, *available at* http://www.messagelabs.com/mlireport/MLI_2009.09_Sept_SHSFINAL_EN.pdf.

[327] *See* Kevin Poulsen, *Hackers Assault Epilepsy Patients via Computer,* March 28, 2008, Wired.com, *available at* http://www.wired.com/politics/security/news/2008/03/epilepsy.

[328] *Id.*

[329] *Id.*

[330] *See* Jordan Robertson, *Hackers attack epilepsy forum,* May 7, 2008, USA Today, *available at* http://www.usatoday.com/tech/news/computersecurity/2008-05-07-hackers-attack-epilepsy_N.htm ("In a similar attack this year [2008], a piece of malicious code was released that disabled software that reads text aloud from a computer screen for blind and visually impaired people. That attack appeared to have been designed to cripple the computers of people using illegal copies of the software, researchers said.").

[331] *Broadband & Telemedicine* at p. 45.

[332] *See* M. Savastano et al., *Identity-management factors in e-health and telemedicine applications*, 14 J. of Telemedicine and Telecare 386 (2008).

[333] *CERIAS Report* at p. 12.

[334] *See* Ellie Friedman, *Telemedicine 101: Is Your Telehealth Network Secure?* March/April 2003, Telemedicine Information Exchange, *available at* http://tie.telemed.org/articles/article.asp?path=articles&article=securenetwork_ef_tpr03.xml (originally printed in Telehealth Practice Report (2003), v8(1):4, p. 10-11) (*"Telemedicine 101").*

[335] Chris Ellis, '*7 Steps' for network security*, Communications News 40(2): 36-7 (Feb. 2003), *available at* http://findarticles.com/p/articles/mi_m0CMN/is_2_40/ai_97724647/.

[336] *Telemedicine 101.*

[337] *Id.*

[338] A recent incident at an Ohio hospital is instructive. A woman was coaxed by an ex-boyfriend into installing a Spyware program on a computer in the hospital where she worked. Over a 10-day period, the "spyware sent more than 1,000 screen captures to [the ex-boyfriend] via e-mail. They included details of medical procedures, diagnostic notes and other confidential information relating to 62 hospital patients. He was also able to obtain e-mail and financial records of four other hospital employees as well." *See* Robert McMillan, *Misdirected Spyware Infects Ohio Hospital*, Sept. 17, 2009, IDG News Service, *available at* http://www.csoonline.com/article/502517/Misdirected_Spyware_Infects_Ohio_Hospital?page=1%20%20IDG.

[339] *See Computer Crime and Security Survey* at p. 13-14, Computer Security Institute, Federal Bureau of Investigation (2005), *available at* http://www.cpppe.umd.edu/Bookstore/Documents/2005CSISurvey.pdf, ("*Security Survey*").

[340] *Telemedicine 101.*

[341] *CERIAS Report* at p. 16.

[342] *Security Survey* at p.18-19.

[343] *Id.*

[344] *CERIAS Report* at p. 15.

[345] *See* K. Z. Haigh & H. A.Yanco, *Automation as Caregiver: Survey of issues and Technologies*, Proceedings of the AAAI-02 Workshop: *Automation as caregiver*, at p. 7 (2002).

[346] *See* American Medical Association, Physician Education, Licensure, and Certification, http://www.ama-assn.org/aps/physcred.html#license.

[347] *See* Glenn W. Wachter, *Interstate Licensure of Telemedicine Practitioners*, March 10, 2000, Telemedicine Information Exchange (Mar. 2000), *available at* http://tie.telemed.org/articles/article.asp?path=telemed101&article=interstate Licensure_gw_tie00.xml ("*Interstate Licensure*").

[348] *Broadband & Telemedicine* at p. 46.

[349] *See Telemedicine Report to the Congress*, HHS, GPO No: 0126-E-04 (MF) (1997); *Telemedicine Report to Congress*, HHS, GPO No: 619-261/65410 (2001).

[350] *See, e.g., Telemedicine Licensure Report*, The Center for Telemedicine Law & The Office for the Advancement of Telehealth (June 2003), *available at* ftp://ftp.hrsa.gov/telehealth/licensure.pdf (citing two examples: In 2002, when the House Commerce Committee inserted language in the Safety Net Legislation that expressed the Congressional interest in collaboration among regulatory boards to facilitate elimination of barriers to telehealth practice. (Healthcare Safety Net Amendments of 2002, Pub. L. No. 107-251, 116 Stat. 1621). This legislation was ultimately signed by the President. Similar language was included in the Senate version of the prescription drug legislation pending on Capitol Hill. (See S. 1, 108th Cong., 1st Sess. § 450H, 2003).

[351] *Interstate Licensure*.

[352] *Broadband & Telemedicine* at p. 46-47.

[353] *See Physician Credentialing, Policy 21,* American College of Medical Quality (last updated Feb. 2004), *available at* http://www.acmq.org/policies/policy21.pdf ("*Physician Credentialing*").

[354] *Id.*

[355] *See* Center for Telehealth and E-Health Law, Credentialing & Accreditation, http://www.telehealthlawcenter.org/?c=125 (*"Credentialing & Accreditation"*).

[356] *Physician Credentialing.*

[357] *Credentialing & Accreditation.*

[358] *Id.*

[359] *See Credentialing: CTeL Assesses the Impact of CMS Conditions of Participation on Telehealth*, Center for Telehealth and E-Health Law, *available at* http://www.telehealthlawcenter.org/?c=125&a=1937.

[360] *See Credentialing,* Telemedicine Resource Center, University of Michigan Health System, *available at* http://www.med.umich.edu/telemedicine/partners/ext_credentialing.html.

[361] A physician would be credentialed by the distant facility in two ways: (1) the distant facility could credential the physician based on their own standards; or (2) the distant facility could accept the credentials of the treating physician based on the fact that the remote institution is JC-accredited. *Credentialing & Accreditation.*

[362] *See The Joint Commission and Telemedicine: The Final Word?,* May 13, 2009, HCPro, *available at* http://www.hcpro.com/ACC-232912-1000/The-Joint-Commission-and-Telemedicine-The-Final-Word.html.

[363] *Credentialing & Accreditation.*

[364] *Id.*

[365] *Id.*

[366] *See Healthcare Liability/Damages,* Friends of the U.S. Chamber of Commerce, *available at* http://www.friendsoftheuschamber.com/issues/index.cfm?ID=59.

[367] *See Key Issues in Analyzing Major Health Insurance Proposals*, at Ch. 7, n. 57, Congressional Budget Office (Dec. 2008), *available at* http://www.cbo.gov/ftpdocs/99xx/doc9924/12-18-KeyIssues.pdf.

[368] *See* Jeffery L. Rensberger, *Choice of Law, Medical Malpractice, and Telemedicine: The Present Diagnosis with a Prescription for the Future*, 55 U. Miami L. Rev. 31 (2000).

[369] *See Regulatory Jurisdiction,* at p. 4, Mar. 12, 2008, Action for Health, *available at* http://ir.lib.sfu.ca/bitstream/1892/4094/1/Regulatory%20Jurisdiction.pdf.

[370] *See* Patricia C. Kuszler, *Telemedicine and Integrated Healthcare Delivery: Compounding Malpractice Liability*, 25 Am. J.L. & Med. 297 (1999).

[371] *See* Jonathan Bick, *Emerging Internet Telemedicine Issues*, Dec. 24, 2007, N.J. Law J., *available at* http://www.bicklaw.com/Telemed.htm.

[372] *See, e.g.,* Dennis Thompson, *In Health Care Today, It's Electronic All the Way*, Oct. 3, 2009, HealthDay.com, *available at* http://www.healthday.com/Article.asp?AID=627398(reporting on a recent study of tele-stroke patients and quoting a lead author as saying that "I don't think the electronic interactions are going to completely replace the personal interaction, but they can augment them. You don't have to be standing in front of a physician to accomplish certain things, but that hands-on interaction needs to be there in many cases.").

[373] *See* Pamela Whitten, Ph.D. et. al, *St. Vincent's Home Telehealth for Congestive Heart Failure Patients,* at p. 151-152, J. Telemedicine and e-Health (March 2009).

[374] *Id.* at p. 151.

[375] *Id.*

[376] *See Philips National Study on the Future of Technology & Telehealth in Home Care,* at p. 32, National Association for Home Care & Hospice, Philips Home Healthcare Solutions, Fazzi Associates, Inc. (April 2008), *available at* http://www3.medical.philips.com/resources/hsg/docs/en-us/custom/PhilipsNationalStudyFullReport.pdf ("*Philips 2008*").

[377] *See In-Home Health Monitoring Market Faces Near- Term Uphill Struggle: Seniors and Baby Boomers Lukewarm to Service Concept, Frugal on Spending,* Parks Associates (January 24, 2006), *available at* http://www.download3k.com/Press-In-Home-Health-Monitoring-Market-Faces-Near-Term.html

[378] *Id.*

[379] *See* Carpenter, Mark, *Serving the Consumer: Older Adults & Technology.* An AARP Presentation at the ATA 7th Annual Industry Briefing (Dec. 2005).

[380] *See Overcoming the Psychological Barriers to Telemedicine: Empowering Older Americans to Use Remote Health Monitoring Services* at p. 12, New Millennium Research Council (Feb. 2007), *available at* http://www.newmillenniumresearch.org/archive/Telemedicine_Report_022607.pdf ("*Empowering Older Adults*").

[381] *See* Marsha King, *Elderly seek to grow old together, form new support groups; Circles of Caring catch on,* May 1, 2006, The Seattle Times, *available at* http://www.innovations.harvard.edu/news/12237.html.

[382] *Empowering Older Adults* at p. 13.

[383] *Id* at p. 14.

[384] *Id.* Results from a 2004 study are illustrative: "three participants stated that they could think of friends or relatives who would refuse to 'wear' a device, being afraid that it would stigmatize them as frail or needing special assistance." *See* George Demiris et al., *Older Adults' Attitudes Towards and Perceptions of 'Smart Home' Technologies: A Pilot Study* at p. 87-94, Medical Informatics and the Internet in Medicine 29.2 (2004), *available at* http://eldertech.missouri.edu/files/Papers/Demiris/Older%20adults%27%20attitudes%20towards%20and%20perceptions%20of%20smart%20hom.pdf. .

[385] *See, e.g., Old age in the technology age: New devices to monitor health and well-being at home a growing new sector. San Francisco Chronicle*, Aug. 8, 2005. http://www.sfgate.com/cgibin/article.cgi?f=/c/a/2005/08/08/BUG7PE2HL01.DTL.

[386] *Empowering Older Adults* at p. 13.

[387] *See Electronic Medical Records*, The American Consumer Institute (March 2008), *available at* http://www.theamericanconsumer.org/2008/03/07/electronic-medical-records-the-benefits-significantly-outweigh-the-costs/ ("*Electronic Medical Records*").

[388] *Finding a Cure* at p. 123.

[389] *See* Anne Zieger, *Despite Benefits, Telemedicine Barriers Remain High*, March 10, 2008, FierceHealthIT, *available at* http://www.fiercehealthit.com/story/despite-benefits-telemedicine-barriers-remain-high/2008-03-10.

[390] *See* David W. Bates, *Physicians and Ambulatory Electronic Health Records*, at p. 1182, Health Affairs, (September/October 2005), *available at* http://content.healthaffairs.org/cgi/reprint/24/5/1180 ("*Physicians & EHRs*").

[391] *See Press Release, HHS Fact Sheet – HIT Report At-A-Glance,* July 21, 2004, U.S. Department of Health & Human Services, HHS.gov, *available at* http://www.hhs.gov/news/press/2004pres/20040721.html ("*HHS Fact Sheet*").

[392] *Id.*

[393] *See Connecting the Enterprise,* at p. 24, CDW-G (Jan. 2009), *available at* http://webobjects.cdw.com/webobjects/media/pdf/newsroom/CDWG-Unified-Communications-Report-0109.pdf. "Unified communications" refers to "the convergence of communications and applications through the integration of products that facilitate the use of multiple enterprise communication methods, including equipment, software and services," at p. 4 (citing a Gartner study).

[394] *See* Samuel J. Wang et al., *A Cost-Benefit Analysis of Electronic Medical Records in Primary Care*, at p. 400, April 1, 2003, American Journal of Medicine, Vol. 114, *available at* http://www.brighamandwomens.org/gms/News/WangEMRCostBenefit.pdf.

[395] *Id*.

[396] *See Study: EHR System Efficiencies Can Cover the Cost of Adoption,* July 13, 2007, Wordpress.com, *available at* http://emradvice.wordpress.com/category/ehr/.

[397] *Electronic Medical Records*.

[398] *Id*.

[399] *See* Jan Walker et al*., The Value of Health Care Information Exchange and Interoperability*, Health Affairs, 19 January 2005, *available at* content.healthaffairs.org/cgi/content/abstract/hlthaff.w5.10.

[400] *See* Ram Misra, Shankar Srinivasan & Dinesh Mital, *Outsourcing of Healthcare Services: Issues and a Framework for Success,* 1 J. of Info. Tech. & Applications 79-88 (Sept. 2006).

[401] *See* Thomas R. McLean and Edward P. Richards, *Teleradiology: A Case Study of the Economic and Legal Considerations in International Trade in* Telemedicine, at p. 1381, Health Affairs (Sept./Oct. 2006) , *available at* http://content.healthaffairs.org/cgi/reprint/25/5/1378 ("*Teleradiology Case Study*").

[402] *Id.*

[403] *Id.* at p. 1382.

[404] *See* Jeff Marion, *Outsource your EHR to India*, Sept. 4, 2009, HealthcareITNews.com, *available at* http://www.healthcareitnews.com/blog/outsource-your-ehr-india.

[405] *See* Sanjiv N. Singh & Robert M. Wacther, *Perspectives on Medical Outsourcing and Telemedicine – Rough Edges in a Flat World?* at p. 1623, The New England J. of Med., Vol. 358 (April 2008).

[406] *Id.* at p. 1622.

[407] *Id.*

[408] *Teleradiology Case Study.*

[409] *Id.* at p. 1380.

[410] *See* Associated Press, *Some U.S. Hospitals Outsourcing Work,* Dec. 6, 2004, MSNBC, *available at* http://www.msnbc.msn.com/id/6621014/.

[411] *Teleradiology Case Study* at p. 1380.

[412] *Id.*

[413] *Id.* at p. 1379.

[414] For example, a 1997 GAO report estimated that "nine federal departments and independent agencies…invested at least $646 million in telemedicine projects from fiscal years 1994 to 1996." *See* Report to Congressional Requesters, *Telemedicine: Federal Strategy is Needed to Guide Investments,* at p. 3, U.S. General Accounting Office (Feb. 1997), *available at* http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=gao&docid=f:n397067.pdf.

[415] *Broadband & Telemedicine* at p. 20.

[416] *See* FCC, Rural Healthcare Pilot Program, http://www.fcc.gov/cgb/rural/rhcp.html.

[417] *See In the Matter of Rural Healthcare Support Mechanism,* WC Docket No. 02-60 (rel. Nov. 19, 2007), at para. 2, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-279101A1.pdf ("*FCC Rural Health Pilot Order*").

[418] *See, e.g.,* Alan Joch, *Broadband Flows to Rural Clinics,* June 9, 2008, GOV. HEALTH IT, *available at* http://www.govhealthit.com/print/4_18/features/350394-1.html.

[419] *See Comments of the American Telemedicine Association on the FCC Notice of Inquiry*, *In the Matter of a National Broadband Plan for Our Future,* GN Docket No. 09-51, at p. 5.

[420] *Physicians & EHRs* at p. 1182.

[421] *Broadband & Telemedicine* at p. 30.

[422] *See* Healthcare IT Standards Panel, About, http://hitsp.org/about_hitsp.aspx.

[423] This effort seeks to "provide a secure, nationwide, interoperable health information infrastructure that will connect providers, consumers, and others involved in supporting health and healthcare. *See* HHS, NHIN – Background, http://www.hhs.gov/healthit/healthnetwork/background/.

[424] NIST collaborates with the healthcare industry to promote the use of HIT. To this end, it was recently awarded $20 million under the American Recovery and Reinvestment Act of 2009 ("ARRA") to support its work in testing and analyzing standards for EHRs. *See* Joseph Conn, *Money to Boost EHR Initiatives Nationwide: Stimulus*, Feb. 23, 2009, ModernHealthcare.com, *available at* http://www.modernhealthcare.com/article/20090223/REG/302239983 ("*Money to Boost EHR*").

[425] CCHIT is a voluntary initiative that leverages its reputation as a leading certifier of EHRs to create incentives for doctors to adopt and use the efficient tools in order to bolster their quality of patient care and to protect against medical liabilities. *See CCHIT Certified Electronic Health Records Reduce Malpractice Risk*, White Paper of CCHIT (2007), *available at* http://www.cchit.org/files/wpCCHITPhysicianBusinessCaseforCertEHR.pdf.

[426] *See, e.g., Testimony of HITSP Program Director LeRoy Jones before the House Ways and Means Subcommittee on Health*, July 24, 2008, *available at* http://waysandmeans.house.gov/hearings.asp?formmode=view&id=7234.

[427] *See, e.g.,* Deborah D. McAdams, *Legislators Press for Spectrum Inventory*, Sept. 17, 2009, Television Broadcast, *available at* http://www.televisionbroadcast.com/article/87290 (quoting FCC Chairman Julius Genachowski as saying that "there is a demand crunch coming" for spectrum) ("*Spectrum Inventory*").

[428] *FCC Wireless Innovation NOI.*

[429] *Spectrum Inventory* (referring to comments made by FCC Commissioners during a House oversight hearing and to two separate spectrum inventory bills that were passed in the House and the Senate in 2009).

[430] *See* Mark Terry, *Text Messaging in Healthcare,* 14 J. Telemed. & e-Health 520, 521 (July/Aug. 2008).

[431] *See, e.g.,* Niraj Sheth & Yukari Iwatani Kane, *Smart-Phone Makers Call the Doctor*, Oct. 7, 2009, Wall St. J. (describing a pilot program at Stanford Hospital & Clinics in California to "test software that will let medical staff access patient charts on Apple's iPhone.").

[432] *See* Carol Wilson, *Hospitals Becoming Wireless Hotbeds*, Sept. 23, 2009, Telephony Online, *available at* http://telephonyonline.com/3g4g/news/hospitals-becoming-wireless-0923/.

[433] *Tomorrow's Wireless World,* at p. 12, OfCom (rel. May 7, 2008), *available at* http://www.ofcom.org.uk/research/technology/overview/randd0708/randd0708.pdf; *see also* Adam Sherwin, *New Wi-Fi Devices Warn Doctors of Heart Attacks,* May 7, 2008, THE TIMES, *available at* http://technology.timesonline.co.uk/tol/news/tech_and_web/article3883082.ece.

[434] *See* Heath Stover, *The Truth About EMR- Physician Resistance*, EzineArticles, *available at* http://ezinearticles.com/?id=878043 ("*Physician Resistance*").

[435] *Id.*

[436] *Id.*

[437] *See* CLAYTON M. CHRISTENSEN, JEROME H. GROSSMAN & JASON HWANG, THE INNOVATOR'S PERSCRIPTION: A DISRUPTIVE SOLUTION TO HEALTHCARE 135, (McGraw-Hill 2009).

[438] See Milt Freudenheim, *For Outsiders, Opening Doors to Health Care*, Aug. 20, 2009, N.Y. Times, http://www.nytimes.com/2009/08/20/education/20HEALTH.html.

[439] *Physicians & EHRs* at p. 1182.

[440] *Id.*

[441] *See* Chip Means, *Saving the healthcare industry: EMRs are the 'beginning, not the end',* July 1, 2009, Healthcare IT News, *available at* http://www.healthcareitnews.com/news/saving-healthcare-industry-emrs-are-beginning-not-end.

[442] *Physician Resistance*.

[443] *See National Transmission Grid Study* at p. 63, U.S. Department of Energy (May 2002), a*vailable at* http://www.pi.energy.gov/documents/TransmissionGrid.pdf.

[444]*See The Smart Grid: An Introduction*, at p. 7, Prepared for the U.S. Department of Energy by Litos Strategic Communication (2008), *available at* http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages.pdf ("*DOE Smart Grids*").

[445] *Id.* at p. 8.

[446] *Id.*

[447] *Id.*

[448] The U.S. Department of Energy has found that demand for electricity in the United States has exceeded transmission growth by almost 25% each year since 1982. DOE estimates that new and necessary electricity infrastructure to support great demand would require a $1.5 trillion investment. *Id.*

[449] *See* Amy Abel, *Smart Grid Provisions in H.R. 6, 100th Congress*, Dec. 20, 2007, CRS Report for Congress, *available at* http://assets.opencrs.com/rpts/RL34288_20071220.pdf ("*CRS Report*").

[450] *See* Steve Pullins, *Smart Grid: Enabling the 21st Century Economy*, Presentation at the Governor's Energy Summit West Virginia (Dec. 2008), *available at* http://www.netl.doe.gov/moderngrid/docs/SG-Enabling%20the%2021st%20Century%20Economy_Pullins_2008_12_02.pdf

[451] *DOE Smart Grids.*

[452] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at Slide 108 (citing: Normalized from *The iGridProject*, The Brattle Group, July 2009; *Smart 2020: Enabling the Low Carbon Economy in the Information Age*, United States Report Addendum, GESI and BCG, Nov. 2008; *Power Delivery System of the Future: A Preliminary Estimate of Costs and Benefits*, EPRI, July 2004; *The Green Grid: Energy Savings and Carbon Emissions Reduced Enabled by a Smart Grid, EPRI*, Jun. 2008).

[453] *See* Michael Kintner-Meyer, Kevin Scheider & Robert Pratt, *Impact Assessment of Plug-In Hybrid Vehicles on Electric Utilities and Regional U.S. Power Grids, Part 1: Technical Analysis*, Journal of EUEC (2007), *available at* http://www.euec.com/documents/pdf/Paper_4.pdf.

[454] *See, e.g., Wiser Wires,* Oct. 8, 2009, The Economist (observing that "More intelligence in the grid would also help integrate renewable sources of electricity, such as solar panels or wind turbines. As things stand, the trouble is that their output, being hostage to the weather, is highly variable. A standard grid becomes hard to manage if too many of them are connected to it; supply and demand on electricity-transmission systems must always be in balance. A smart grid could turn on appliances should, for instance, the wind blow more strongly.").

[455] *DOE Smart Grids* (citing a study by the European Wind Energy Association).

[456] *Id.*

[457] *See* Hannah Choi Granade et al., *Unlocking Energy Efficiency in the U.S. Economy*, at p. iii, McKinsey Global Energy and Materials, McKinsey & Co., *available at* http://www.mckinsey.com/clientservice/electricpowernaturalgas/downloads/US_energy_efficiency_full_report.pdf ("*McKinsey Energy Efficiency*").

[458] *Id.*

[459] *See* Bracken Hendricks, *Wired for Progress: Building a National Clean-Energy Smart Grid, Version 1.0*, at p. 31, Center for American Progress (Feb. 2009), *available at* http://www.americanprogress.org/issues/2009/02/pdf/electricity_grid.pdf ("*Wired for Progress*").

[460] *See, e.g., Primer on Demand-Side Management*, at p. 30-32, A Report to the World Bank (Feb. 2005), *available at* http://siteresources.worldbank.org/INTENERGY/Resources/PrimeronDemand-SideManagement.pdf (describing a real-time pricing pilot project in Chicago).

[461] *See Smart Grid System Report*, at p. 30, U.S. Dept. of Energy (July 2009), *available at* http://www.oe.energy.gov/DocumentsandMedia/SGSRMain_090707_lowres.pdf (citing a Dec. 2008 FERC staff report on advanced metering and demand response) ("*Smart Grid System Report*").

[462] *See* Press Release, *Tendril Introduces Next Phase of its Groundbreaking Energy Management Platform,* Feb. 3, 2009, Tendril, *available at* http://www.tendrilinc.com/2009/02/tendril-introduces-next-phase-of-its-groundbreaking-energy-management-platform.

[463] *Building the smart grid.*

[464] *See* Staff Report, *Assessment of Demand Response & Advanced Metering*, at p. i, FERC (Dec. 2008), *available at* http://www.ferc.gov/legal/staff-reports/12-08-demand-response.pdf ("*2008 FERC Assessment*").

[465] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at Slide 110. *Source*: *National Assessment of Demand Response Potential*, FERC, June 2009.

[466] *See, e.g.,* Rebecca Smith, *New Appliances, in Sync with Smart Meters, Shit to Energy-Saver Modes When Told*, Sept. 28, 2009, Wall St. J.

[467] See *John Timmer,* GE brings smart grids to life as appliances gain support, *July 9, 2009, Ars Technica,* available at http://arstechnica.com/business/news/2009/07/ge-cuts-a-deal-to-ready-its-appliances-for-the-smart-grid.ars.

[468] *Id.*

[469] *Wired for Progress* at p. 1.

[470] *See* Charles Waltner, *Smart Buildings Offering Clever Ways to Reduce Energy Consumption*, July 21, 2008, Cisco, *available at* http://newsroom.cisco.com/dlls/2008/ts_072108.html (citing a study by The Hartman Co.) ("*Smarter Buildings*").

[471] McKinsey argues that viewing a building as one integrated system, "rather than as a set of independent end-uses," can result in "additional energy savings in a cost effective manner." *McKinsey Energy Efficiency* at p. 32.

[472] *Smarter Buildings.*

[473] *Wired for Progress* at p. 31.

[474] *See Technology Providers: One of Six Smart Grid Stakeholder Books*, at p. 3, Prepared for the U.S. Department of Energy by Litos Strategic Communication (2008), *available at* http://www.oe.energy.gov/DocumentsandMedia/TechnologyProviders.pdf.

[475] *See Executive Order: Federal Leadership in Environmental, Energy, and Economic Performance*, The White House, Office of the Press Secretary (rel. Oct. 5, 2009), *available at* http://www.whitehouse.gov/the_press_office/President-Obama-signs-an-Executive-Order-Focused-on-Federal-Leadership-in-Environmental-Energy-and-Economic-Performance/.

[476] *See* Eve Tahmincioglu, *The Quiet Revolution: Telecommuting*, Oct. 5, 2007, MSBC, *available at* http://www.msnbc.msn.com/id/20281475/.

[477] *Id.*

[478] *See* Joseph Romm, *The Internet and the New Energy Economy* in Sustainability at the Speed of Light (Dennis Pamlin, ed.), at p. 39 (2002), *available at* http://assets.panda.org/downloads/wwf_ic_1.pdf ("*Internet and New Energy Economy*").

[479] *See* Joseph P. Fuhr Jr. & Stephen B. Pociask, *Broadband Services: Economic and Environmental Benefits*, The American Consumer Institute (Oct. 2007), *available at* http://www.theamericanconsumer.org/2007/10/31/broadband-services-economic-and-environmental-benefits/.

[480] *Id.*

[481] *Internet and New Energy Economy* at p. 37.

[482] *McKinsey Energy Efficiency* at p. 99.

[483] *See, e.g.,* Prepared Remarks of Chairman Julius Genachowski, Federal Communications Commission, *Preserving a Free and Open Internet: A Platform for Innovation, Opportunity, and Prosperity*, The Brookings Institution, Sept. 21, 2009, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293568A1.pdf (noting that "the Internet is helping enable smart grid technologies, which promise to reduce carbon dioxide emissions by hundreds of millions of metric tons.").

[484] *See FCC hires energy director, plans rules for smart grid networks*, Aug.18, 2009, Smart Grid Today.

[485] *Comment Sought on the Implementation of Smart Grid Technology*, National Broadband Plan Public Notice #2, GN Docket Nos. 09-47, 09-51, 09-137 (rel. Sept. 4, 2009), *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-2017A1.pdf.

[486] *See* FCC, National Broadband Plan, Workshops: Smart Grid, Broadband and Climate Change, http://www.broadband.gov/ws_eng_env_trans.html.

[487] *See* NIST, Smart Grid Interoperability Standards Project, http://www.nist.gov/smartgrid/.

[488] *See NIST denies need for prodding on IP in smart grid*, Sept. 8, 2009. Smart Grid Today ("*NIST Denies*").

[489] See *NIST Framework and Roadmap for Smart Grid Interoperability Standards, Release 1.0,* Sept. 24, 2009, NIST, *available at* http://www.nist.gov/public_affairs/releases/smartgrid_interoperability.pdf ("*NIST Smart Grids Standards Framework & Roadmap – Release 1.0*").

[490] *See Commerce Secretary Presents Draft NIST Smart Grid Roadmap*, Sept. 25, 2009, Smart Grid Today.

[491] *NIST Denies.*

[492] *See Smart Grid Policy*, FERC, 18 CFR Chapter I, Docket No. PL09-4-000 (rel. July 16, 2009)*, available at* http://www.ferc.gov/whats-new/comm-meet/2009/071609/E-3.pdf ("*FERC Smart Grid Policy Statement*").

[493] *Id.* at para. 29-85.

[494]*Id.* at para. 22-28.

[495] *See The Strategic Plan: FY 2009-2014*, at p. 23, FERC (rel. Oct. 15, 2009), *available at* http://www.ferc.gov/about/strat-docs/FY-09-14-strat-plan-print.pdf.

[496] *Id.*

[497] *See* Press Release, *Sixteen State Regulators Join NARUC-FERC Smart Grid Collaborative*, Mar. 31, 2008, NARUC, *available at* http://www.naruc.org/News/default.cfm?pr=77&pdf.

[498] *Boulder Named 'Smart Grid City"*, Mar. 12, 2008, Denver Business Journal, *available at* http://denver.bizjournals.com/denver/stories/2008/03/10/daily26.html

[499] Kate Galbraith, *Deep in the Heart of Texas: A Smart Grid*, Dec. 3, 2008, New York Times, *available at* http://greeninc.blogs.nytimes.com/2008/12/03/deep-in-the-heart-of-texas-a-smart-grid/?scp=7&sq=%22Smart%20grid%22&st=cse

[500] *See, e.g., McKinsey Energy Efficiency* at p. 101-107 (discussing the need for more coordinated collaboration among stakeholders in and around the energy sector).

[501] *See, e.g.,* Dieter Helm, *The New Energy Paradigm*, at p. 18, in THE NEW ENERGY PARADIGM (D. Helm, ed.) (Oxford 2007) (noting that "energy policy tends to lag market developments").

[502] The FCC defines the "value chain" in the wireless context as "the chain of individual, value-creating activities. This chain includes not only those activities performed by wireless communications service providers themselves, but also those performed by all other entities, including providers of inputs and complements to wireless communications services." *See In the Matter of Fostering Innovation and Investment in the Wireless Communications Market*, at n. 2, GN Docket No. 09-157 (rel. August 27, 2009).

[503] *See, e.g.,* Charles. M. Davidson, *Losing the Forest for the Trees: Properly Contextualizing the Use of Early Termination Fees in the Current Wireless Marketplace*, at p. 19-22, ACLP Scholarship Series (June 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Early%20Termination%20Fees%20-%20June%202009.pdf (analyzing the impact of regulatory certainty on innovation in the wireless market); Robert Han & Hal Singer, *Why the iPhone Won't Last Forever and What the Government Should Do to Promote its Successor*, The Georgetown Center for Business & Public Policy (Sept. 2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1477042 (arguing that "heavy handed" regulation in the wireless sector would deter "disruptive" innovation in handset innovation).

[504] *See, e.g.* Lino Mendiola, *The Erosion of Traditional Ratemaking Through the Use of Special Rates, Riders, and Other Mechanisms*, 10 Tex. Tech Admin. L.J. 173, 177-178 (2008) ("The value of the utility's property, less depreciation, constitutes the "rate base." Tangible property includes plants and equipment that are "used and useful" in providing service. Intangible property includes the value of working capital and may include other items like legal rights." (*internal citations omitted*)).

[505] *See, e.g.,* Howard A. Shelanski, *Adjusting Regulation to Competition: Toward a New Model for U.S. Telecommunications Policy*, 24 Yale J. on Reg. 55, 59-62 (2007).

[506] Between 1939 and 1962, the percentage of households that had telephone service increased from 42 percent to 80 percent. *See* SUSAN MCMASTER, THE TELECOMMUNICATIONS INDUSTRY 84 (Greenwood Press 2002).

[507]*See* Douglas H. Ginsburg, *Synthetic Competition*, 16 MEDIA L. & POL'Y 1, 5 (2006), *available at* http://www.nyls.edu/user_files/1/3/4/30/84/88/16MLP1fall06.pdf.

[508] *See, e.g.,* HERBERT HOVENKAMP, THE ANTITRUST ENTERPRISE: PRINCIPLE AND EXECUTION 13-14 (Harv. U. Press 2005).

[509] *See Smart Grid Report*, at p. 28, U.S. Department of Energy (July 2009), *available at* http://www.oe.energy.gov/DocumentsandMedia/SGSRMain_090707_lowres.pdf,.

[510]*Id.*

[511] Edward Robinson, *Smart-grid competition heats up with involvement of telecom technology*, Sept. 6, 2009, The Seattle Times, *available at* http://seattletimes.nwsource.com/html/businesstechnology/2009813989_smartgrid06.html?syndication=rss.

[512] Some, however, advocate the construction of an entirely new "mesh" network to support the smart grid and related applications (e.g., plug-in hybrid vehicles). *See, e.g.,* David Weinberger, *The Grid, Our Cars and the Net: One Idea to Link them All*, May 8, 2009, Wired.com, *available at* http://www.wired.com/autopia/2009/05/the-grid-our-cars-and-the-internet-one-idea-to-link-them-all/ (providing an overview of a proposal by Robin Chase, founder of Zipcar).

[513] *See Do utilities blame smart grid gear-makers for lack of standards?* Sept. 17, 2009, Smart Grid Today.

[514] *CRS Report*.

[515] *See Congressional top dogs jump on Smart Grid bandwagon...NIST, NEMA, and NARUC say wait until standards are in place... Utility group publishes standards white paper*, Mar. 9, 2009, Smart Grid News, *available at* http://www.smartgridnews.com/artman/publish/news/Congressional_top_dogs_jump_on_Smart_Grid_bandwagon_NIST_NEMA_and_NARUC_say_wait_until_standards_are_in_place_utility_group_publishes_standards_white_paper-533.html.

[516] *See, e.g.,* Tony Clark & Michael J. Santorelli, *Federalism in Wireless Regulation: A New Model for a New World*, ACLP Scholarship Series (Feb. 2009), *available at* http://www.nyls.edu/user_files/1/3/4/30/83/Clark%20%20&%20Santorelli%20-%20Wireless%20Federalism%20-%20February%202009.pdf (discussing regulatory federalism in the wireless market).

[517] As an example, the wireless market has shifted away from state-by-state regulation and towards a framework that is largely national in scope. States, however, do retain regulatory jurisdiction over "terms and conditions" of wireless service. *See Omnibus Budget Reconciliation Act of 1993*, Pub. L. No. 103-66, § 6002(b), 107 Stat. 312, 392 (codified in relevant part at 47 U.S.C. § 332) (imposing a national regulatory framework for wireless).

[518] *See, e.g., Accelerating Smart Grid Investments*, at p. 21, World Economic Forum in partnership with Accenture (2009), *available at* http://www.weforum.org/pdf/SlimCity/SmartGrid2009.pdf (noting that "If smart grids are to gain traction, it will need to be clear to all the stakeholder groups what smart grids are, how they are different to the status quo and why they will be a central enabler of a low-carbon future" and opining that "Consumers will need to be educated on how their energy consumption

patterns at home, at work and in transit drive cost and have value") ("*Accelerating Smart Grid Investments*").

519 *See Lighting the Way: Understanding the Smart Energy Consumer*, at p. 4, IBM Global Business Services, Institute for Business Value, *available at* http://www.ibm.com/common/ssi/fcgi-bin/ssialias?infotype=PM&subtype=XB&appname=GBSE_GB_TI_USEN&htmlfid=GBE03187USEN&attachment=GBE03187USEN.PDF.

520 *Id.* at p. 5-6.

521 *Id.* at p. 7.

522 *Id.* at p. 6 ("The impact of the global economic downturn of 2008 is clearly competing with the environmental concerns of consumers. Across the core group of countries [included in the IBM survey], the number of consumers paying a premium for green products and services is down 20 to 30 percent.").

523 *Smart Grid System Report* at p. 35 (citing *2008 FERC Assessment*).

524 *See Building the smart grid*, June 4, 2009, The Economist, *available at* http://www.economist.com/sciencetechnology/tq/displaystory.cfm?STORY_ID=13725843 ("*Building the smart grid*").

525 *See* Sarah Reedy, *Grid Week: DOE Secretary Chu on Fighting Consumer Smart-Grid Resistance*, Sept. 21, 2009, Telephony Online, *available at* http://telephonyonline.com/business_services/news/doe-secretary-chu-smart-grid-20090921/.

526 *See* National Association of State Utility Consumer Advocates, Resolution 2009-03: Smart Grid Principles of the National Association of State Utility Consumer Advocates, *available at* www.nasuca.org/2009-03%20FINAL.doc ("NASUCA Principles").

527 *NIST Smart Grids Standards Framework & Roadmap – Release 1.0* at p. 5.

528 *See Do utilities blame smart grid gear-makers for lack of standards?*, Sept. 17, 2009, Smart Grid Today.

529 *See* Sarah Reedy, *Smart Grid Series, Part 4: How Standards will Shape the Grid,* Sept. 18, 2009, Telephony Online, *available at* http://telephonyonline.com/topics/smart-grids/ieee-mcdonald-standards-0918/ ("*How Standards Will Shape*").

530 *NIST Smart Grids Standards Framework & Roadmap – Release 1.0* at p. 5.

531*CRS Report*.

532 *How Standards Will Shape.*

533 *See, e.g.,* Comments of the Utilities Telecom Council and Edison Electric Institute, p. 7-11, *In the Matter of a National Broadband Plan for Our Future*, GN Docket No. 09-51 (sub. Jun 8, 2009); *see also The Utility Spectrum Crisis: A Critical Need to Enable Smart Grids*, p. 14-18, Utilities Telecom Council (Jan. 2009), *available at* http://www.utc.org/fileshare/files/3/Public_Policy_Issues/Spectrum_Issues/finalspectrumcrisisreport0109.pdf.

534 *See, e.g., Letter of Digital Energy Solutions Campaign to FCC Chairman Genachowski*, at p. 2 ("*Digital Energy Letter*").

535 *See, e.g.,* Deborah D. McAdams, *Legislators Press for Spectrum Inventory*, Sept. 17, 2009, Television Broadcast, *available at* http://www.televisionbroadcast.com/article/87290 (quoting FCC Chairman Julius Genachowski as saying that "there is a demand crunch coming" for spectrum.).

536 *Id.* (referring to comments made by FCC Commissioners during a House oversight hearing and to separate spectrum inventory bills that were passed in the House and the Senate in 2009).

[537] *Accelerating Smart Grid Investments* at p. 22-23 (noting that there is a lack of skills and expertise in the energy sector regarding digital network security and how a lack of skilled workers may make networks vulnerable in the transition from analog to digital systems).

[538] *See, e.g.,* Brian Krebs, '*Smart Grid*' *Raises Security Concerns,* July 28, 2009, The Washington Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/07/27/AR2009072702988.html ("*Smart Grid Security Concerns*").

[539] *See Cyberspace Policy Review: Assuring a Trusted and Resilient Information and Communications Infrastructure*, at p. 29, Executive Office of the President (May 2009), *available at*: www.whitehouse.gov/assets/documents/Cyberspace_Policy_Review_final.pdf ("*White House Report*").

[540] *Smart Grid Security Concerns*.

[541] *See* Jeanne Meserve, '*Smart Grid*' *May be Vulnerable to Hackers*, March 21, 2009, CNN, *available at* http://www.cnn.com/2009/TECH/03/20/smartgrid.vulnerability/index.html (citing a report by IOActive).

[542] *See* Jeff St. John, *Defense Contractors Pursue the Smart Grid*, Sept. 4, 2009, *GreenTech Media*, *available at* http://www.greentechmedia.com/articles/read/defense-contractors-pursue-the-smart-grid.

[543] *See* Mark F. Foley, *Data Privacy and Security Issues for Advanced Metering Systems (Part 2),* July 1 2008, Smart Grid News, *available at* http://www.smartgridnews.com/artman/publish/industry/Data_Privacy_and_Security_Issues_for_AdvanceNd_Metering_Systems_Part_2.html,

[544] *See* Longhao Wang and Eliabeht Carin Eraker, *Consumer Privacy and Smart Grid Technology,* Oct. 6, 2009, Privacy Beta Blog, Center for Democracy & Technology, *available at* http://blog.cdt.org/2009/10/06/consumer-privacy-and-smart-grid-technology/ (summarizing recent comments submitted to the FCC regarding smart grids and observing that "granular usage data reveals deeply personal information about consumer habits, and about consumer activities within the private space of the home. Given both the sensitive nature and high commercial value of this data, utilities and third-party businesses will be eager to make use of it, as will law enforcement investigators and, unfortunately, criminals. For example, if your thermostat is set at 55 degrees for 3 days in the winter in New England, that is a good signal that you are away from your house. As such, a lack of care around this data will pose serious privacy and security risks for consumers. These issues are further complicated by the reality that the Smart Grid, at present, is governed by a patchwork of state and federal laws.").

[545] *NASUCA Principles*.

[546] *White House Report* at p. 33.

[547] *See* Jim Duffy, *Cisco Targeting Utilities*, May 18, 2009, Network World, *available at* http://www.networkworld.com/community/node/41938 (noting that "Cisco is looking to supply utilities with an IP network, from the power generation facilities to the home. Cisco's smart grid strategy will encompass data centers and substations, neighborhood-area networks, and businesses and homes.").

[548] *See* U.S. Dept. of Transportation, Commuter Choice Primer, http://www.itsdocs.fhwa.dot.gov/jpodocs/repts_pr/13669.html.

[549] These include Connecticut, Georgia, Oregon and Virginia. *See* Telecommute Connecticut, About Us, http://telecommutect.com/about/about.php (providing resources and consultative services to businesses looking to implement a telecommuting program); Georgia House Bill 194 (2005), http://www.legis.state.ga.us/legis/2005_06/fulltext/hb194.htm (providing $20,000 credit for a telework assessment, and a $1,200 per employee credit for teleworkers that meet a certain threshold of time teleworking for the years 2008 and 2009); Oregon Department of Energy, Transportation,

http://egov.oregon.gov/ENERGY/TRANS/transhm.shtml; and Telework!Va, http://www.teleworkva.org/.

550 *Comments of Google on Smart Grid Technology Deployment in California*, Dec. 18, 2008, Google.Org, *available at* http://www.google.org/powermeter/cpuc.html.

551 *Id.*

552 *See* Google.org, PowerMeter, http://www.google.org/powermeter/index.html.

553 *See* John Timmer, *Google wants in on the smart grid of the future*, Feb. 10, 2009, Ars Technica, *available at* http://arstechnica.com/science/news/2009/02/google-wants-in-on-the-smart-grid.ars.

554 *Digital Energy Letter* at p. 3 (noting that "In this way Opto pulls real-time energy use data that it presents on both an in-home display and a Web portal, enabling trial customers to not only monitor their usage remotely, but also to remotely control different appliances over whatever wireless or wireline broadband connection they have.").

555 *See* Google.org, PowerMeter: Partners, http://www.google.org/powermeter/partners.html.

556 According to the U.S. Department of Education, 34.9 million students attended pre-K–8th grade public school, while 4.8 million students attended pre-k–8th grade private school. The DOE also found that 14.9 million students attended public high school in 2008, while 1.35 million students attended a private high school. *See Digest of Education Statistics, 2007,* at Table 3, U.S. Department of Education, National Center for Education Statistics 2008-022 (2008), *available at* http://nces.ed.gov/fastfacts/display.asp?id=65.

557 *See The Condition of Education 2007,* Indicator 2, U.S. Department of Education, National Center for Education Statistics (NCES 2007–064), *available at* http://nces.ed.gov/fastfacts/display.asp?id=78 (data as of 2005).

558 These programs include English as a Second Language, adult basic education classes, GED classes, college/university/vocational training, apprenticeships, and courses taken for work or personal interest. *See Issue Brief: Recent Participation in Formal Learning Among Working-Age Adults with Different Levels of Education*, U.S. Department of Education, National Center for Education Statistics 2008-041 (Jan. 2008), *available at* http://nces.ed.gov/pubs2008/2008041.pdf (data collected between 2000 and 2005).

559 *See, e.g.,* TERRY M. MOE & JOHN E. CHUBB, LIBERATING LEARNING: TECHNOLOGY, POLITICS, AND THE FUTURE OF AMERICAN EDUCATION 109 (2009) ("Schools organized around distance learning can offer AP physics or remedial math or Mandarin or whatever local districts are not offering; and they can cater to constituencies – students who are gifted, in need of specialized courses, in rural or inner-city areas, in need of extra credits for graduation and so on – that are underserved by the current system.") ("LIBERATING LEARNING").

560 *See* U.S. Department of Education, National Center for Education Statistics, Question: What percentage of elementary and secondary schools offer distance education?, http://nces.ed.gov/fastfacts/display.asp?id=79.

561 *See High-Speed Broadband Access for All Kids: Breaking Through the Barriers*, State Educational Directors Association (June 2008), available at http://www.setda.org/web/guest/2020/broadband ("*Breaking Through the Barriers*").

562 *See Evaluation of Evidence-Based Practices in Online Learning,* at p. xi, U.S. Department of Education, Center for Technology in Learning (2009), *available at* http://www.ed.gov/rschstat/eval/tech/evidence-based-practices/finalreport.pdf ("*Evaluation of Online Learning*").

563 *See* I. Elaine Allen and Jeff Seaman, *Staying the Course: Online Education in the United States, 2008,* at p. 5, Sloan Consortium, *available at* http://www.sloanconsortium.org/publications/survey/index.asp; *see also* Eve Tahmincioglu, *The Faculty Is Remote, But Not Detached*, March 9, 2008, N.Y. Times.

[564] *Evaluation of Online Learning* at p. ix.

[565] *See Maximizing the Impact: The Pivotal Role of Technology in a 21st Century Education System*, at p. 2, A Joint Report of the Partnership for 21st-Century Skills, ISTE & SETDA (2007), *available at* http://www.21stcenturyskills.org/documents/p21setdaistepaper.pdf.

[566] *See, e.g.,* Ray Uhalde and Jeff Strohl, *American in the Global Economy*, p. 47-50, A Background Paper for the New Commission on the Skills of the American Workforce (Dec. 2006), *available at* http://www.skillscommission.org/pdf/Staff%20Papers/America_Global_Economy.pdf.

[567] *See* 21stCenturySkills.org, Maine Advisory Council, http://www.21stcenturyskills.org/route21/index.php?option=com_content&view=article&id=135&Itemid=219.

[568] *See Internet Access in U.S. Public Schools and Classrooms: 1994-2005,* at p. 10, National Center for Education Statistics, *available at-* http://nces.ed.gov/pubs2007/2007020.pdf ("*Public Schools*").

[569] *Id.*

[570] *See, e.g.,* John Windhausen, Jr., *A Blueprint for Big Broadband*, at p. 14, EDUCAUSE (Jan. 2008), *available at* http://www.educause.edu/ir/library/pdf/EPO0801.pdf.

[571] *See Connected to the Future,* at p. 8, Center for Public Broadcasting, (2002), *available at* http://www.cpb.org/stations/reports/connected/connected_report.pdf

[572] *See* Linda A. Jackson et al., *Does Home Internet Use Influence the Academic Performance of Low-Income Children*, Developmental Psychology 42(3) (2006) 429, *available at* www.apa.org/releases/dev423-jackson.pdf.

[573] *See* Robert Atkinson and Daniel Castro, *Digital Quality of Life: Understanding the Personal & Social Benefits of the Information Technology Revolution: Education & Training,* at p. 22, Information Technology and Innovation Foundation (Oct. 2008), *available at* http://www.itif.org/files/DQOL-4.pdf ("*Digital Quality of Life – Education & Training*").

[574] *Breaking Through the Barriers* at p. 6.

[575] According to the U.S. Department of Education, 100 percent of public schools had Internet access by 2003. *See* U.S. Department of Education, National Center for Education Statistics, Digest of Education Statistics 2008: Table 427 – Public schools and instructional rooms with internet access, by selected school characteristics: Selected years, 1994 through 2005, http://nces.ed.gov/programs/digest/d08/tables/dt08_427.asp ("*NCES Table 427*").

[576] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at Slide 119.

[577] *See* U.S. Department of Education, National Center for Education Statistics, Question: How many schools have access to the Internet?, http://nces.ed.gov/fastfacts/display.asp?id=46.

[578] *See* Kelly Caraher and Meredith Braselman, *News Release, 2009 School Safety Index Finds Security Improvements Aren't Keeping Pace with Breaches,* May 18, 2009, CDWG, *available at* http://newsroom.cdwg.com/news-releases/news-release-05-18-09.html.

[579] *See The 21st-Century Campus: Are We There Yet?* at p. 17, Oct. 13, 2008, CDWG *available at* http://webobjects.cdw.com/webobjects/media/pdf/newsroom/CDWG-21st-Century-Campus-1008.pdf ("*CDWG 2008"*)

[580] *See* Kelly Caraher and Meredith Braselman, *News Release, 2009 School Safety Index Finds Security Improvements Aren't Keeping Pace with Breaches,* May 18, 2009, *available at* http://newsroom.cdwg.com/news-releases/news-release-05-18-09.html.

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[582] *NCES Table 427.*

[583] *See Access, Adequacy, and Equity in Education Technology,* at p. 9, National Education Association (May 2008), *available at* http://www.edutopia.org/files/existing/pdfs/NEA-Access,Adequacy,andEquityinEdTech.pdf (*"NEA 2008"*).

[584] *Id.* at p. 10.

[585] *CDWG 2008* at p. 17.

[586] *Id.*

[587] *See* Amanda Lenhart, *Presentation: Teens and Social Media – An Overview*, Slide 5, April 10, 2009, Pew Internet & American Life Project, *available at* http://www.pewinternet.org/Presentations/2009/17-Teens-and-Social-Media-An-Overview.aspx.

[588] *Id.* at Slide 8.

[589] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at Slide 120 (citing Pew studies).

[590] *Id.* at Slide 7.

[591] *NEA 2008* at p. 23.

[592] *See Internet Access in U.S. Public Schools and Classrooms: 1994-2005,* at p. 10, National Center for Education Statistics, *available at* http://nces.ed.gov/pubs2007/2007020.pdf.

[593] *NEA 2008* at p. 19.

[594] *Id.* at p. 20.

[595] *See* CMCH Mentors, Cell phones, http://www.cmch.tv/mentors/hotTopic.asp?id=70 (citing C&R Research).

[596] *Women, Teens, and Seniors – Mobile Web Use 2009.*

[597] *See* Project K-Nect, Home, http://www.projectknect.org/Project%20K-Nect/Home.html.

[598] *See* Carly Shuler, *Pockets of Potential: Using Mobile Technologies to Promotes Children's Learning*, at p. 14, Industry Brief, The Joan Ganz Cooney Center at Sesame Workshop (Jan. 2009), *available at* http://www.joanganzcooneycenter.org/pdf/pockets_of_potential.pdf.

[599] *See* Press Release, *35% of Teens Admit to Using Cell Phones to Cheat*, June 18, 2009, Common Sense Media, *available at* http://www.commonsensemedia.org/about-us/press-room/hi-tech-cheating-poll.

[600] CDWG at p. 17.

[601] *See* eLearners.com, Facts and Figures from the Online Education Research, http://www.elearners.com/guide-to-online-education/online-education-research.asp (citing the Vault.com study).

[602] *Digital Quality of Life – Education & Training* at p. 18.

[603] *See* Joe Mullich, *A Second Act for E-Learning*, Workforce.com (Feb. 2004), *available at* http://www.workforce.com/section/11/feature/23/62/89/index.html.

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[605] *See 21st Century Campus* at p. 6, White Paper.

[606] *See A Resource Guide Identifying Technology Tools for Schools*, at p. 7, The state Educational Technology Directors Association (SETDA) and the National Association of State Title I Directors (NASTID), September 2009, *available at* http://www.setda.org/c/document_library/get_file?folderId=295&name=DLFE-490.pdf.

[607] *Id.*

[608] "Higher costs for online development and delivery are seen as barriers among those who are planning online offerings, but not among those who have online offerings." *See* Elaine Allen and Jeff Seaman, *Online Nation*: *Five Years of Growth in Online Learning,* at p. 3, The Sloan Consortium (October 2007).

[609] *See* Tom Rolfes and Tammy Stephens, *21st Century Networks for 21st Century Schools: Making the Case for Broadband*, at p. 4-6, CoSN ("*21st Century Networks*").

[610] *Id.*

[611] *Id.*

[612] *Id.*

[613] *Id.*

[614] *Id.* at p. 5.

[615] *Home Broadband Adoption 2009* at p. 14-16 ("Home broadband adoption for adults with household incomes under $20,000 grew by 40 percent from 2008 to 2009. However, a total of only 35 percent of adults with household incomes under $20,000 have broadband at home, compared to 63 percent of all adults.").

[616] One study found that, in 2000, "64 percent of households with at least one child between the ages of 2 and 17 had a computer. By 2002, 83 percent of family households reported computer ownership — a 30 percent growth rate in two years." *See Connected to the Future,* at p. 2-3, Corporation for Public Broadcasting, http://www.cpb.org/stations/reports/connected/connected_report.pdf ("*Connected to the Future*").

[617] *See* Tamar Lewin, *In a Digital Future, Textbooks are History*, Aug. 8, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/08/09/education/09textbook.html?_r=3&ref=education.

[618] *See Fast Facts About Online Learning*, at p. 2, NACOL International Association for K-12 Online Learning (2008), (citing *Upcoming Statistical Abstract of the United States: 2009, Table 252*, *available at* http://www.census.gov/compendia/statab).

[619] *Public Schools* at p. 6.

[620] *NEA 2008* at p. 2.

[621] *See Internet Access in U.S. Public Schools and Classrooms: 1994-2005,* at p. 6, National Center for Education Statistics, *available at* http://nces.ed.gov/pubs2007/2007020.pdf.

[622] *Connected to the Future* at p.6.

[623] *Id*. According to U.S. Census data from 2005, less than half – 45 percent – of blacks used a computer at home, compared to over 60 percent for both Whites and Asians. *See Computer and Internet Use in the United States: October 2007*, Table 4 - Reported Computer and Internet Access for Individuals 15 Years and

Older, by Selected Characteristics: 2005, U.S. Census Bureau, *available at* http://www.census.gov/population/socdemo/computer/2007/tab04.xls.

624 *See* American Library Association, Library Fact Sheet No. 6, http://www.ala.org/ala/aboutala/offices/library/libraryfactsheet/alalibraryfactsheet6.cfm (citing an analysis of 2002 data by the National Center for Education Statistics).

625 *Id.*

626 *See* Mark Warschauer, *Information Literacy in the Laptop Classroom,* Teachers College Record (2007), *available at* http://www.tcrecord.org/Content.asp?ContentID=14534 (*"Information Literacy"*).

627 *Id.*

628 *Id.*

629 *See* J. James Cengiz Gulek and Hakan Demirtas, *Learning with technology: The impact of laptop use on student achievement*, at p. 29, Journal of Technology, Learning, and Assessment, vol. 3, no. 2 (2005), *available at* http://escholarship.bc.edu/cgi/viewcontent.cgi?article=1052&context=jtla.

630 *See generally* Michael Russell et al., *Laptop learning: A comparison of teaching and learning in upper elementary classrooms equipped with shared carts of laptops and permanent One-to-One laptops*, Technology and Assessment Collaborative Study, Boston College (Feb. 2004), *available at* http://www.bc.edu/research/intasc/PDF/Andover1to1.pdf.

631 *Id.*

632 *See Overview of the Schools and Libraries Program,* Universal Service Administrative Company, *available at* http://www.universalservice.org/sl/about/overview-program.aspx.

633 *Id.*

634 *Breaking Through the Barriers* at p. 22.

635 *See Report to Congressional Requesters, Long-Term Strategic Vision Would Help Ensure Targeting of E-rate Funds to Highest-Priority Uses,* at p. 2, United States Government Accountability Office (GAO) (March 2009) (*"GAO Report"*).

636 *Id.*

637 *See* Comments of Sheryl Abshire, Chief Technology Officer of the Calcasieu Parish School System, Presentation at FCC Workshop: Education (Aug. 20, 2009), available at http://www.broadband.gov/ws_education.html ("The most widely disseminated criticism of the E-Rate program is its lack of funding.").

638 *Breaking Through the Barriers* at p. 23.

639 *Id.*

640 "Each year from 1998- 2007, the amount of funding applicants requested exceeded the amount available… From 1998 through 2007, applicants requested a total of about $41 billion in E-rate funding—174 percent of the $23.4 billion in program funding." *GAO Report* at p. 13.

641 *Breaking Through the Barriers* at p. 23.

642 *See* Universal Service Administrative Company, Step 5: Discount Matrix, http://www.universalservice.org/sl/applicants/step05/discount-matrix.aspx.

643 *See* Patricia M. Worthy, *Racial Minorities and the Quest to Narrow the Digital Divide: Redefining the Concept of "Universal Service,"* 26 Hastings Comm. & Ent. L.J. 1, 45 (2003) (*citing* Charles R. McClure and John

Carlo Bertot, *Public Library Internet Service: Impacts on the Digital Divide*, Information Use Management and Policy 16 (2000)).

644 *GAO Report* at Highlights.

645 *Id.*

646 *See* Laura Devaney, *e-Rate wants to be user friendly*, Sept. 24, 2009, eSchool News, *available at* http://www.eschoolnews.com/news/top-news/index.cfm?i=60880 ("*E-rate User Friendly*").

647 *GAO Report* at Highlights.

648 *E-rate User Friendly*.

649 *Id.*

650 *See* U.S. Department of Education, Enhancing Education Through Technology State Program, http://www.ed.gov/programs/edtech/index.html.

651 *See Focus on Technology Integration in America's Schools*, at p.4, SETDA (2009) *available at* http://www.setda.org/c/document_library/get_file?folderId=6&name=DLFE-329.pdf ("*America's Schools*").

652 *America's Schools* at p. 4.

653 *Id* at p.17.

654 *See Stimulus Broadband Funds Aim to Expand Public Access, Service and Mapping*, July 9, 2009, Thompson, *available at* http://www.thompson.com/public/newsbrief.jsp?cat=EDUCATION&id=2226 ("*Stimulus Broadband Funds*").

655 *21st Century Networks* at p. 6.

656 *See Ready, set, go*, Oct. 3, 2009, The Economist.

657 *Id.*

658 *See* Alexandra R. Moses, *Stimulus Package to Quickly Impact Education Technology*, Feb. 20, 2009, Edutopia, *available at* http://www.edutopia.org/economic-stimulus-education-school-technology ("*Stimulus to Impact Education Technology*").

659 *Id.*

660 *21st-Century Networks* at p. 6.

661 *Id.*

662 *Id.*

663 *Id.*

664 *Id.*

665 *Id.*

666 *Id.*

667 *Stimulus to Impact Education Technology*

668 *See, e.g.,* Clayton M. Christensen and Michael B. Horn, *Commentary: Don't Prop up Failing Schools*, June 2, 2009, CNN, *available at* http://www.cnn.com/2009/US/06/02/christensen.schools/index.html.

669 *Stimulus to Impact Education Technology* (quoting an estimate made by Hilary Goldmann, director of government affairs with the International Society for Technology in Education).

[670] H.R. 558 – The Achievement Through Technology and Innovation (ATTAIN) Act of 2009 – was introduced in January 2009. This bill would reauthorize Section IID of the NCLB. Full text of the bill is *available at* http://www.govtrack.us/congress/billtext.xpd?bill=h111-558.

[671] *See* State Education Technology Directors Association, 2008 Gateway to Graduation Toolkit: ATTAIN Act, http://www.setda.org/web/toolkit2008/student-engagement/attain.

[672] *See* Y. Zhao & K.A. Frank, *Factors affecting technology use in schools: An ecological perspective,* 40 American Educational Research Journal 807-840 (2003).

[673] *See* R.M. Wallace, *A framework for understanding teaching with the Internet,* 41 American Educational Research Journal 447-488 (2004).

[674] *See CDW-G 21st Century Campus Study,* at p. 21, White Paper, CDW-G (January 2009) ("*21st Century Campus*").

[675] *Id*. at p. 4.

[676] *Id*. at p. 16.

[677] *See* Yao-Ting Sung & Alan Lesgold, *Software Infrastructure for Teachers: A Missing Link in Integrating Technology with Instruction*, Teachers College Record (2007), *available at* http://www.tcrecord.org/Content.asp?ContentID=14536 ("*SIT 2007*").

[678] *Public Schools* at p. 9.

[679] *Id.*

[680] *Id.*

[681] *NEA 2008* at p. 3.

[682] *Id* at p. 17.

[683] *See* Christine Van Dusen, *eSN Special Report: 21st Century Teacher Education,* June 1, 2009, eSchool News, *available at* http://www.eschoolnews.com/news/special-reports/special-reports-articles/index.cfm?i=58995&page=1.

[684] *See* J.H. Sandholtz & B. Reilly, *Teachers, not technicians: Rethinking technical expectations for teachers*, 106 Teachers College Record 487-512 (2004).

[685] *SIT 2007* (quoting M. Guzdial et al., *Beyond adoption to invention: Teacher created collaborative activities in higher education*, 10 J. of the Learning Sciences 265-279 (2001)).

[686] *SIT 2007.*

[687] *NEA 2008* at p. 16.

[688] *Id.*

[689] *Id.*

[690] *SIT 2007.*

[691] *NEA 2008* at p. 14.

[692] *Id.* at p. 15.

[693] *See* MOUSE, Why Mouse Squad? http://www.mouse.org/programs/mouse-squad/why-mouse-squad.

[694] *Id.*

[695] *See* MOUSE, MouseTech Source, http://www.mouse.org/programs/mouse-techsource (citing a 2005-2008 study conducted by Fordham University's National Center for Schools and Communities, a summary of which is *available at* http://www.mouse.org/sites/default/files/Fordham%20Summary%20for%20Website.pdf.

[696] *Id.*

[697] *NEA 2008* at p. 16.

[698] *See* Karen Kaminski, Pete Seel, and Kevin Cullen, *Technology Literate Students? Results from a Survey,* at p. 35, Educause Quarterly (2003), *available at* http://net.educause.edu/ir/library/pdf/eqm0336.pdf ("*Technology Literate Students*").

[699] *See Getting America's Students Ready for the 21st Century: Meeting the Technology Literacy Challenge, A Report to the Nation on Technology and Education,* at p. 1, U.S. Department of Education, (1996), *available at* http://www.ed.gov/Technology/Plan/NatTechPlan/.

[700] *Id.*

[701] *Technology Literate Students* at p. 34.

[702] *NEA 2008* at p. 32.

[703] *Id.*

[704] *Id.*

[705] *Connected to the Future* at p. 2.

[706] *Id.* at p. 8.

[707] *Home Broadband Adoption 2009* at p. 13.

[708] *Technology Literate Students* at p. 34.

[709] *See* Carole Bausell and Elizabeth Klemick, *Tracking U.S. Trends,* March 29, 2007, Education Week.

[710] *See* Scott J. Cech, *Tests of Tech Literacy Still Not Widespread Despite NCLB Goals*, Jan. 29, 2008, Education Week.

[711] *See* Ted Kolderie and Tim McDonald, *How Information Technology Can Enable 21st Century Schools*, at p. 6, The Information Technology and Innovation Foundation (July 2009), *available at* www.itif.org/files/Education_ITIF.pdf..

[712] *Id.* at p. 7.

[713] *SIT 2007.*

[714] *21st Century Campus*.

[715] *SIT 2007.*

[716] *See* Catherine Gewertz, *Outside Interests,* March 29, 2007, Education Week.

[717] *21st Century Campus* at p. 6.

[718] *See* Elaine Allen and Jeff Seaman, *Online Nation*: *Five Years of Growth in Online Learning,* at p. 3, The Sloan Consortium (Oct. 2007), *available at* www.sloan-c.org/publications/survey/pdf/online_nation.pdf.

[719] *Id* at p. 18-19.

[720] *Id.*

[721] *Id* at p. 3.

[722] *Public Schools* at p. 4.

[723] *Breaking Through the Barriers* at p. 6.

[724] *Id.*

[725] *21st Century Networks* at p. 3.

[726] *Breaking Through the Barriers* at p. 4.

[727] *21st Century Networks* at p. 2.

[728] *Breaking Through the Barriers* at p. 23.

[729] *Id.* at p. 6.

[730] *Id.*

[731] *Id.*

[732] *21st Century Networks* at p. 3.

[733] *Id.*

[734]*See* Katie Ash, *Schools' Broadband Needs Grow as Ed-Tech Evolves,* Sept. 30, 2008, Education Week's Digital Directions, *available at* http://www.edweek.org/dd/articles/2008/09/30/01broadband.h02.html.

[735] *See, e.g.,* ROBERT A. SCHAPIRO, POLYPHONIC FEDERALISM: TOWARD THE PROTECTION OF FUNDAMENTAL RIGHTS 22 (Chicago 2009) (discussing the historical and legal bases for the largely local control of schools).

[736] *Id.* at p. 23 (observing that the "NCLB Act institutes massive federal regulation of the administration of elementary and secondary education in the United States. In return for receiving federal education funds, states must accept provisions that regulate the qualifications of teachers, establish student performance goals, and impose detailed reporting requirements. NCLB requires states to establish proficiency goals for the performance of students. Yearly testing monitors the progress in achieving these benchmarks.").

[737] *See* U.S. Department of Education, National Center for Education Statistics: NAEP Overview, http://nces.ed.gov/nationsreportcard/about/.

[738] *America's Schools* at p.3.

[739] LIBERATING LEARNING at p. 7.

[740] *See* Vivek Kundra, *Streaming at 1:00 in the Cloud*, Sept. 15, 2009, The White House Blog, *available at* http://www.whitehouse.gov/blog/Streaming-at-100-In-the-Cloud.

[741] *See, e.g.,* Press Release, *FCC Continues E-Government Push with Crowdsourcing Launch: Web 2.0 Tools Increasing Public Participation at FCC*, Sept. 11, 2009, FCC, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293392A1.pdf (announcing the deployment of a variety of tools – e.g., IdeaScale, YouTube, Facebook, etc. – to assist in the development of the FCC's national broadband plan).

[742] The federal government provides this definition for RSS: "RSS stands for Really Simple Syndication. It's an easy way for you to keep up with news and information that's important to you, and helps you avoid the conventional methods of browsing or searching for information on websites. Now the content you want can be delivered directly to you without cluttering your inbox with e-mail messages. This content is called a 'feed.'" See USA.gov, What is RSS?, http://www.usa.gov/Topics/Reference_Shelf/Libraries/RSS_Library/What_Is_RSS.shtml. The government also maintains and makes available to the public catalogue of RSS feeds for federal government agencies and entities. *See* USA.gov, U.S. Government RSS Library, http://www.usa.gov/Topics/Reference_Shelf/Libraries/RSS_Library.shtml.

[743] A growing number of government agencies and policymakers are using Twitter. USA.gov, for example, has its own twitter feed. *See* http://twitter.com/usaGOV.

[744] A number of commentators have questioned the value of blogs in spurring constructive dialogue. For a brief overview of recent literature, *see* Julianne Mahler & Priscilla M. Regan, *Blogs as Public Forums for Agency Rulemaking*, at p. 2, Issues in Governance Studies No. 26, Brookings Institution (Aug. 2009), *available at* http://www.brookings.edu/~/media/Files/rc/papers/2009/08_blogs_mahler_regan/08_blogs_mahler_regan.pdf.

[745] *See FCC Explains Relationship of Blogband to the Record in the National Broadband Plan Proceeding*, Sept. 22, 2009, Public Notice, GN Docket No. 09-51, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-09-2089A1.pdf ("The FCC wishes the public to be aware that views relevant to the docket may be expressed in the course of discussion on Blogband. Thus, for the purposes of this proceeding, Blogband is hereby deemed to be part of the public record in GN Docket No. 09-51. For this reason, interested persons are advised to review not only ECFS, but also Blogband to ensure that they are aware of all relevant views expressed to the Commission concerning the National Broadband Plan.") ("*Blogband Press Release*").

[746] *See* The Peer to Patent Project, About Community Patent, http://dotank.nyls.edu/communitypatent/about.html (With the consent of the inventor, the Peer-to-Patent: Community Patent Review pilot, developed by the New York Law School Institute for Information Law and Policy in cooperation with the USPTO, enables the public to submit prior art and commentary relevant to the claims of pending patent applications in Computer Architecture, Software, and Information Security.").

[747] *See IRS e-file for Individuals,* Internal Revenue Service, *available at* http://www.irs.gov/efile/article/0,,id=118508,00.html.

[748] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 125 (citing the IRS Inspector General).

[749] *Id.* at slide 130 (citing a 2007 Pew survey and *Governance Studies* by The Brookings Institution).

[750] *See* The White House, Issues: Technology, http://www.whitehouse.gov/issues/technology/.

[751] *See* President Barack Obama, *Memorandum for the Heads of Executive Departments and Agencies*, Jan. 21, 2009, The White House, *available* at http://www.whitehouse.gov/the_press_office/Transparency_and_Open_Government/.

[752] *See* Jesse Lee, *Transparency and Government*, May 21, 2009, White House Blog, *available at* http://www.whitehouse.gov/blog/09/05/21/Opening/.

[753] *Id.*

[754] *See* IdeaScale, About, http://www.ideascale.com/tour/.

[755] The White House's initiative is housed at http://opengov.ideascale.com/.

[756] *See* White House, Open Government, Innovations Gallery, http://www.whitehouse.gov/open/innovations/.

[757] *See* Data.gov, About, http://www.data.gov/about.

[758] Pub. L. No. 107-347, 116 Stat. 2899.

[759] *See* Regulations.gov, About, http://www.regulations.gov/search/Regs/home.html#aboutProgram.

[760] *See* Beth Noveck, *The Electronic Revolution in Rulemaking*, 53 Emory L. J. 433, 439 (2004) ("Technology itself is not per se the savior of citizen participation. What is revolutionary are not the tools alone, but the

way they embed into the tools methods of interpersonal communication and information exchange. I call this methods-plus-technology "speech tools." They enable group collaboration, not because they are interactive, but because they structure and limit communication. They help to unblock the bottleneck of irrelevance and superfluity. Speech tools make communication useful by managing it and can therefore structure cooperation by groups. Agency officials can use these tools to bring about qualitative (as distinct from merely quantitative) and manageable communication in rulemaking," [*citations omitted*].) ("*Electronic Revolution*").

761 *See* Ray Mosley, *Federal Register 2.0: Opening a Window onto the Inner Workings of Government*, Oct. 5, 2009, The White House Blog, *available at* http://www.whitehouse.gov/blog/Federal-Register-20-Opening-a-Window-onto-the-Inner-Workings-of-Government/.

762 *Id.*

763 *Id.*

764 *See* FedThread.org, Home, http://www.fedthread.org/.

765 *See Local Government RSS Feeds, Wikis Catch On*, Sept. 21, 2009, Government Technology, *available at* http://www.govtech.com/gt/articles/726409 (citing a study by the Public Technology Institute).

766 *See* Matt Williams, *Transportation Departments Burn Rubber on Twitter,* Sept. 24, 2009, Government Technology, *available at* http://www.govtech.com/gt/articles/726973 (noting that "Some state and local transportation departments are launching Twitter accounts not just for the main agency, but also for individual roads and construction projects.").

767 *See, e.g.,* Andrea DiMaio, *Federal Shift to Cloud Raises Tough Issues for CIOs*, Oct. 7, 2009, Gov. Tech., *available at* http://www.govtech.com/gt/articles/729707 (discussing how the federal government's recent adoption of cloud computing services may influence the decisions of local and state-level CIOs).

768 *See* Aaron Smith et al., *The Internet and Civic Engagement*, at p. 5, Pew Internet & American Life Project (Sept. 2009), *available at* http://www.pewinternet.org/~/media//Files/Reports/2009/The%20Internet%20and%20Civic%20Engagement.pdf ("*Internet & Civic Engagement*").

769 *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 130 (citing: 2007 Pew survey; *Governance Studies,* The Brookings Institution).

770 *See* Aaron Smith, *The Internet's Role in Campaign 2008*, April 15, 2009, Pew Internet & American Life Project, *available at* http://pewresearch.org/pubs/1192/internet-politics-campaign-2008.

771 *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 130 (citing: 2007 Pew survey; *Governance Studies,* The Brookings Institution).

772 The political blogging phenomenon has been analyzed by a number of commentators over the years. For an overview of recent commentary, *see generally Special Issue: Blogs, Politics and Power*, 134 Public Choice 1-138 (2008), *available at* http://www.springerlink.com/content/l7p064672q84/?p=224ef5f9aabc48d5af057ec2c0f8670f&pi=14. In particular, one article focuses on the value of blogs vis-à-vis traditional political discourse (e.g., via the "mainstream" media). Among many other findings, the authors conclude that "Blogs…affect political debate by affecting the content of media reportage and commentary about politics. Just as the media can provide a collective interpretive frame for politicians, blogs can create a menu of interpretive frames for the media to appropriate." *See* Henry Farrell & Daniel W. Drezner, *The Power & Politics of Blogs*, 134 Public Choice 14, 22 (2008), *available at* http://www.springerlink.com/content/rm2051728x01278r/fulltext.pdf.

773 President Obama raised over $500 million via mostly small, online contributions. In particular: "3 million donors made a total of 6.5 million donations online adding up to more than $500 million. Of those

6.5 million donations, 6 million were in increments of $100 or less. The average online donation was $80, and the average Obama donor gave more than once." *See* Jose Antonio Vargas, *Obama Raised Half a Million Online*, Nov. 20, 2008, Washington Post – The Clickocracy, *available at* http://voices.washingtonpost.com/44/2008/11/20/obama_raised_half_a_billion_on.html.

[774] *Internet & Civic Engagement* at p. 7.

[775] *See* Huffington Post, http://www.huffingtonpost.com/; Politico, www.politico.com.

[776] *See* http://technorati.com/search/politics?language=n&media=blogs (search conducted on Sept. 25, 2009).

[777] *See* CitizenTube, http://www.citizentube.com/.

[778] *See* The Huffington Post, FundRace 2008, http://fundrace.huffingtonpost.com/ ("FundRace makes it easy to search by name or address to see which presidential candidates your friends, family, co-workers, and neighbors are contributing to.").

[779] *See* FactCheck.org, About Us, http://factcheck.org/about/ ("We …aim[] to reduce the level of deception and confusion in U.S. politics.").

[780] *See* EarmarkWatch.org, FAQ, http://www.earmarkwatch.org/faq/.

[781] *See Rise of Facebook as a Political Organizing Tool*, in The 14th Biannual Youth Survey on Politics and Public Service by Harvard University's Institute of Politics: Exeuctive Summary (April. 2008), *available at* http://www.iop.harvard.edu/Research-Publications/Polling/Spring-2008-Survey/Executive-Summary.

[782] *See, e.g.,* Zack Exley, *The New Organizers: What's Really Behind Obama's Ground Game*, Oct. 8, 2008, The Huffington Post, *available at* http://www.huffingtonpost.com/zack-exley/the-new-organizers-part-1_b_132782.html.

[783] For example, a number of recent protests (or "Tea Parties") against tax increases were coordinated via the Web. *See* Glenn Harlan Reynolds, *Tax Day Becomes Protest Day*, April 15, 2009, Wall St. J., *available at* http://online.wsj.com/article/SB123975867505519363.html ("So who's behind the Tax Day tea parties? Ordinary folks who are using the power of the Internet to organize. For a number of years, techno-geeks have been organizing "flash crowds" -- groups of people, coordinated by text or cellphone, who converge on a particular location and then do something silly, like the pillow fights that popped up in 50 cities earlier this month. This is part of a general phenomenon dubbed "Smart Mobs" by Howard Rheingold, author of a book by the same title, in which modern communications and social-networking technologies allow quick coordination among large numbers of people who don't know each other.").

[784] *See File Note Found: 10 Years after E-FOIA, Most Federal Agencies are Delinquent*, at p. 1, The National Security Archive, George Washington University (March 2007), *available at* http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB216/e-foia_audit_report.pdf.

[785] *See, e.g.,* Jerry Brito, *Hack, Mash, & Peer: Crowdsourcing Government Transparency*, 9 Colum. Sci. & Tech. L. R. 119, 123-127 (2008) (discussing how online government data is difficult to use) ("*Crowdsourcing Government*"); Darrell M. West, *State & Federal Electronic Government in the United States, 2008*, Government Studies at Brookings, Brookings Institution (2008), *available at* http://www.brookings.edu/~/media/Files/rc/reports/2008/0826_egovernment_west/0826_egovernment_west.pdf (assessing state and federal websites based on a variety of metrics, including readability and disability access) ("*State & Federal e-Government 2008*").

[786] *See* David Robinson et al., *Government Data and the Invisible Hand,* 11 Yale J. L. & Tech. 160, 161 (2009) ("*Government Data*").

[787] *Electronic Revolution* (discussing the promise of e-rulemaking generally and its potential to dramatically alter the traditional agency decision-making process); *cf*. Stuart Minor Benjamin, *Evaluating*

E-Rulemaking: Public Participation and Political Institutions, 55 Duke L.J. 893, 898 (2006) (arguing that "the uncertainties about the impact and desirability of e-rulemaking are sufficiently great that experimenting with e-rulemaking should proceed on a trial basis, in an attempt to gain greater empirical grounding before the government plunges into any particular set of changes to the rulemaking process.") ("*Evaluating E-Rulemaking*").

[788] *See* BETH SIMONE NOVECK, WIKI GOVERNMENT 34 (Brookings 2009) ("WIKI GOVERNMENT").

[789] *See* Press Release, *Live, from New York, It's NYC Government!* Sept. 24, 2009, The Office of New York City Councilmember Gale Brewer.

[790] *Crowdsourcing Government* at p. 124.

[791] *See* The White House, Issues: Technology, http://www.whitehouse.gov/issues/technology/.

[792] *See* Darrell West & Jenny Lu, *Comparing Technology Innovation in the Private and Public Sectors*, at p. 18, Governance Studies at Brookings, Brookings Institution (June 2009), *available at* http://www.brookings.edu/papers/2009/06_technology_west.aspx ("*Comparing Technology Innovation*").

[793] *Id.* at p. 2.

[794] *See* Michael Calabrese, *The End of Spectrum 'Scarcity,'* at p. 3-4, Working Paper # 25, The New America Foundation (June 2009), *available at* http://www.newamerica.net/files/Calabrese_WorkingPaper25_EndSpectrumScarcity.pdf (noting that the federal government owns nearly a quarter of all spectrum in the 300-3,000 MHz range).

[795] WIKI GOVERNMENT at p. 133 ("One important consequence of the shortcomings of public consultation is a reduction in the quality of data used to make government decisions. Despite transparency and participation legislation, the current paradigm for regulatory decision-making remains highly vulnerable to ideological bias and manipulation."); *see also* William Fenwick et al., *The Necessity of e-Government*, 25 Santa Clara Computer & High Tech L. J. 427, 447 (2009) (noting that "the goal [of e-government] is to minimize or eliminate delays and intermediaries between citizens or businesses and the government that increase the costs and slow down the delivery of government services.") ("*Necessity of e-Government*").

[796] *See* Mark LeVigne, *Electronic Government: A Vision of the Future That is Already Here*, 52 Syracuse L. Rev. 1243, 1248 (2002) (noting that "one of the visions of e-government is to break down these silos, integrating business processes, service programs, and streamlining information management.").

[797] *Comparing Technology Innovation* at p. 2.

[798] *FCC Broadband Taskforce Presentation - Sept. 29, 2009* at slide 128.

[799] *State & Federal e-Government 2008.*

[800] *See* FCC Chairman Julius Genachowski, *Remarks to the FCC Staff*, at p. 4, June 30, 2009, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-291834A1.pdf.

[801] *Crowdsourcing Government* at p. 123.

[802] Available at http://www.broadband.gov/.

[803] *Blogband Press Release*. The blog is *available at* http://blog.broadband.gov/.

[804] *See* OpenInternet.gov, About, http://www.openinternet.gov/about-open-internet.html.

[805] *See* Federal Web Managers Council, Who we Are, http://www.usa.gov/webcontent/about/council.shtml.

[806] *See Recommended Policies and Guidelines for Federal Public Websites Final Report of the Interagency Committee on Government Information Submitted to The Office of Management and Budget* (rel. June 9, 2004), *available at* http://www.usa.gov/webcontent/about/documents/icgi_report.html; *see also* WebContent.gov, Requirements and Best Practices, http://www.usa.gov/webcontent/reqs_bestpractices.shtml.

[807] *Government Data* at p. 162-163.

[808] *See, e.g.,* Massimo Calebresi, *Wikipedia for Spies: The CIA Discovers Web 2.0*, April 8, 2009, *available at* http://www.time.com/time/nation/article/0,8599,1890084,00.html.

[809] *Id.*

[810] *See Older Workers: Enhanced Communication among Federal Agencies Could Improve Strategies for Hiring and Retaining Experienced Workers*, at p. 37, GAO (Feb. 2009), *available at* http://www.gao.gov/new.items/d09206.pdf.

[811] *See Federal Research: Opportunities Exist to Improve the Management and Oversight of Federally Funded Research and Development Centers*, at p. 34, GAO (Oct. 2008), *available at* http://www.gao.gov/new.items/d0915.pdf.

[812]*See* USA Spending.gov, IT Dashboard, Analysis: Current Year, http://it.usaspending.gov/?q=content/current-year-fy2009-enacted.

[813] *See* Press Release, *Obama's Budget Obama's Budget Reveals Technology Spending Trends For Next Five Years,* July 9, 2009, INPUT, *available at* http://www.input.com/corp/press/detail.cfm?news=1427.

[814] Under the President's 2009 budget, funding to support interagency e-government initiatives will increase from $8 million in 2008 to $33 million by 2010. *See* The Fiscal Year 2010 Budget Appendix, p. 1123-1124, *available at* http://www.whitehouse.gov/omb/budget/fy2010/assets/appendix.pdf.

[815] President Obama has asked agency heads to cut $100 million in expenses over the next year. *See, e.g.,* Gregg Carlstrom, *Agencies Details $100 million in 2010 Budget Cuts*, July 28, 2009, Federal Times, *available at* http://www.federaltimes.com/index.php?S=4209558.

[816] *Comparing Technology Innovation* at p. 2.

[817] *See* Todd Spangler, *YouTube's Bandwidth Bill Estimated at $300 million for 2009*, Sept. 9, 2009, Multichannel News, *available at* http://www.multichannel.com/article/339947-YouTube_s_Bandwidth_Bill_Estimated_At_300M_For_2009.php. Some, however, have posited that this amount could be closer to zero. *See* Ryan Singel, *YouTube's Bandwidth Bill is Zero. Welcome to the New Net*, Oct. 16, 2009, Wired.com, *available at* http://www.wired.com/epicenter/2009/10/youtube-bandwidth/.

[818] *See* Robert McMillan, *Government Eyes Big Savings with First Cloud Service*, Sept. 16, 2009, InfoWorld, *available at* http://www.infoworld.com/d/cloud-computing/government-eyes-big-savings-first-cloud-service-916.

[819] *See* Bev Godwin et al., *Social Media and the Federal Government: Perceived and Real Barriers and Potential Solutions*, WebContent.gov, Using Technology (Dec. 2008), *available at* http://www.usa.gov/webcontent/documents/SocialMediaFed%20Govt_BarriersPotentialSolutions.pdf (noting that a variety of laws – from procurement policies to the Administrative Procedure Act – are outdated vis-à-vis social media) ("*Social Media & the Federal Government*").

[820] P.L. 89-487, 80 Stat. 250 (1966), codified at 5 U.S.C. 552 (1996).

[821] *See* Michael Herz, *Law Lags Behind: FOIA and Affirmative Disclosure of Information,* 7 Cardozo Pub. L. Pol'y & Ethics J. 577, 580 (2009).

[822] WIKI GOVERNMENT at p. 121.

[823] *See* Robert Ratish, *Democracy's Backlog: The Electronic Freedom of Information Act Ten Years Later*, 34 Rutgers Computer & Tech. L.J. 211, 212 (2007).

[824] *Id.* at 222.

[825] P.L. 79-404, 60 Stat. 238, codified at 5 U.S.C. 1001–1011.

[826] WIKI GOVERNMENT at p. 131.

[827] P.L. 107-347, 116 Stat. 2899, codified at 44 U.S.C. 101.

[828] *Id.* at Sect. 206.

[829] WIKI GOVERNMENT at p. 139.

[830] *Crowdsourcing Government* at p. 124. However, the FCC recently announced the launch of an upgraded version of its Electronic Comment Filing System, which will includes, among other new features, "the ability for users to file multiple documents to multiple rulemakings in a single submission; advanced search and query of rulemakings; ability to extract comments; RSS feeds; and the ability to export data results to Excel or PDF formats." *See* Press Release, FCC Announces the Public Launch of the Electronic Comment Filing System (ECFS) Version 2.0, Oct. 14, 2009, FCC, *available at* http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-293952A1.pdf.

[831] P.L. 104-13, 109 Stat. 163 (1995), codified at 44 U.S.C. 3501-20.

[832] *Id*.

[833] WIKI GOVERNMENT at p. 122.

[834] *Social Media & the Federal Government* at p. 3.

[835] *Id.*

[836] *IRS E-file Record – 2009*

[837] *Internet & Civic Engagement* at p. 4.

[838] *Id*. at p. 4-5.

[839] *Id.* at p. 5.

[840] *See* Anand Giridharadas, *Athens on the Net*, Sept. 12, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/09/13/weekinreview/13giridharadas.html?scp=1&sq=athens%202.0&st=cse.

[841] *Id.*

[842] *Id.*

[843] *See* Saul Hansell, *Ideas Online, Yes, but Some Not So Presidential*, June 22, 2009, N.Y. Times, *available at* http://www.nytimes.com/2009/06/23/technology/internet/23records.html,.

[844] WIKI GOVERNMENT at p. 174-177.

[845] *Id.* at p. 109.

[846] *See* Apps for Democracy, About, http://www.appsfordemocracy.org/about/.

[847] *Id.*

[848] *See* Apps for Democracy: Community Addition, http://www.appsfordemocracy.org/dc-awards-10000-final-prize-to-iphone-facebook-app-combo/.

[849] *Evaluating E-Rulemaking* at p. 896-897.

[850] *Cf. Evaluating E-Rulemaking* at p. 904-908 (observing that the costs associated with high levels of public participation in e-rulemaking could hinder the rulemaking process and increase the risk that good ideas are overlooked during the review process).

[851] *Id.* at p. 921.

[852] *See* Electronic Privacy Information Center, Cookies, http://epic.org/privacy/internet/cookies/.

[853] *See* Michael Fitzpatrick and Vivek Kundra, *Federal Websites: Cookie Policy*, July 24, 2009, White House OSTP Blog, *available at* http://blog.ostp.gov/2009/07/24/cookiepolicy/ (citing OMB Director Memo M-00-13, later updated by M-03-22, *available at* http://blog.ostp.gov/2009/07/24/cookiepolicy/#TB_inline?height=220&width=370&inlineId=tb_external).

[854] *See* Michael Fitzpatrick and Vivek Kundra, *On Cookies*, Aug. 11, 2009, White House OSTP Blog, *available at* http://blog.ostp.gov/2009/08/11/the-way-the-cookie-crumbles/.

[855] *See* Spencer S. Hsu and Celia Kang, *Obama Web-Tracking Proposal Raises Privacy Concerns,* Aug. 11, 2009, Wash. Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/08/10/AR2009081002743.html (quoting American Civil Liberties Union spokesman Michael Macleod-Ball).

[856] *Id.*

[857] *Id.* (noting that The current ban on cookies, according to senior OMB officials, applies only to federal agencies and not third parties. That means that a visitor to http://www.whitehouse.gov, for example, isn't tracked by the government, but information about a user who clicks on a YouTube video on the site could be tracked by Google, according to a source at the company with knowledge of the partnership with the Obama administration.").

[858] *See* Kenneth A. Bamberger and Deirdre K. Mulligan, *Privacy Decisionmaking in Administrative Agencies*, 75 U. Chi. L. Rev. 75, 75-76 (2008).

[859] *See* Ellen Nakashima, Brian Krebs & Blaine Harden, *U.S., South Korea Targeted in Swarm Of Internet Attacks*, July 9, 2009, Wash. Post, *available at* http://www.washingtonpost.com/wp-dyn/content/article/2009/07/08/AR2009070800066.html.

[860] *See* Ben Bain, *Information-Sharing Platform Hacked*, May 13, 2009, Federal Computer Week, *available at* http://www.fcw.com/Articles/2009/05/13/Web-DHS-HSIN-intrusion-hack.aspx.

[861] *See* Siobhan Gorman, *Electricity Grid in U.S. Penetrated by Spies*, April 8, 2009, Wall St. J.

[862] *Online Shopping* at p. i.

[863] *White House Report.*

[864] *See* Jaikumar Vijayan, *Google Pursues Government Biz: Security Concerns Loom*, Sept. 17, 2009, Business Week, *available at* http://www.businessweek.com/technology/content/sep2009/tc20090917_122270.htm ("*Google Pursues*").

[865] 44 U.S.C. § 3541, et seq.

[866] *Google Pursues* (citing a study by Unisys Corp. that found "Of the 312[survey] respondents, about 51% cited security and data privacy concerns as the biggest impediment to adopting cloud services.").

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