

**High-Speed Internet Access in Hanover County:
From Innovation to Expectation**

September 2010

About the High-Speed Internet Group

The High-Speed Internet Group (HSIG) is an ad hoc citizens' committee convened by Hanover County South Anna District Supervisor John Gordon in the summer of 2010. The HSIG was convened to explore what options might be available to the county to address the lack of reliable high-speed Internet access in rural areas of Hanover County. The intent of the group is to:

1. Describe the importance and impact of high-speed Internet availability
2. Research and report on the current status of high-speed Internet service availability to residents and businesses in Hanover County, particularly those in rural areas of the county
3. Explore potential strategies for achieving ubiquitous high-speed Internet coverage in Hanover County
4. Suggest recommendations for the future

Pursuant to these objectives, this white paper was submitted to South Anna District Supervisor John Gordon on September 20, 2010.

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Definitions for terms used in this report

Broadband: This term is used synonymously with the term high-speed Internet. See the definition for high speed Internet below.

DSL: Digital subscriber line (DSL) service is Internet connection technology delivering high bandwidth over ordinary telephone lines. Typically DSL providers offer 128 kilobits per second speeds for uploading and 1.5 megabits per second for downloading. The other phone line-based service is the cheaper and slower dial-up, while cable and satellite Internet services are much faster but also cost more. DSL can provide up to 6 or 8 mbps under ideal conditions, but usually is much slower. DSL typically does not even reach the 1.5 mbps most providers advertise, because the quality of telephone lines and other equipment has not been upgraded to accommodate higher speeds. In rural areas with lines that are decades old, DSL connection can be as slow as 200 kbps, which is still much faster than the 56 kbps maximum of dial-up modems. In those same rural areas, dial-up may only provide around 28 kbps. (Definition from http://www.ehow.com/about_4676286_what-definition-dsl.html)

High-speed Internet: In this report, this term is abbreviated HSI used synonymously with the term broadband. There are many definitions of “high-speed Internet access.” As the term denotes, its definition is based on the speed at which information can be transferred across the Internet connection. This speed affects the ability of the user to view web pages quickly, access video or audio content, manage large files, etc. There are two speeds to consider: speed from the user’s computer to other destinations on the Internet (upstream or upload speed), and speed from other sources on the Internet to the user’s computer (downstream or download speed). In July 2010 the Federal Communications Commission’s *Sixth Broadband Deployment Report* re-defined broadband speeds to be 4 megabits per second (Mbps) downstream and 1 Mbps upstream, noting that this “is the minimum speed required to stream a high-quality – even if not high-definition – video while leaving sufficient bandwidth for basic web browsing and e-mail, a common mode of broadband usage today” (see http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-10-129A1.doc, p. 4). This report adopts that definition. As levels of performance continue to increase, this definition undoubtedly will be updated from time to time.

Internet access: Any technology for accessing the Internet using any wired or wireless data stream at any speed. This would include, for example, dialup, mobile devices, public computers and kiosks, broadband connections, and so forth.

Reliability: This concept is less precise, and its measurement may depend on the experiences and perceptions of the end user. For many end users, it means having a connection that does not cut off or re-set itself too frequently. Understanding reliability implies getting feedback from users.

Executive Summary

Citizens in Hanover County have approached county officials periodically about the lack of reliable Internet access in rural areas of the county. In spring 2010, South Anna District Supervisor John Gordon convened the High-Speed Internet Group (HSIG), an ad hoc citizens' committee. The HSIG was charged to examine the current state of HSI in Hanover County and to explore what options might be available to the county to address the lack of reliable high-speed Internet access in rural areas of the county. This report aims to:

1. Describe the importance and impact of high-speed Internet availability
2. Research and report on the current status of high-speed Internet service availability to residents and businesses in Hanover County, particularly those in rural areas of the county
3. Explore potential strategies for achieving ubiquitous high-speed Internet coverage in Hanover County
4. Suggest recommendations for the future

Importance and impact of HSI

High-speed Internet (HSI) access, like many other technologies in human history, has moved from being a new luxury to being a basic expectation of modern society. This evolution from innovation to expectation has occurred more rapidly for the Internet than it has for almost any other innovation. Today, 80% of American adults report using the Internet and roughly 60% report having access to broadband Internet service at home. Cost is the most frequently reported reason for dial-up Internet users to not have broadband Internet connections at home, while lack of interest and lack of available access were the most frequent reasons given by non-users for not using the Internet at home.

The issues of cost and access created the “digital divide” in the mid-1990s, when minorities – particularly those in the rural South and the central cities of the northeastern United States – were in danger of being left out of the personal computing and Internet revolutions. Many of those gaps still exist, but they have been narrowed significantly. Today’s discussion of the digital divide focuses on the lack of access in rural areas and the costs to establish connections over “the last mile” to widely separated homes.

Lack of access to HSI service prevents full participation, or imposes significant burdens on households for their participation, in a variety of critical activities:

1. Primary and secondary education, in which HSI is now an expectation
2. College-level and professional training
3. Telework opportunities, which enhance workplace productivity and reduce traffic and pollution
4. Economic development, particularly for small business seeking to leverage the power of microcomputing and the Internet
5. Governmental transactions and citizen engagement with government

6. Health care
7. Commercial activities including banking, buying and selling, researching purchases, and tracking one's status in "most valued customer" benefits programs

Current status of high-speed Internet service availability to residents and businesses in Hanover County

Collecting reliable information is difficult. Commercial providers are not always at liberty to share detailed information because it is proprietary and making it public could undermine their competitive positions. In addition, information exists at different levels. Coarse information can be obtained showing areas of the county in which HSI coverage is said to exist, but hour-to-hour performance at specific locations in those areas may vary significantly from the performance levels that "should" exist. Information at the level of the individual user may differ from the large-scale pictures that exist. Anecdotal information can reveal exceptions to the broad picture. New developments in technology are occurring frequently. Numerous technologies compete for bringing HSI to rural customers. Gathering all of this information into an integrated picture that systematically incorporates evidence from individual users is a task that goes beyond the scope of this ad hoc committee's expertise and resources. However, mapping efforts are underway in many localities, and the eCorridors effort at Virginia Tech may prove to be a good resource for Hanover County.

Despite these difficulties, existing information and new information obtained from county and private sources confirms what seems to be known informally – HSI access is good in most parts of the Suburban Services Area, but it can be frustratingly patchwork not only in more rural areas of the county but also in areas that lie tantalizingly close to good HSI access.

Potential strategies for achieving ubiquitous high-speed Internet coverage in Hanover County

The broad and changing array of technological solutions to HSI access exceed the capacity of the ad hoc committee to recommend any one approach for Hanover County. The committee's research can only provide a sampler of the wide variety of approaches that have been taken in other localities to address the issue of providing ubiquitous HSI. These approaches might be thought of as lying along a continuum encompassing pure free market solutions or incentivizing the private sector ("market-based" solutions), establishing public/private partnerships (a hybrid solution), and building publicly-funded infrastructure that private companies pay to use or having government be the builder of the infrastructure and the provider of the Internet services ("municipal broadband" solutions).

Goochland County contracted a study to determine the feasibility of county-wide broadband as discussed in other parts of this report. No action has been reported to date on the findings in that report.

Caroline County has a corridor program in place that utilizes towers for wireless systems. This approach gives the appearance of broad coverage but does not address dead zones and interference. The county has a standing technology committee that serves as an example for the HSI's first recommendation (below).

Louisa County has no program in place or reportedly underway. Louisa appears to be still looking for solutions to get broadband to public service and school sectors.

The respective Boards of Supervisors of Essex, Gloucester, King & Queen, King William, Mathews and Middlesex Counties will each conduct a public hearing to receive public comment on and to consider the proposed adoption of a concurrent resolution to create the Middle Peninsula Broadband Authority to facilitate the deployment of high speed Internet and communications services to residents, businesses, institutions and governmental agencies throughout the unserved and underserved portions of each county on the Middle Peninsula.

Nationally, the majority of broadband expansion programs that have realized success were done through significant public funding provided by economic stimulus monies or special funds, such as the Tobacco Indemnification Program in Southside Virginia and North Carolina. Programs funded and managed entirely at the local level are more difficult to locate and research. They often provide little detailed information on the actual service area and use of broadband technology. Getting on the front end of special grants or Federal incentives appears to be a key to any success, though. Public/private partnerships (the “hybrid approach” on the continuum of approaches described earlier) seem to be fruitful.

Good resources in this area include the Virginia Office of Telework Promotion and Broadband Assistance, and the Connected Nation program.

Recommendations

This white paper presents just a sampler of the numerous technical, regulatory, economic, demographic, and policy issues that impact access to high-speed Internet service in the U.S. It is clear that the breadth and complexity of these issues far exceed the time and expertise available to this HSIG. However, there are several recommendations that seem just as clearly advisable for the HSIG to make at this point, based on the information in this white paper.

1. Establish a standing Technology Committee

The HSIG believes that forming a standing Technology Committee is essential if Hanover County is to address the issues that are sketched in this white paper. A standing committee would be able to pursue and sustain research and policy formation regarding HSI. Such a committee must include significant citizen representation. It also must include representation from the county administration, local elected officials, and telecommunications providers serving the county or other localities in the region. Many of the other recommendations presented below could be pursued without such a committee, but would almost certainly be more effectively pursued through the actions of a standing Technology Committee.

2. Map actual user-level access to high-speed Internet service in the county

This would allow the county to move from anecdotal evidence to richer and denser information about broadband access in specific geographic locations. One of the greatest challenges in addressing access to HSI is to accurately map where there are problems with access from the user perspective. There are numerous mapping projects in progress around the U.S. The county should identify a mapping partner and pursue a vigorous effort to map Internet access speeds in rural areas of the county. A promising mapping partner in Virginia may be the eCorridors project at Virginia Tech (<http://www.ecorridors.vt.edu/maps/broadbandmap.php>). The HSIG recommends that the county discuss with eCorridors a concerted effort to lead county citizens to map their access using eCorridors in exchange for county access to the detailed county data from eCorridors.

3. Investigate grant and foundation funding for the expansion of HSI in Hanover County

There are numerous federal and foundation programs offering money to assist with the expansion of HSI. Hanover County appears to be too densely populated and have too many households with existing access to HSI to qualify for most funding that is designated for HSI expansion in rural areas without any service at all¹. But grant and foundation funding should be more thoroughly investigated before assuming that it is not available to areas like Hanover County. A good map showing where economic recovery funds have been spent can be found at <http://www.usda.gov/recovery/map>.

4. Explore public/private collaborations

Similarly to the electricity co-ops that were instrumental in bringing electric service to rural America, broadband co-ops seem to be growing in popularity and effectiveness. The county should explore the pros and cons of forming a broadband co-op or broadband authority. This would include establishing relationships with the business sector, local and state elected officials, and local or regional efforts already underway.

5. Obtain citizen input in a more systematic fashion

The HSI SIG spent time exploring ways to engage citizens systematically about HSI issues to inform this paper, but there were insufficient resources and time available to do so. In addition to the mapping effort recommended above, the county should pursue citizen input on HSI issues through one or more of the following means: an insert or article in the quarterly county newsletter; a question or two added to the periodic county citizen satisfaction survey; a series of public meetings; an exploratory survey conducted using in-house resources; a formal survey; or other means not suggested here.

6. Establish a relationship with the Virginia Office of Telework Promotion and Broadband Assistance

The Virginia Office of Telework Promotion and Broadband Assistance is a state agency that is dedicated to broadband expansion and offers online resources to help communities and businesses get connected. See <http://www.otpb.vi.virginia.gov/index.shtml> for more.

7. Establish relationships to help with HSI expansion in Hanover County or the wider Richmond region

In addition to the relationships with Hanover County's state legislators implied in other recommendations, the county should work to create common cause with other localities and their representatives specific to expansion of HSI service in Hanover County or the wider Richmond region.

8. Stay up to date on technological advances

The wide range of technologies available today will be exceeded by future developments. It is difficult to say if there will ever be a one-size-fits-all solution to expanding HSI in rural areas of

¹ The FCC designates only Amelia, Appomattox, Bath, Craig, Highland and Surry counties, and Bedford City, as unserved broadband areas in Virginia – that is, “geographical areas not served by any provider of advanced telecommunications capability.” (Federal Communications Commission, *Sixth Broadband Deployment Report*, July 20, 2010, Appendix C, pp. 66-67.)

the county. The county should stay up to date on technological advances that might impact its decisions concerning access to HSI.

9. Explore further use of the county's 911 tower system to achieve ubiquitous HSI coverage

This infrastructure is already being used to provide a platform from some vendors who lease space. It may be useful in extending coverage further, through additional leases or other arrangements.

10. Explore the feasibility of a contract for countywide broadband coverage similar to the franchising agreement for cable television.

Such a franchising agreement would establish a de facto monopoly provider for Internet service for all county households, presumably with the advantage of extending coverage throughout the county.

11. Explore adding HSI access to developers' proffers for new construction in Hanover County.

To the extent that this approach would be feasible and legal, it may provide an effective way to create positive momentum or critical mass for widespread HSI.

12. Explore using the county's web site, members of a standing Technology Committee, or other means to provide citizen information and consumer education about HSI in Hanover County.

It would be useful to provide information about coverage, services offered by various providers and future plans for HSI in Hanover County in a more centralized fashion. Citizens and potential consumers might find this to be a more effective way to get oriented to the choices they have and to participate in continuing developments in HSI. The county website would be a natural location for this information for people who already have access to the Internet. Members of a standing Technology Committee might serve as first points of contact in their districts for citizens with questions or concerns about HSI.

I. High-Speed Internet – An Introduction

From innovation to expectation

Successful technologies tend to follow a predictable pattern of development. They start as new and disruptive innovations that may appear to be passing fads, expensive status symbols or even dangerous challenges to the status quo. They become more widespread as the necessary infrastructures and societal behaviors grow to support the production and use of the innovation. Early demand may create temporary scarcities or high prices, but sustained demand generally yields increasing performance at decreasing prices as the production and use of the innovation move from experimental to routinized operations. Eventually, what was once innovative and disruptive becomes ubiquitous and expected, and those without access to the innovation may be excluded from economic opportunities or from other important aspects of our society. Examples of successful technologies that followed this course include cellular telephones, microcomputers, television and electricity. Even the printing press was at one time a radical new technology.

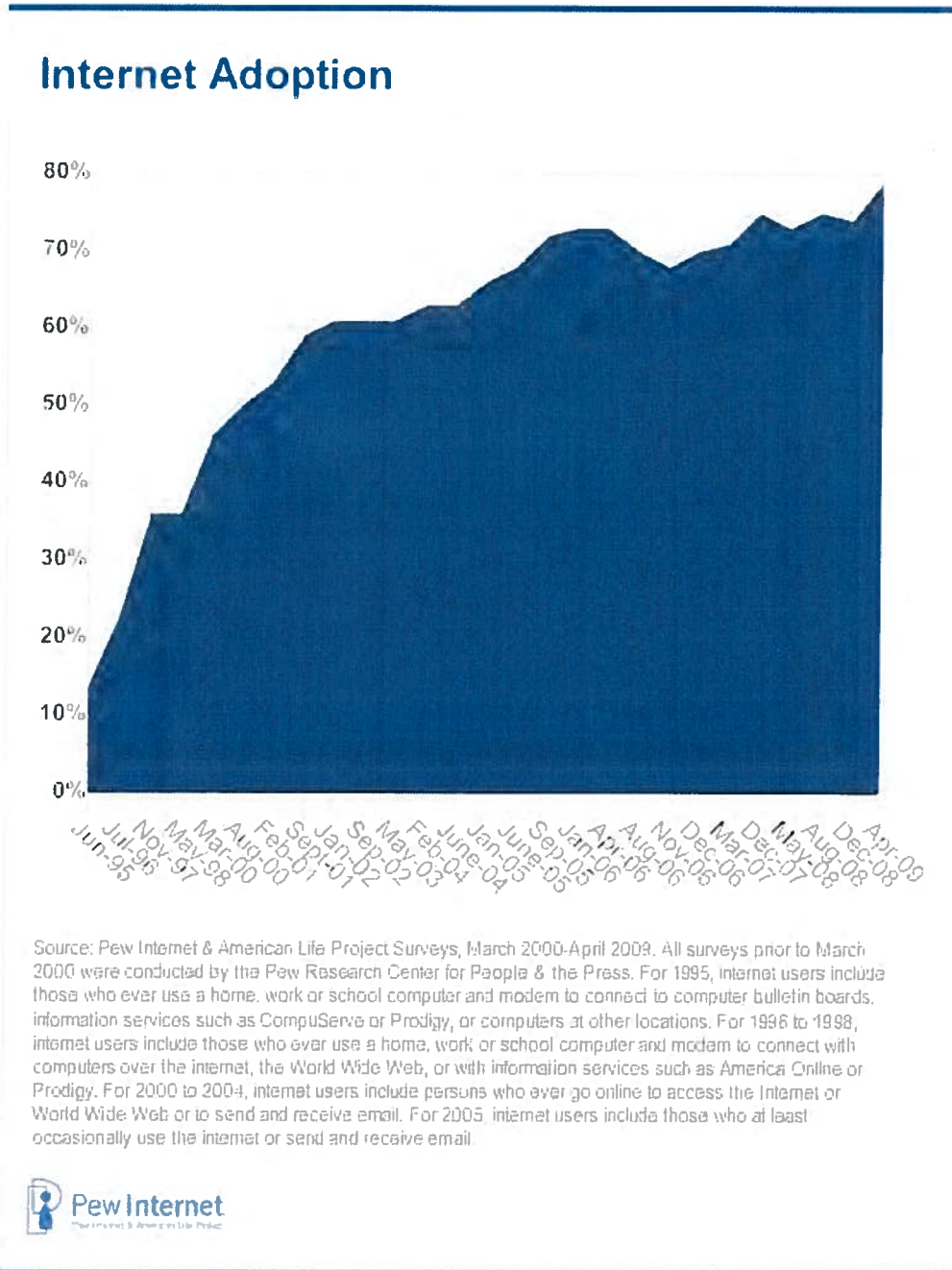
This broad view of innovation sets the context for this white paper about high-speed Internet access in Hanover County, Virginia. In the last fifteen years, worldwide, the Internet has significantly altered interpersonal communications, use of leisure time, news media, business, education, science, government, health care and almost any other endeavor one would care to name. The request for this paper, similar activities in other localities in Virginia, and numerous existing programs to address disparities in Internet access all bear witness to the fact that Internet access has evolved to become a fundamental expectation in our modern society.

Trends in access to the Internet

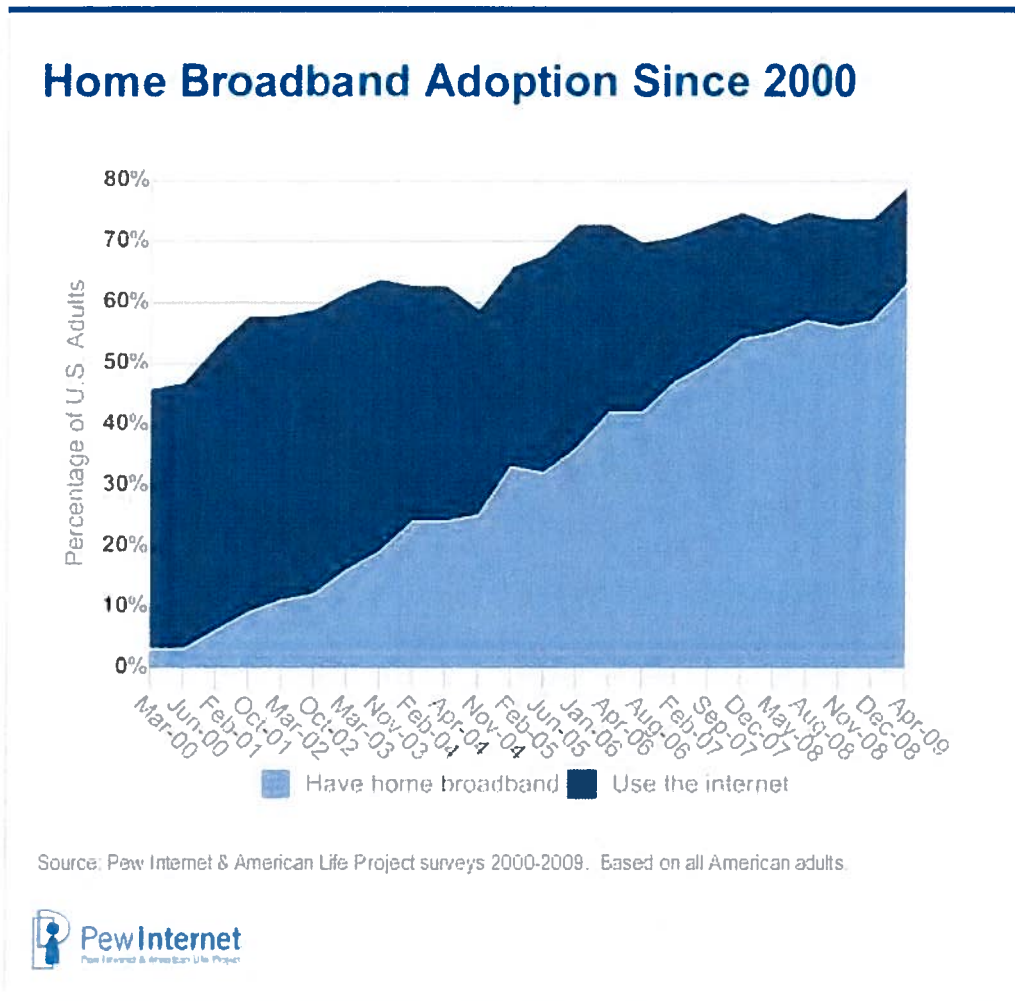
Internet access may be the fastest-growing innovation in history. The Pew Research Center has tracked how the Internet is impacting our society through its series of surveys conducted as part of the Pew Internet & American Life Project. From June 1995 to January 2002, the percentage of American adults who reported using the Internet rose from about 15 percent to roughly 60 percent (Figure 1) and by April 2009 it was nearly 80 percent (Figure 2). From March 2000 through April 2009, broadband Internet connections for home use increased from about 3 percent to roughly 60 percent (Figure 2)².

² Figures accessed at <http://pewinternet.org/Reports/2010/Home-Broadband-2010.aspx>

Figure 1: Internet adoption among American adults, 1995-2009



Source: Pew Internet & American Life Project, accessed at <http://www.pewinternet.org/Static-Pages/Trend-Data/Internet-Adoption.aspx>

Figure 2: Home broadband adoption, 2000-2009

Source: Pew Internet & American Life Project, accessed at <http://www.pewinternet.org/Static-Pages/Trend-Data/Home-Broadband-Adoption.aspx>

Disparities in access to the Internet

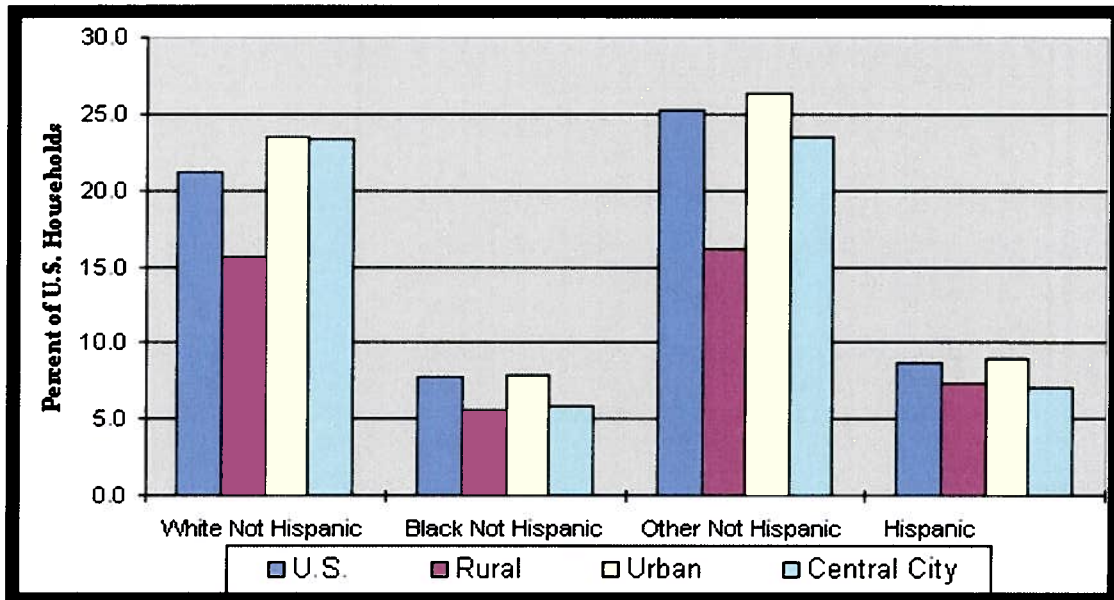
In the earlier days of Internet expansion in the mid-1990s, the typical Internet user was male, white and fairly well-off financially³. There were concerns about a “digital divide” that was closely linked to socioeconomic status, race and geography. The digital divide was initially measured by ownership of a computer in the home and presence of a telephone in the home, as access to the Internet in the mid- to late 1990s was achieved primarily by dialing up using a modem. As early as 1995, national survey data established that poor and minority Americans in central cities and rural areas – particularly those in the central cities of the Northeast and the rural areas of the South – were significantly lagging other Americans in Internet access⁴ as

³ Pew Internet & American Life Project, 2000 (p. 2), accessed at http://pewinternet.org/~media/Files/Reports/2000/New_User_Report.pdf

⁴ National Telecommunications and Information Administration, *Falling Through the Net*, July 1995, accessed at <http://www.ntia.doc.gov/ntiahome/fallingthru.html>

shown in Figure 3. Even though all groups posted gains in online access from 1994 to 1997, the gap actually widened during that time in most demographic categories.

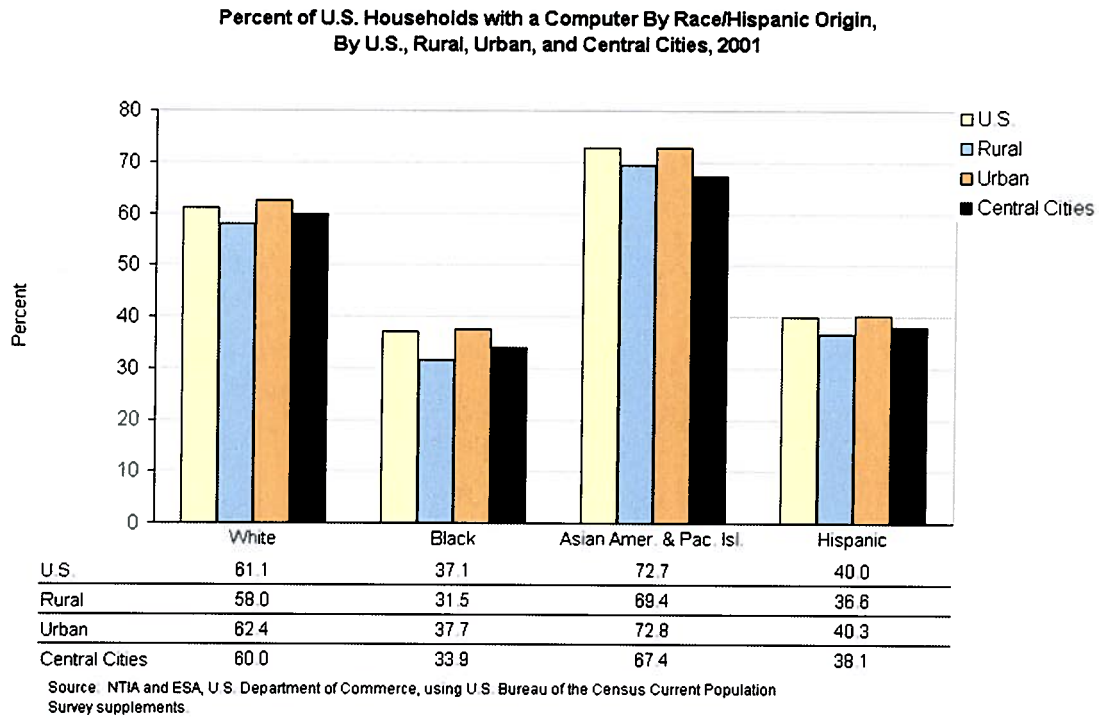
Figure 3: U.S. Households with Online Access by Race/Origin and Geography, 1997



Source: National Telecommunications and Information Administration, *Falling Through the Net II: New Data in the Digital Divide*, July 1998, accessed at <http://www.ntia.doc.gov/ntiahome/net2/charts.html>.

The digital divide persisted through the first decade of the 21st century. In 2001, as measured by ownership of a computer at home, minorities still lagged (Figure 4).

Figure 4: Home computer ownership, 2001



Source: National Telecommunications and Information Administration, accessed at <http://www.ntia.doc.gov/ntiahome/dn/hhs/ChartH3.htm>

This digital divide has been reduced, especially in terms of race/ethnicity, but it has not been erased. The Pew Internet & American Life Project reported that 63% of whites but only 46% of African-Americans had broadband access in 2009, while 67% of whites and 56% of African-Americans had broadband access in 2010⁵. There are still large differences in broadband adoption across different demographic groups that have serious implications for our society (see Table 1).

Table 1: Demographic Trends in Broadband Access, 2009-2010

	2009	2010	Percentage point change, 2009-2010	Percent change, 2009-2010
All adults	63%	66%	3	5%
Gender				
Male	64	66	2	3%
Female	63	65	2	3%
Age				
18-29	77	80	3	4%
30-49	72	75	3	4%
50-64	61	63	2	3%
65+	30	31	1	3%
Race/Ethnicity				
White (non-Hispanic)	65	67	2	3%
Black (non-Hispanic)	46	56	10	22%
Hispanic (English-speaking)	68	66	-2	-3%
Education				
Less than high school	30	33	3	10%
High school grad	52	54	2	4%
Some college	71	76	5	7%
College graduate	83	86	3	4%
Household income				
Less than \$30,000	42	45	3	7%
\$30,000-\$49,999	62	67	5	8%
\$50,000-\$74,999	80	79	-1	-1%
\$75,000+	85	87	2	2%
Geography				
Rural	46	50	4	9%
Non-rural	67	70	3	4%
Source: Pew Research Center's Internet & American Life Project, April 29-May 30, 2010 Tracking Survey. N=2,252 adults 18 and older. From <i>Home Broadband 2010</i> , accessed at http://pewinternet.org/Reports/2010/Home-Broadband-2010.aspx				

⁵ Pew Internet & American Life Project, 2010 (p. 2), accessed at <http://pewinternet.org/Reports/2010/Home-Broadband-2010.aspx>

Today, discussions about disparities in Internet access frequently focus on a rural-urban divide created by lack of physical access to high-speed connections.

According to the Pew Center, in 2007 cost was the most frequently stated reason for dial-up users to not have broadband Internet connections at home, but lack of interest and lack of available access were the most frequent reasons given for not using the Internet at home by non-users. See Table 2 below.

Table 2: Reasons for not having a broadband Internet connection, 2007 and 2010

What would it take to get you to switch to broadband? (asked of those with dial-up – 9% of all adults)		
Response	2007 only	
	% of dial-up users	% of all adults
Price must fall	35	3.2
Nothing would get me to switch	19	1.7
Don't know	16	1.4
It would have to become available where I live	14	1.3
Other	11	1.0

What is the MAIN reason you don't use the Internet or e-mail? (asked of non-users – 25% of all adults)				
Response	2007		2010	
	% of non-users	% of all adults	% of non-users	% of all adults
Not interested in getting online	33	8.3	35	7.4
Can't get access	13	3.3	6	1.3
Difficult	9	2.3	9	1.9
Other	9	2.3	9	1.9
Too expensive	7	1.8	10	2.1
Too busy/no time	7	1.8	6	1.3
Waste of time	7	1.8	7	1.5
Don't have a computer	4	1.0	12	2.5
Too old to learn	3	0.8	4	0.9
Physically unable	3	0.8	2	0.4

Source: The Internet and the American Life Project conducted by the Pew Research Center, 2007, <http://www.pewinternet.org/Infographics/Reasons-people-do-not-have-home-broadband.aspx> and *Home Broadband 2010*, accessed at <http://pewinternet.org/Reports/2010/Home-Broadband-2010.aspx>

These data indicate that there are probably four dimensions that affect whether an individual has high-speed Internet access at home.

1. **Physical:** A high-speed connection has to be physically available to the individual's home. It has to actually perform at high speeds and be reliable enough to warrant paying for it.
2. **Economic:** The cost of the service must be affordable. In addition, the cost must be perceived as "worth it."
3. **Social:** An individual is probably more likely to use the connection if there is a social environment or network that supports using the connection. This could include informal social networking among friends or acquaintances, formal or professional networking, the

impact of legal or political systems, popular culture, etc. At a minimum, an individual is probably not less likely to connect as long as there are no strong social sanctions that discourage connection.

4. Personal: Personal preferences will also impact the decision to use a high-speed connection.

It seems reasonable to “borrow” national data to help understand what the situation might be in Hanover County. Hanover County’s 471 square miles encompass more densely developed suburban and village-like areas as well as rural areas, the county’s demographics are not strongly at odds with national statistics, and the same mechanisms that affect use of high-speed Internet connections in other areas of the nation should apply in Hanover County as well (although perhaps in different proportions than they do nationally).

A more detailed discussion of high-speed Internet coverage in Hanover County is presented later in this report, but it is important to present in this introduction the impacts of lack of access to high-speed Internet connections.

Impacts of lack of access to high-speed Internet connections

In Hanover County, citizens have expressed concern about lack of reliable high-speed Internet access in more rural areas of the county. The national data presented earlier illustrate the fact that rural areas lack access. The following anecdotal examples illustrate the increasing importance of access to high-speed Internet service.

1. Martin’s Food Stores made changes to the FuelPerks! plan formerly offered at Ukrops stores in the Richmond area. The previous plan provided users with an update on their current FuelPerks! balance at the bottom of the grocery receipt. Now, customers can check their balance only by going online.
2. World Financial Network Bank is a financial company offering store credit cards to popular retail outlets including Ann Taylor, Victoria’s Secret, J Crew, and others. The company now charges customers \$2.00 per month to receive a paper copy of their monthly statement while offering free emailed electronic copies.
3. United Healthcare no longer offers a printed booklet describing the terms and details of their coverage. A call to customer service will simply result in a referral to their website.
4. The Virginia Department of Motor Vehicles now offers a \$1.00 discount for online transactions including license and vehicle renewals while charging \$5.00 extra for in-person visits. (There are no discounts or extra charges for transactions carried out by mail or telephone.)

Far beyond high-speed Internet access being a mere convenience, residents and county leadership have recognized some significant advantages that would accrue if there were widespread reliable high-speed Internet access throughout Hanover County:

1. Education: Opportunities for children in the public schools and for adult education are heavily reliant on high-speed Internet access. Student assignments and communication with teachers in the Hanover County Public Schools are increasingly dependent on high-speed Internet access. Households without access must arrange for their children to do homework at public libraries, or get to school early or stay late to use computers there, at a cost of travel time and flexibility of scheduling. Parents may miss important

communication unless they have employment situations that are flexible and “wired” enough to allow them to monitor e-mail from work. These issues represent a growing difference in educational opportunities – and possibly outcomes – within the county.

2. The growing availability of online training and for-credit college classes depends on high-speed Internet access. County residents without such access are excluded from these professional development and educational opportunities unless they travel to facilities with such access.
3. Telework: This is a concept that is gaining widespread acceptance for several reasons. Telework means that employees fulfill their job duties from home using their high-speed Internet connections. This may include the ability to access files or other computer resources on the employer’s network as if the employee were physically in the office; telecommunication by telephone, e-mail or interactive conferencing; creating reports or other products; and maintaining or troubleshooting information technology infrastructure, computer programs, web pages and other applications. As such, it represents a societal behavioral change that depends on high-speed Internet access. According to the Virginia Office of Telework Promotion and Broadband Assistance, some of the advantages of telework are:
 - a. Increased productivity
 - b. Lower business operating costs (e.g., reduced real estate costs)
 - c. Increased employee morale⁶
 - d. Reduced costs associated with employee recruitment and retention
 - e. Improved continuity of operations plans in the event of a natural disaster or other emergency
 - f. Accommodation of persons with disabilities who otherwise might not be able to work at the main facility
 - g. Reduced commuter traffic and road congestion
 - h. Reduced environmental impacts⁷

The ability to participate in telework programs because high-speed Internet is available in an employee’s home area may also be thought of as quality of life issue for the county. (For one example, see the letters to the editor in the appendix to this report.) In addition, section 2.2-2817.1 of the Code of Virginia calls for 20% of the Commonwealth’s eligible workforce to be participating in alternative work schedules or telework by 2010.

Hanover County residents without high-speed Internet access are unable to take advantage of telework in most cases.

4. Economic development: High-speed Internet access is a critical piece of infrastructure for businesses large and small. Reliable high-speed Internet access throughout Hanover County would have the following economic development advantages:
 - a. Wider eligibility for residents to run small businesses from home if they require high-speed Internet access. This would increase the potential base of small

⁶ Presumably, improved morale would result from better work/life balance, eliminating some stressful commute time, or other factors.

⁷ Presumably, reduced environmental impacts would result from less pollution, less reliance on oil, fewer new roads, etc.

business owners in the county and support the growth of community-based businesses.

- b. A reliable high-speed Internet infrastructure in place at large-scale business or mixed-use developments could be a competitive advantage in the county's ongoing efforts to keep tax rates low by balancing business/commercial and residential uses.
- c. As access to reliable high-speed Internet access becomes more of an expectation, residential real estate without the possibility of that access may sell more slowly or at lower prices than would comparable homes with high-speed Internet access.

Hanover County residents without high-speed Internet access are left out of these economic development opportunities.

- 5. Health: The Internet has become an important source of health information for many consumers and patients, both as a source of information about health care practitioners and as a mechanism for supporting communities of interest regarding specific diseases or health conditions. Those without Internet access cannot make use of these resources.
- 6. Government: Many transactions between county residents and county government can be conducted by Internet. High-speed Internet access may also afford a variety of opportunities for citizen engagement. Citizens without high-speed Internet access are left out of these communication channels.
- 7. Commercial: Not only are today's web pages designed for high speed connections, but interactions and routine procedures with businesses that serve the citizenry are designed for high-speed Internet access. Those without high-speed Internet access do not have these opportunities for savings.

Indeed, the Pew Center reported in 2010⁸ that two-thirds of Americans thought that lack of broadband access was either a major disadvantage (43%) or a minor disadvantage (23%) in finding out about job opportunities or learning career skills. Majorities of respondents to the same survey thought that lack of broadband access was either a major or minor disadvantage in getting health information, learning new things to improve or enrich life, using government services, keeping up with news and information, and keeping up with the local community.

II. Current Technologies for Delivering HSI

Goochland County recently commissioned a consultant study of broadband access. The report by CBG Communications is a comprehensive and useful document⁹ that appears to have been funded by a federal grant. A report of this type specific to Hanover County might be something to pursue in the near future. The Goochland County report contains some helpful information about broadband technologies. Some of the findings of the Goochland County report may also apply to Hanover County.

⁸ Pew Internet & American Life Project, *Home Broadband 2010*, accessed at <http://pewinternet.org/Reports/2010/Home-Broadband-2010.aspx>

⁹ CBG Communications Inc., *Report on Broadband Network Deployment Options for Goochland County, Virginia*, June 2008.

The ability for any provider to offer broadband services will be based on the technology used and the infrastructure that can be made available to deploy the technology. Profiled below are the various technologies currently available in Hanover County. Each of the broadband technologies detailed below have potential connection speeds listed. For instance, where a speed is listed at 26 Kbps (Kilobits per second), this equates to 256,000 bits being transported during a 1 second interval. 1.5 Mbps (Megabits per second) equates to approximately 1,500,000 bits per second.

Cable Modem Service (Comcast)

Cable modem services provide speeds up to approximately 16 Mbps downstream and 2 Mbps upstream utilizing a HFC (Hybrid Fiber Coaxial) network. An HFC network is characterized by fiber optic cable from the nearest head end or hub to neighborhood nodes. Each neighborhood node typically serves approximately 500 homes, using coaxial television cable to connect the node to each house on the node. The system then employs Cable Modem Termination Systems (CMTS) gear in the head end or hub, which communicates with the individual cable modems or routers in subscribers' homes. The CMTS also communicates with the main server, which is connected to the Internet. This provides the high-speed Internet connection from the service provider to the home.

Typical service providers use a certain density formula regarding households passed per mile to determine whether it is cost feasible for the company to provide services and recoup its investment within a period of time consistent with industry standard return on investment (ROI). In order for a service provider to provide coverage to all areas, it would need to extend its system by adding additional fiber optics, additional nodes and additional coaxial cable. The additional cable would be installed either underground by trenching and placing conduit and cable in the trench, or aerially by developing additional pole attachments and pulling strand and cable. Construction costs vary depending on the type of construction method, underground or aerial. Average construction costs are approximately \$30,000 per mile.

Digital Subscriber Line (Verizon)

Digital Subscriber Line (DSL) is a broadband service designed to provide high-speed Internet over traditional telephone lines. DSL is typically provided in asymmetrical form (more speed downstream and less upstream), with downstream speeds as fast as 3 Mbps and upstream speeds as slow as 128 Kbps. Older telephone lines, which may be found in more rural areas, can restrict DSL speeds.

Providers utilize fiber optic cable from the central office to a neighborhood wire cabinet, where the service is then provided along traditional copper telephone lines into the home. There is a device within the central office called a Digital Subscriber Line Access Multiplexer (DSLAM) that communicates with the DSL modem at the customer's location in order to provide the high-speed connection. The DSLAM is in turn connected to the Internet server.

DSL is limited in that it cannot be provisioned wherever there are telephone lines, unlike cable modem service which can be provisioned wherever there are cable TV lines. Rather the service must be provisioned within approximately 15,000 to 18,000 feet from the central office (or DSL extender) in order to provide the appropriate signal quality for DSL transmission. The connection speed will decrease as the distance from the central office or extender to the home increases.

In order for the service provider to provide DSL service to all homes, it would need to extend fiber to a DSL extension location. This could be done either by over-lashing or placing another

aerial attachment on its existing pole attachments, utilizing existing conduit to pull through additional fiber, or providing new conduit through additional underground trenching. Average cost is approximately \$25,000 per mile for fiber optic cable extension and approximately \$20,000 per central office extender.

Broadband Over Cellular (Verizon, AT&T/ Cingular, Sprint/ Nextel, T-Mobile)

Cellular telephone providers also provide broadband services over their cellular networks using a variety of what are known as 3G (third generation) technologies. In this mode, broadband service can be used in a fixed location, or as a mobile service.

The ability to utilize the service is similar to the ability to utilize cellular voice service. It depends upon the amount of cell coverage and the strength of the signal that is available at the user's location. Coverage and signal strength also affect the speed of the connection, which is typically between 512 Kbps and 1.4 Mbps. Similar to cable modem service, it is also a shared service – the more users there are trying to access the service from a single cell tower, the slower will be the transfer rate per user. Cellular carriers do not always provide mobile data services where they provide cellular telephone service.

Approximate costs are \$100,000 per additional tower and subsequent antenna placement, plus annual operating costs.

Fixed Wireless

Fixed wireless broadband services are typically provided in a point-to-point configuration from a central tower location or through a series of “hops” across several points in a mesh network to a customer's location. These systems can utilize the same types of tower infrastructure as do broadband over cellular communications. Approximate costs are \$50,000 for installation on existing towers and \$150,000 for installation of a new tower.

Wi-Fi

Wi-Fi is a popular wireless broadband technology because so many laptop computers are built with Wi-Fi components installed. It is easy to purchase a Wi-Fi card or device that can link to an external port on a computer. Wi-Fi hot spots or access points are typically available in locations such as airports, fast food restaurants, coffee shops, bookstores, libraries, etc. Hot spots are limited to a range of approximately 300 to 1,500 feet from the broadcasting signal source.

Satellite

Satellite service providers offer broadband service levels with speeds as high as 1.5 Mbps for downloads and 256 Kbps for uploads at a user cost of approximately \$79.95 per month plus the initial setup fee of approximately \$300.

Broadband Over Power Lines

Providing broadband over regular power lines is technically feasible. It is attractive because it uses infrastructure that already goes “the last mile” to almost every household in the country. However, the experience with BOPL is spotty because the Internet signal tends to compete with television and ham radio signals, causing interference to them. In addition, spikes in power loads within the household – such as those caused by turning a vacuum cleaner on – can interrupt the Internet signal. Research in this area continues because of the tremendous advantages that would

be realized if broadband could be delivered through the existing electrical distribution infrastructure.

Fiber Optics

Fiber optic cable is currently fastest and most reliable method of providing HSI, and it has a near limitless capacity to provide broadband services. It is often used for the central “backbone” of a broadband network, with other, somewhat slower, methods used for completing connections outward to users. Generally, Internet will only implement fiber optic networks where demand warrants the installation costs or performance at that level is required. Currently Verizon provides the fiber-optic FIOS service to Hanover County in limited areas. The current cost of building fiber optic systems is dependent upon the backbone structure already in place and the average population densities being served. The cost ranges from \$850 to \$2,260 per household. This is currently not a viable option for carriers in rural areas due to the excessive cost and low population densities.

Wireless Internet service providers (WISPs)

Using unlicensed devices, WISPs around the country are providing an alternative high-speed connection in areas where cable or DSL services have been slow to arrive. Obviously, wireless Internet services would be ideal for rural areas. The Federal Communication Commission also has identified a number of areas where unlicensed devices may be helpful in supplying communication services to rural communities. Particularly, at this time, the FCC has under consideration a Notice of Inquiry in ET Docket 03-380 which seeks comments on the feasibility of allowing unlicensed devices to operate in the television broadcast spectrum at locations and at times when the spectrum is not being used. The Notice also seeks comment on the feasibility of permitting unlicensed devices to operate in other bands, such as the 3650-3700 MHz band, at power levels higher than other unlicensed transmitters with only the minimal technical requirements necessary to prevent interference to licensed services.

WiMax

WiMax is another option that will become available to a larger degree in rural areas in the very near future. WiMax stands for “Worldwide Inter-operability for Microwave Access” and it promises to provide very high connection speeds, up to 6 Mbps, or even higher. Some large companies are investing in WiMax networks, including Clearwire, Sprint and Google.

WiMax deployments do not seem to be numerous. Also, because development of new technology usually starts where there is the best return on investment, early WiMax efforts have been focused in business-centric areas (not rural areas). Still, WiMax offers some of the fastest wireless Internet connections available. In the near future, it might become a more affordable option for high speed Internet in rural areas.

WiMax requires less infrastructure than other wireless technologies because it does not require not physical line of sight to accomplish transmission of data. This results in fewer towers and lower costs. WiMax costs approximately \$30,000 per square mile of coverage plus on-going operational costs.

4G (“fourth generation” cell phone wireless)

At the end of 2008, the FCC voted to authorize the use of unlicensed “white space” in the spectrum for the development of broadband Internet. The two companies that jumped at this

opportunity were Verizon and AT&T. Both of these companies are using this 700 MHz telecommunications spectrum to develop brand new high-speed 4G wireless networks. These new networks are based on a technology called “Long Term Evolution”, or LTE. Speeds of the new LTE networks promise to be much faster than DSL or cable. Verizon expects the first deployments of its 4G LTE network to take place in 2010, and they intend to have their network blanket the country with high speed Wireless Internet over the next few years – even in rural areas. AT&T’s network will probably first become available in 2011. Although LTE is only just becoming available now, it might revolutionize Internet access in rural America.

III. Hanover County’s High Speed Internet Supply and Demand 2007-2010

Hanover County government and agencies

The Hanover County information technology system is wide-area networked (WAN) through various circuits and providers, and various physical connections. The County pays for T1 connections. (T1 connections run at 1.544 Mbps downstream and upstream. On the downstream side, T1 does not meet the 4 Mbps downstream speed found in the updated definition of HSI.) The majority of County departments are adequately wired for their needs. Different departments are set up according to their needs. The Department of Social Services has Internet needs that differ from Animal Control, for example. More than 100 different computer and software applications are in use by County departments. No County office or department provides public Internet access.

The Pamunkey Regional Library (PRL) is a quasi-county system that operates ten branch libraries in Hanover, King William, King and Queen, and Goochland counties. Six of those branches lie within Hanover County. The PRL’s greatest information technology need is for more bandwidth. PRL offers some access to HSI, but it could be more affordable. The ten branches utilize primarily a Verizon frame relay for their HSI service, but in Hanover the PRL is exploring a working relationship for HSI access with Comcast. All branch libraries have computers for use by library patrons who have a PRL library card, another jurisdiction’s library card, or are employed in any of the four counties served by PRL. Otherwise, the patron must pay a \$25 annual fee. All branches have Wi-Fi Internet access.

The Hanover County School Board staff indicated there is no initiative for laptops for all students at this time. A mobile cart of 28 laptops in each school serves 126 students for school use only. Students without home HSI can come to school early and/or stay late at school to use school computers for studies. Connections are data, Ethernet and wireless. The public schools report no problems with lack of bandwidth.

Private communications vendors

All cellular telephone service providers have a relationship with 911 for call forwarding of emergency calls. Hanover County is large – 471 square miles. Anecdotally, there is a gulf between the county’s operations and citizens’ HSI needs.

To help describe the status of HSI service in Hanover County, the HSIG contacted private communications vendors and sought the number of households served, the number of households with access to HSI as a percentage of the total, the number of households currently accessing HIS as a percentage of those with access, and the stand-alone cost for their HSI service.

Private communications vendors were as forthcoming as possible about the requested information, but some information was not made available to the HSI due to the need to protect proprietary interests. Comcast, Virginia Broadband, Sprint, Verizon Wireless and CenturyLink were all contacted. Responses from communications vendors ranged from providing full statistics to no response to the requests. Only one of the providers was able to provide any/all of this information. This information is summarized in Table 3.

Table 3: HSI Access and Use in Hanover County

Vendor	Homes Passed	Homes with access to HSI	Homes accessing HSI	Unbundled Cost	Bundled Cost
Century Link	4,999	3,684 - 74%	2,485 - 62%	\$19.99/\$29.95	\$19.95
Comcast	28,110 (county) 3,955 (Ashland)	Proprietary information	Proprietary information	\$38.95	\$24.95
Sprint (wireless only)	Proprietary information	Proprietary information	Proprietary information	\$59.99	\$59.99
Verizon Wireless	Proprietary information	Proprietary information	Proprietary information	FIOS \$49.99 + DSL \$19.99 +	\$54.99* \$69.99*
Virginia Broadband	Essentially not operating in Hanover, mostly in Caroline, Dawn/Ruther Glen area				

*FIOS is bundled with TV; DSL is bundled with phone

CenturyLink (previously Embarq) offers asynchronous digital subscriber line (ADSL) services that is branded as HSI. As with normal DSL, it requires a wire phone line. There is no wireless offered through CenturyLink. This company serves the Beaverdam, Gum Tree and Montpelier areas. The minimum unbundled monthly cost is \$19.99 if you provide your own phone and \$29.95 without your own phone. Increased availability would depend on conversion of equipment at telephone switching stations.

Verizon Wireless offers wireless broadband using EVDO 3G (evolution data-optimized third generation) service. Wireless service is offered county-wide, with the caveat that wireless service will not be available in those pockets with poor or no wireless reception. Verizon also offers DSL to its wired phone line customers. The unbundled monthly cost is \$19.99 but can be more depending on the length of the service contract and the speed and range of the service.

Figure 5: ATT - East Hanover Coverage

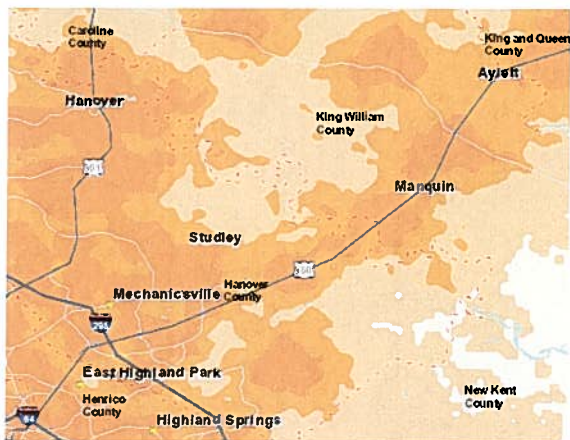


Figure 6: ATT - Southwest Hanover Coverage

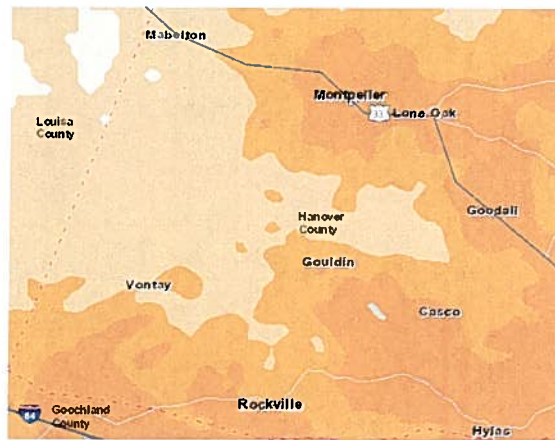


Figure 7: ATT - West Hanover Coverage

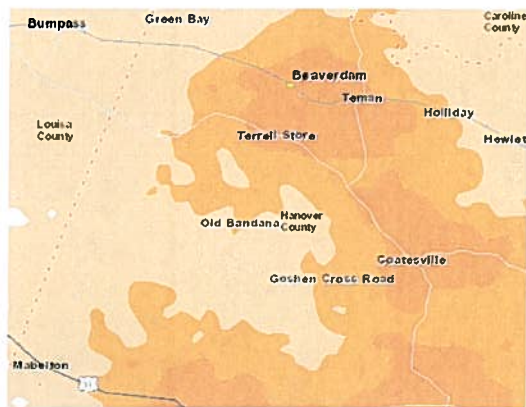


Figure 8: ATT - Northwest Hanover Coverage

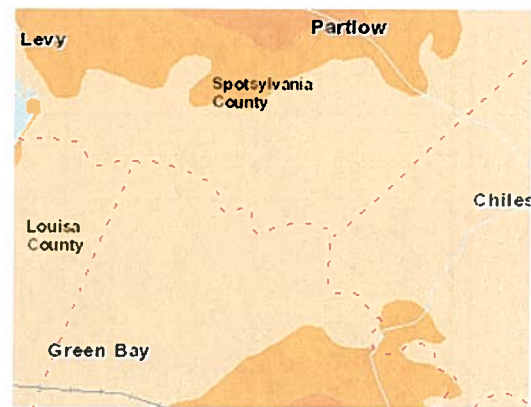


Figure 9: Verizon - West Hanover Coverage



Figure 10: Verizon - East Hanover Coverage



Blue=Broadband, Green=Enhanced, up to 140Kbps, White=No coverage

Source for Figure 9 and Figure 10: "High Speed Internet Availability," Hanover County government staff presentation to the Hanover County Board of Supervisors, August 2008.

Hanover County's Strategic Advantages for Attracting HSI infrastructure providers

(Excerpts taken from a conversation with Marc Weiss, Director, Hanover County Economic Development Authority)

"From an economic development point of view, we are primarily interested in coverage within the Suburban Services Area, which is the location of most Hanover businesses. The major concentration of business activity today stretches from the Town of Ashland, south along I-95, then south along I-295 to Route 360. In the future, we will need to work with providers to ensure that broadband access is extended throughout the Suburban Services Area as development occurs in other geographies. I am not aware that we have 'lost' a business opportunity because of a lack of broadband. We are at a competitive disadvantage for large users such as data centers, because they require a high level of fiber capacity from multiple providers and through multiple feeds, although we have recently located a web hosting and data center company that is providing the infrastructure at its own expense.

"Provision of utilities, whether it is water and sewer, cable TV, or HSI is dependent on achieving sufficient density of users to make the service economically feasible. Again, for the same reasons we could not service rural development with central water and sewer, it would be difficult to provide 'hard wired' Internet throughout the rural areas. Those areas are more likely to be served through wireless technology or emerging electric line technology, using infrastructure that is easy to deploy or is already in place.

"The County has no plans to enter the broadband market. This is not a core function of Hanover County government and would likely face the same issues that development of the utility system faced when it was started, only in reverse. When the County utility system started, residents outside of the Suburban Service area did not want to fund the system, so it is funded through connection fees and user fees within the Suburban Services area. Presumably, most households in the Suburban Services area have access to broadband. Would they support funding a County broadband service in rural areas, which may be very costly per household?"

"The Department of Economic Development works with developers and businesses on a case by case basis [to consider having sites 'wired' for business]. The Greater Richmond Partnership headed up an effort several years ago to locate all the fiber in the region and develop a plan for provision of broadband. The providers were very reluctant to disclose information about their backbone because of competitive and security concerns and so the project never was able to move forward. The providers will tell us that they can provide broadband solutions at our business park locations as needed by individual businesses and by-and-large have performed well over the years. Hanover County Economic Development has cultivated close relationships with staff at Verizon and Level 3 so that we can obtain accurate and up-to-date information when we have a specific request from an existing business or a new business prospect. Comcast has also moved very aggressively in the last few years to serve the business market."

Relationship of the updated all-county 911 (emergency services) response system to HSI

(Based on a conversation with Phil Heins, Hanover County's Emergency Communications Department Director)

A \$26 million bond referendum approved by voters in Hanover County in 2005 has funded construction of the 911 Customer Premises Equipment (CPE¹⁰) system. This project is now operational. It included several new communications towers and the construction of a new emergency communications call center immediately south of the Administration Building in the county government complex at Hanover Courthouse.

Mr. Heins has been exploring for some time possible solutions to advancing high speed Internet offerings to the citizens of Hanover County. Mr. Heins has recently been discussing solutions with an independent provider named Digital Future, although discussions are still preliminary.

Additionally, Mr. Heins stated that the county "has and continues to lease space on our public safety towers to cell and high speed data companies." There are thirteen primary tower sites. Most of the towers are 300 to 400 feet tall. Seven are county property, five are under lease agreement with the schools and one is under lease from a private landowner. A list can be found in the appendix of this report containing the addresses of the existing towers and the heights available for wireless providers to lease. Two of these towers are reserved for public safety use only.

The sixteen fire and rescue stations within Hanover County are currently provided high speed data connectivity via Verizon air cards. A schematic can be found in the appendix of this report showing the locations of these facilities. It is reasonable to assume that citizens living near these locations should be able to receive the same service from Verizon Wireless. The new 911 CPE equipment which is housed in the county's emergency communications center requires direct connectivity to a fiber optic ring rather than using the standard COMA lines from the telephone company. The fiber optic ring will be established to run from the county administration complex to Verizon's closest 911 tandem at the intersection of Stuart Avenue and Chester. Once this type of high speed direct connectivity is achieved, the county emergency communications center will be fully converted to the Next Generation 911 standard¹¹ which enables multimedia communications between the 911 center and callers in the field (such as texting, emails, and video streaming from 911 callers).

There seems to be no established timetable for the acquisition of this backbone, and funding is an issue. It might be possible that this build-out, if and when it happens, could be leveraged by

¹⁰ Customer Premises Equipment is telephony or networking equipment provided by the telecommunications service provider but installed at the customer's location.

¹¹ The Next Generation 911 initiative was borne of the ENHANCE 911 Act of 2004. The Act authorized the National Highway Traffic Safety Administration, under the U.S. Dept of Transportation, to establish a national 911 Implementation Coordination Office. The Office administers grants to Public Safety Answering Points in an effort to fund the standardization of all emergency communications to an interoperable standard ("digital, Internet Protocol-based delivery of multimedia 911 calls"). Establishment of these protocols would allow victims to access 911 via text messaging, video and email as well as allow local, state and federal entities to communicate readily with one another. It also allows for public awareness information to be transmitted outward to signs, cell phones whose owners have signed up for the alert system, etc., providing a valuable, efficient early emergency warning system to citizens. See <http://www.fcc.gov/pshs/services/911-services/nextgen.html> for more.

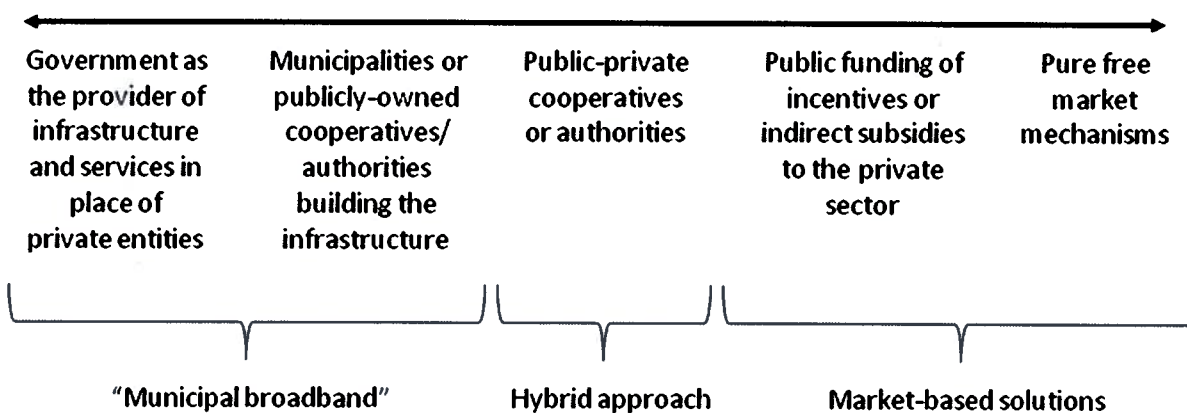
building in excess data capacity and allowing citizens to access nodes on the loop. However, it is unknown to the HSI Group at this time if such additional traffic would be allowable on a network established for emergency communications. Mr. Heins supported the idea that a representative from the Emergency Communications Department should be included on a standing technology committee if this type of committee were to be established in Hanover County.

IV. Approaches to HSI Expansion

A continuum of approaches

Examples from the U.S. demonstrate that high-speed Internet expansion can be pursued using a wide variety of strategies. They range along a continuum from creating government entities at one extreme, to waiting for the free market to fill in the gaps at the other extreme, and various public-private relationships in between. Figure 11 shows this continuum in a schematic form.

Figure 11: A continuum of approaches to HSI expansion found in the US



Any approach will have its pros and cons. For example, pure free market solutions do not cost taxpayers anything, but the reason for discussing HSI access in the first place is that extending service to rural areas does not generate enough (or any) profits to make it worthwhile for businesses to do it. So there may be some parts of the country, and perhaps Hanover County itself, in which citizens cannot ever expect to have HSI service at a price they consider to be affordable. On the other hand, municipal or community broadband service seems to work in places such as Ashland, OR¹², but some taxpayers may be opposed to that sort of initiative on the basis of taxpayer expense or undesirable expansion of government's role. In addition, municipal broadband services may find it difficult to avoid operating in the red – the Ashland Fiber Network faces these challenges as well¹³.

¹² The Ashland Fiber Network was created by the city of Ashland, OR. The city built the fiber-optic infrastructure to carry broadband Internet and cable television content, and works with nine private service providers who deliver Internet connection services to consumers. See <http://www.ashlandfiber.net/faq.htm#1> for more.

¹³ In summer 2010 the Ashland Fiber Network was operating at an annual deficit of \$47.77 per customer with a customer base of about 4,200 customers. AFN was proposing a revised business plan to cut annual losses to \$23.23 per customer in the current fiscal year and move to revenues of \$31.70 per customer in the next fiscal year. See <http://www.mailtribune.com/apps/pbcs.dll/article?AID=/20100806/NEWS/8060319> for more.

Ultimately, there is no such thing as a free lunch.

“When it comes to communications, the United States relies on a privateer system: We depend on private companies to perform public callings. That works up to a point, but private industry will build only so much. Real public infrastructure costs real public money. We already know that, in the real world, if you're not willing to invest in infrastructure, you get what we have: crumbling airports, collapsing bridges, and broken levees. Why did we think that the wireless Internet would be any different?”¹⁴

Localities surrounding Hanover County with efforts to enhance broadband access

1. Goochland County contracted a study to determine the feasibility of county-wide broadband as discussed in other parts of this report. No action has been reported to date on the findings in that report.
2. Caroline County has a corridor program in place that utilizes towers for wireless systems. This approach gives the appearance of broad coverage but does not address dead zones and interference. A Virginia Broadband antenna placed at a Carmel Church water tower in 2006 marked the first steps to introduce their service throughout Caroline County¹⁵. The county has a standing technology committee. Mr. Floyd Thomas, Vice Chairman of the Caroline County Board of Supervisors, is directly involved with that committee. Mr. Thomas is willing to talk more about their committee with Hanover County.
3. Louisa County has no program in place or reportedly underway. Louisa appears to be still looking for solutions to get broadband to public service and school sectors.
4. The Eastern Virginia counties listed below have started public hearings about creating a regional service. The respective Boards of Supervisors of Essex, Gloucester, King & Queen, King William, Mathews and Middlesex Counties will each conduct a public hearing to receive public comment on and to consider the proposed adoption of a concurrent resolution to create the Middle Peninsula Broadband Authority as authorized by the Virginia Wireless Service Authorities Act (§15.2-5431.1 et seq. of the Code of Virginia, 1950, as amended). The purpose of the proposed regional broadband authority is to facilitate the deployment of high speed internet and communications services (“broadband”) to residents, businesses, institutions and governmental agencies throughout the unserved and underserved portions of each county on the Middle Peninsula.

Methods Used by Successful American Rural Localities

Nationally, the majority of broadband expansion programs that have realized success were done through significant public funding provided by economic stimulus monies or special funds, such as the Tobacco Indemnification Program in Southside Virginia and North Carolina. Programs funded and managed entirely at the local level are more difficult to locate and research. They often provide little detailed information on the actual service area and use of broadband technology. Getting on the front end of special grants or Federal incentives appears to be a key to any success, though. Public/private partnerships, such as the Connected Nation program noted

¹⁴ Tim Wu: “Where’s My Free Wi-Fi? Why Municipal Wireless Networks Have Been Such a Flop.” *Slate* magazine, 9/27/2007, accessed 8/29/10 at <http://www.slate.com/id/2174858>.

¹⁵ <http://www.co.caroline.va.us/fastweb.html>

below, seem to be fruitful. However, there is still little real information on how these programs translate to actual coverage and speed on the ground.

Other local success stories nationally

Search the Internet for success stories and you'll find many news articles highlighting counties throughout the nation. The approaches to creating HSI access in various counties and rural localities are as different as the localities themselves. Cases of working toward county-wide coverage by Wi-Fi and new WiMax technologies are side-by-side with investment of county and federal funds to "wire" entire counties with cable or DSL. There are still few reports that cover real usage within the county and how well the services actually work in all areas, especially for "last mile" users as is the issue in Hanover County. In most cases, county zoning or ordinances were the biggest inhibiting factors for companies trying to create access for all areas, and some pushback on right of way access from the public created difficulties in areas where there were no other access points beyond electric service access. Initiating involvement by a broad range of citizens groups and businesses in partnership with local government is a significant key to success.

Examples of successes due to federal and special monies directed to particular areas

The Schools and Libraries program, also known as the E-rate program, makes telecommunications and information services more affordable for schools and libraries in America. Congress mandated in 1996 that the Federal Communications Commission (FCC) use the federal Universal Service Fund (USF) to provide discounted eligible telecommunications, Internet access, and internal connections to eligible schools and libraries.

The Minority Media and Telecommunications Council presents a case study of one community, Weirwood, Virginia, and through the Weirwood case the Council gives rural broadband deployment a human face. As MMTC describes it, Weirwood is an isolated rural community on Virginia's Eastern Shore, on the site of a former cotton plantation. Weirwood is only a mile and a half from U.S. Route 13, along which lies a broadband Internet backbone. The residents of Weirwood, however—mostly African-American descendents of former slaves—lack access to broadband. MMTC states that Weirwood has "absolutely no ability to raise internally" the funds needed to build a broadband node to the community from the existing backbone line. Pending acquisition of thorough, reliable, and disaggregated data, we glimpse through Weirwood the state of broadband deployment in impoverished rural areas.

A rural telephone cooperative is getting \$18.9 million in federal stimulus money to build and operate high-speed Internet services in fifteen rural south-central Virginia counties and the cities of Emporia and Franklin. The Buggs Island Telephone Cooperative says the funding will help the area get affordable Internet access, which can make it more competitive in attracting new businesses and create jobs. The cooperative says the grants from the Department of Commerce's Broadband Technology Opportunities Program will fund 80 percent of the cost of upgrading Internet service to up to 100,000 residents and more than 14,000 businesses. The other money comes from a \$3.8 million grant from the Virginia Tobacco Indemnification and Community Revitalization Commission. The area extends from Amelia County to Halifax County, then east to Southampton County.

Pennsylvania enacted a statewide initiative that, according to its website, appears to be very successful in coverage of DSL and cable broadband, however, there are no accounts of local or

county success stories. See <http://www.newpa.com/strengthen-your-community/broadband-initiatives/index.aspx> for more.

Connected Nation

Connected Nation is a public/private partnership to educate, gain access and assist with resources. This program originates through federal funding in the economic stimulus packages over the past few years. While it is primarily set up through a non-profit statewide organization, it often is established by counties coming together with citizen leaders to push the effort forward. Kentucky, Tennessee and Ohio all have programs that are primarily devoted to mapping existing broadband coverage. However, some are helping to fund projects that educate potential users and help gain access to technology, thus boosting demand and increasing the return on investment for private development of broadband access in areas where coverage is lacking. Connected Nation projects also provide resources and leadership to localities in how to establish and administer broadband programs, and alert those areas to grants that are available. On its website, Connected Nation says:

“Connected Nation uses grassroots techniques through our eCommunity Strategies effort to pinpoint underserved areas and create strategic technology plans for these locations. We work with community leadership to address community challenges related to technology growth and implement the necessary programs to overcome these obstacles. eCommunity Strategies helps communities to effectively and efficiently leverage technology by identifying best technology practices and how to acquire such technology.

“Building on the momentum of the National Broadband Plan delivered to Congress by the Federal Communications Commission (FCC) and its call for public-private partnerships to improve broadband adoption, an unprecedented group of Internet service providers (ISPs), computer technology companies and nonprofits announced today a collaboration to help bring broadband services to low-income homes throughout the U.S.”

More information is available at www.connectednation.org.

V. Recommendations

This white paper presents just a sampler of the numerous technical, regulatory, economic, demographic, and policy issues that impact access to high-speed Internet service in the U.S. It is clear that the breadth and complexity of these issues far exceed the time and expertise available to this HSI. However, there are several recommendations that seem just as clearly advisable for the HSI to make at this point, based on the information in this white paper.

1. Establish a standing Technology Committee

The HSI believes that forming a standing Technology Committee is essential if Hanover County is to address the issues that are sketched in this white paper. A standing committee would be able to pursue and sustain research and policy formation regarding HSI. Such a committee must include significant citizen representation. It also must include representation from the county administration, local elected officials, and telecommunications providers serving the county or other localities in the region. Many of the other recommendations presented below could be pursued without such a committee, but would almost certainly be more effectively pursued through the actions of a standing Technology Committee.

2. Map actual user-level access to high-speed Internet service in the county

This would allow the county to move from anecdotal evidence to richer and denser information about broadband access in specific geographic locations. One of the greatest challenges in addressing access to HSI is to accurately map where there are problems with access from the user perspective. There are numerous mapping projects in progress around the U.S. The county should identify a mapping partner and pursue a vigorous effort to map Internet access speeds in rural areas of the county. A promising mapping partner in Virginia may be the eCorridors project at Virginia Tech (<http://www.ecorridors.vt.edu/maps/broadbandmap.php>). The HSIIG recommends that the county discuss with eCorridors a concerted effort to lead county citizens to map their access using eCorridors in exchange for county access to the detailed county data from eCorridors.

3. Investigate grant and foundation funding for the expansion of HSI in Hanover County

There are numerous federal and foundation programs offering money to assist with the expansion of HSI. Hanover County appears to be too densely populated and have too many households with existing access to HSI to qualify for most funding that is designated for HSI expansion in rural areas without any service at all¹⁶. But grant and foundation funding should be more thoroughly investigated before assuming that it is not available to areas like Hanover County. A good map showing where economic recovery funds have been spent can be found at <http://www.usda.gov/recovery/map>.

4. Explore public/private collaborations

Similarly to the electricity co-ops that were instrumental in bringing electric service to rural America, broadband co-ops seem to be growing in popularity and effectiveness. The county should explore the pros and cons of forming a broadband co-op or broadband authority. This would include establishing relationships with the business sector, local and state elected officials, and local or regional efforts already underway.

5. Obtain citizen input in a more systematic fashion

The HSIIG spent time exploring ways to engage citizens systematically about HSI issues to inform this paper, but there were insufficient resources and time available to do so. In addition to the mapping effort recommended above, the county should pursue citizen input on HSI issues through one or more of the following means: an insert or article in the quarterly county newsletter; a question or two added to the periodic county citizen satisfaction survey; a series of public meetings; an exploratory survey conducted using in-house resources; a formal survey; or other means not suggested here.

6. Establish a relationship with the Virginia Office of Telework Promotion and Broadband Assistance

The Virginia Office of Telework Promotion and Broadband Assistance is a state agency that is dedicated to broadband expansion and offers online resources to help communities and businesses get connected. See <http://www.otpba.vi.virginia.gov/index.shtml> for more.

¹⁶ The FCC designates only Amelia, Appomattox, Bath, Craig, Highland and Surry counties, and Bedford City, as unserved broadband areas in Virginia – that is, “geographical areas not served by any provider of advanced telecommunications capability.” (Federal Communications Commission, *Sixth Broadband Deployment Report*, July 20, 2010, Appendix C, pp. 66-67.)

7. Establish relationships to help with HSI expansion in Hanover County or the wider Richmond region

In addition to the relationships with Hanover County's state legislators implied in other recommendations, the county should work to create common cause with other localities and their representatives specific to expansion of HSI service in Hanover County or the wider Richmond region.

8. Stay up to date on technological advances

The wide range of technologies available today will be exceeded by future developments. It is difficult to say if there will ever be a one-size-fits-all solution to expanding HSI in rural areas of the county. The county should stay up to date on technological advances that might impact its decisions concerning access to HSI.

9. Explore further use of the county's 911 tower system to achieve ubiquitous HSI coverage

This infrastructure is already being used to provide a platform from some vendors who lease space. It may be useful in extending coverage further, through additional leases or other arrangements.

10. Explore the feasibility of a contract for countywide broadband coverage similar to the franchising agreement for cable television.

Such a franchising agreement would establish a de facto monopoly provider for Internet service for all county households, presumably with the advantage of extending coverage throughout the county.

11. Explore adding HSI access to developers' proffers for new construction in Hanover County.

To the extent that this approach would be feasible and legal, it may provide an effective way to create positive momentum or critical mass for widespread HSI.

12. Explore using the county's web site, members of a standing Technology Committee, or other means to provide citizen information and consumer education about HSI in Hanover County.

It would be useful to provide information about coverage, services offered by various providers and future plans for HSI in Hanover County in a more centralized fashion. Citizens and potential consumers might find this to be a more effective way to get oriented to the choices they have and to participate in continuing developments in HSI. The county website would be a natural location for this information for people who already have access to the Internet. Members of a standing Technology Committee might serve as first points of contact in their districts for citizens with questions or concerns about HSI.

Appendix: Resources

Reports and documents

Federal Communications Commission, *Sixth Broadband Deployment Report*, July 20, 2010.

Hanover County, "High Speed Internet Availability," Hanover County government staff presentation to the Hanover County Board of Supervisors, August 2008

National Telecommunications and Information Administration, *Falling Through the Net*, July 1995. Washington, D.C.

National Telecommunications and Information Administration, *Falling Through the Net II: New Data in the Digital Divide*, July 1998

Smith, Aaron: *Home Broadband 2010*. Pew Internet & American Life Project, Pew Research Center, 2010. Washington, D.C. Accessed at <http://pewinternet.org/Reports/2000/New-Internet-Users.aspx>.

Wu, Tim: "Where's My Free Wi-Fi? Why Municipal Wireless Networks Have Been Such a Flop." *Slate*, Sep. 27, 2007. Accessed 8/29/10 at <http://www.slate.com/id/2174858>.

Agencies

eCorridors: <http://www.ecorridors.vt.edu/>

Connected Nation: <http://connectednation.org/>

Federal Communications Commission: <http://www.fcc.gov/>

National Telecommunications Information Administration: <http://www.ntia.doc.gov/index.htm>

Pennsylvania Broadband Initiatives: <http://www.newpa.com/strengthen-your-community/broadband-initiatives/index.aspx>

Pew Research Centers Internet & American Life Project: <http://www.pewinternet.org/>

Virginia Office of Telework Promotion and Broadband Assistance:
http://www.otpba.vi.virginia.gov/roundtable_mapping.shtml

Virginia Office of Telework Promotion and Broadband Assistance Community Broadband Toolkit: http://www.otpba.vi.virginia.gov/roundtable_toolkit.shtml

Appendix: Recent Letters to the Editor about HIS

Hanover top digital county?

I'm writing in response to this article in the Aug. 4 edition of The Mechanicsville Local.

This past May I moved from Chester to Mechanicsville (the Black Creek area of Hanover).

I enjoyed Chester as it was a small, quieter portion of Chesterfield but still within short distances to the interstates and malls. I had choices of broadband Internet access from Comcast, Verizon and others. My Verizon DSL service

was inexpensive at only \$14 per month.

I was excited about moving out of a subdivision onto 6.6 acres in Hanover where it was more rural but still somewhat close to the interstates.

Once I moved in I was shocked to discover that hard-wired broadband Internet was not available.

As I am in the Information Technology field high speed access is a requirement for my work.

I discovered that the only options were satellite or Verizon wireless.

Satellite was not an option for me as it will not allow me to connect into my employer's network so my only choice was the Verizon wireless package for \$59 per month.

Unfortunately, I am on the fringe of the coverage area as my signal strength is marginal and connection speeds are

poor.

Watching videos or listening to music is not possible.

My son is unable to do any school research that requires large downloads.

And I am limited as to how much work I can actually do from home while connected each month.

So basically I went from excellent \$14/month service in Chester to poor \$59/month service in Hanover.

I am surprised that Hanover is this far behind Chesterfield on the technical curve for providing broadband Internet access to homeowners, and even more surprised after reading the article that was touting how well the county departments have used technology to provide better services for them themselves and for homeowners.

But, unfortunately, hom-

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owners without broadband access cannot take advantage of this technology.

I have to ask why aren't the cable and Internet companies held to the same service requirements as the phone and electric companies who must provide service to every home regardless of where it's located.

I checked with Comcast and their wires stop about one mile from my house, and Verizon did not have a reason why DSL is not available at my address.

In 2009 the federal government appropriated \$7.2 billion in loans and grants for broadband infrastructure projects in rural areas via its Broadband Initiatives Program (BIP). Did Hanover partake in this program?

I wrote a letter to Supervisor Elton Wade in September 2009 asking whether he knew of any plans to expand broadband in the county. He never replied.

Ron Listo
Mechanicsville

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cell phone signal, no Verizon DSL, and no Clear Wire Internet signal.

While Comcast does have a line in front of our house and our neighbors enjoy Comcast service, for some unknown reason, Comcast is unable to run a cable to our house after repeated orders for service.

It has become a standing joke at our house when the Comcast Triple Play flyer comes in the mail, we say, "Let's call and order today," so the technician can come out again and tell us that there is no cable from the pole to our house -- even when we tell Comcast we need a cable from the pole to the house first.

So, don't be discouraged that the Comcast "wires stop about one mile from your house." Even if the cable was right in front of your house, they probably couldn't get service to you.

As for Verizon DSL, we have been asking for that for five years. "It's on the way," we're told, but somehow it stopped about a mile from our house and has never moved.

I am glad to hear you have a Verizon wireless signal even if it is "marginal and connection speeds are poor." We don't have one at all. The signal begins about a mile down the road either way from our house. This fact made life very interesting last April when a wind storm blew down a tree, which struck the power lines, knocked out our home phones and started a fire on our property.

So, with no cell phone signal, we just fought the fire until someone showed up from the fire department.

My suggestion to you is make sure you have lots of insurance.

Clear Wire told us that we would be in their Internet cov-

erage area when we signed up with them for service, but again there was no signal.

What is interesting is that there is a cell tower located about midway down Rockhill Road, but again there is no Verizon wireless service or Clear Wire Internet service on it. So close, yet so far away.

H.T. Pritchard
Mechanicsville

Digital dead zone

Let me say that I feel Mr. Liso's pain in the lack of 21st century technology in the Black Creek area. You do not suffer alone, neighbor.

We are doomed to dial up Internet, no Verizon wireless

Appendix: County Emergency Communications System Tower Locations

Site	Address	Tower Hght	Tower Coordinates NAD 83	Available Hghts for Wireless Providers	Method to Acquire	GPIN #
Rockville	16405 MLC Lane, Rockville, VA 23146	330'	37-44-13.4N / 77-40-2.1W	205',180', 165', 155'	Lease Agreement with Schools	7729-45-8653 7729-43-4175 7729-41-7385 7729-42-5048
Old Church	2343 Old Church Rd, Mechanicsville, VA 23111	400'	37-37-53.3 N / 77-11-20.6 W	240', 220', 200', 185', 170'	Purchased Property	8765-26-3342
Ellerson	5834 Cold Harbor Rd, Mechanicsville, VA 23111	400'	37-35-9.68N / 77-15-47.28W	240', 210', 185', 170', 160',	Lease Agreement with Schools	8743-09-4401
Georgetown	11375 Georgetown Rd, Mechanicsville, VA 23116	450'	37-42-54.4 N / 77-21-54 W	210', 185', 170', 160'	County Property	8718-16-0091 8718-15-1828 8715-15-1667 8718-16-0164
Beaverdam	19180 Halls Hideaway Ln, Beaverdam, VA 23015	350'	37-55-53.4N / 77-38-37.9 W	220', 200', 185', 160'	Lease Agreement with Schools	7836-04-2404 7836-04-4007
Elmont	12005 Willow Farm Dr., Ashland, VA 23005	400'	37-43-9.6 N / 77-30-30.9 W	240', 220', 200', 185', 170'	Lease Agreement with Schools	7768-95-8984
Doswell	10080 Kings Dominion Blvd., Doswell, VA 23047	400'	37-51-30 N / 77-26-6.4 W	250', 210', 185', 170', 160'	County Property	7893-08-2029
Poor Farm Park	12481 West Patrick Henry Road, Ashland, VA 23005	300'	37-46-56 N / 77-32-16 W	Requires Structural	Lease Agreement with Schools	7860-09-5200 7861-20-0986 7861-10-3274
Montpelier	15182 Clazemont Road, Montpelier, VA 23192	300'	37-49-13 N / 77-41-35 W	Requires Structural	County Property	7812-63-6314 7812-52-3457
Pole Green Park	9027 Pole Green Park Lane, Mechanicsville, VA 2323116	300'	37-39-11 N / 77-18-30 W	Requires Structural	County Property	8726-83-0329 8726-62-7679 8726-81-4062
Farrington	14586 Mountain Road, Glen Allen, VA 23059	300'	37-44-55.3 N / 77-35-46.4 W	205', 180', 165', 155'	County Property	7749-47-4209
Holly Hill	11263 Cedar Lane, Glen Allen, VA 23059	300'	37-41-43 N / 77-29-3 W	235', 205',180', 170', 160'	Lease From Private Landowner	7777-67-6294
Courthouse	13476 Hanover Courthouse Road, Hanover, VA 23069	200'	37-46-52.2N / 77-22-4.5 W	Requires Structural	County Property	8810-09-5858 8811-20-6899

Note 1: Antennas on the Old Church and Ellerson Towers will be flat panel design and no dishes other than for public safety use.

Note 2: Installation of outdoor equipment cabinets require building permit; only installation of an equipment shelter requires minor site plan amendment. Note 3: Old County Equipment will be removed once the new system is operational which will free up space on the Poor Farm, Pole Green, Courthouse and Montpelier Towers

Leased Sites

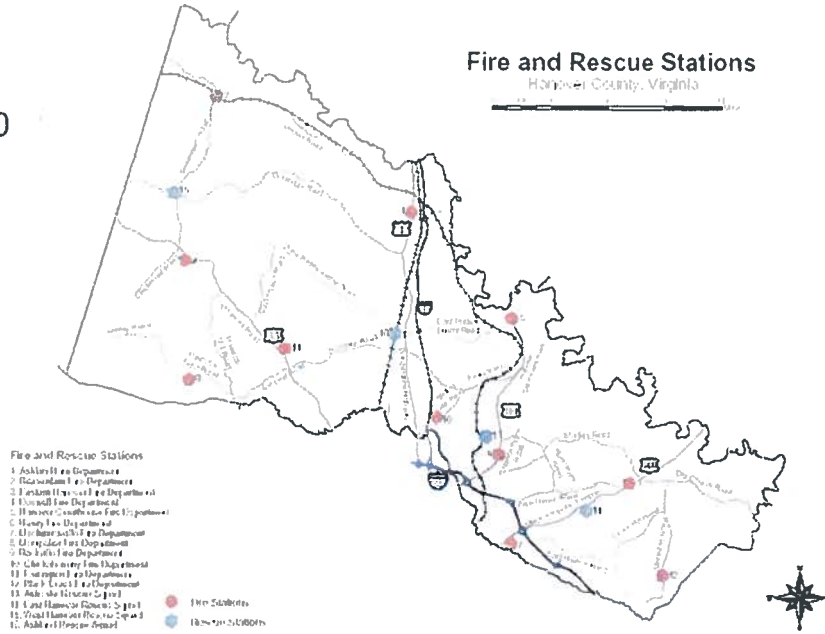
Sinclair	8096 SHADY GROVE ROAD, Mechanicsville 23111	N/A		N/A	Private Tower	8715-01-2811
Coatesville	13006 OLD RIDGE ROAD, Beaverdam, VA 23015	N/A		N/A	Private Tower	7853-98-8248
Gum Tree	15108 WASHINGTON HIGHWAY, Ashland, VA 23005	N/A		N/A	Private Tower	7872-92-9162

Appendix: Schematic of the Locations of County EMS Facilities

Hanover County map

The basics:

- Population = 100,000
- Area = 474 mi²
- 70% rural with small pockets of suburbs
- EMS a branch of the Fire Department
- EMS all volunteer-run (BLS) until recently
- Staff (ALS) work on weekdays



SAMSI
4 October 2007

Emergency Medical Service Systems
Laura A. McLay

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