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The Digital Divide in Kentucky: Is Rural Online Learning Sustainable?

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Abstract

This paper describes the perceived condition of access to high-speed Internet for many rural Kentuckians, and reflects on the experience of attempting to bring broadband Internet accessibility to a rural area in Kentucky. This experience is not unlike rural areas in other states however, as numerous stories were discovered over an 8-year period. The general problem for rural areas is explained and potential solutions examined. One such alternative often touted as the ultimate solution for rural residents is satellite Internet access. Data collected over a 4-year period using two of the most popular satellite providers is presented with an analysis of performance based upon speed and price. The results of this study raise doubt as to the sustainability of affordable and quality online education opportunities.

Key Words: online, learning, sustainable communities

BACKGROUND

The digital divide is a term that was first applied to the gap between those people who have access to broadband Internet and those who do not (Hammond, 1997). This presents both a perceived problem as well as an actual difficulty, especially to citizens whose choice of Internet providers are limited. The perception is that entire communities do not have access to high-speed Internet alternatives and are missing out on current information (Malechi & Bousch, 2003); however, the actuality is that the economic development of the community is also affected in an adverse way (Galloway, 2007). There have been many attempts to study this problem, to apply various techniques to map current levels of accessibility, and even some progress in closing the divide in many areas. There remains, however, issues that continue to prevent many rural Kentuckian's from having affordable access to high-speed Internet. According to ConnectKentuckys' Progress Report (2008), 95% of all Kentucky households have access to broadband Internet, although the original goal was to achieve 100% by the end of 2007. Many obstacles continue to influence potential providers, especially affecting rural residents. Urban areas, and increasingly, some rural areas, are enjoying multiple options to broadband Internet access. There are cable television providers, telephone providers offering both DSL and wireless, and even private and municipal wireless offerings. But are these alternatives an option in rural

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areas? The option typically discussed when the aforementioned technologies are not available, is satellite Internet. This paper examines one of the major obstacles to adult lifelong learning, both formal and informal, due to the lack of broadband Internet accessibility. Adult literacy is the fundamental building block for other learning activities and perhaps one key to successful lifelong learning (Agee, 2005). But how can adult learners use computer technology, especially the Internet, if reading is an issue for them? Access to high-speed Internet affords many learning opportunities to adults because of the tremendous number of multimedia available and the ability to access online tools. These tools do not work well using low-speed connectivity like dial-up, due to significantly lower data transfer speeds. Adults who cannot read may also have problems fully utilizing the Internet simply because of their illiteracy. Though a global issue, this paper examines the current state of accessibility in rural Kentucky from the perspective of a single community in western Kentucky, and reflects upon the struggles to bring additional affordable alternatives to the residents of the area. Additionally, this paper will study satellite efficacy with respect to speed (bandwidth) and cost and relate how this affects long-term sustainability for adult learning.

OBSTACLES TO BROADBAND

There are several factors that hinder potential providers from expanding coverage into rural areas, but there are also factors relevant from the potential subscriber's perspective to be discussed. Costs of deployment and the topography of the potential coverage area are the primary obstacles for potential providers; while culture, cost of service, and a related factor, lack of competition are the key factors for broadband consumers.

Costs

People's ability to pay for broadband Internet access; perhaps, ranks as one of the chief barriers for achieving saturation of coverage in rural areas (Stenberg, Morehart, & Cromartie, 2009). Minimum wage earners and those living on low, fixed incomes are naturally going to be most concerned with basic living necessities, and expensive Internet access will not be received well. A closely related factor, the lack of competition, has a dramatic impact on low income earners' ability to afford high-speed access especially in rural America (Grubesic & Murray, 2004). This means that other solutions like affordable wireless access are going to be necessary as viable options. According to Jeannine Kenney, senior policy analyst for Consumers Union, "Fudging the facts won't provide high-speed Internet access to those who need it most. If the FCC is content to let cable and phone companies control the broadband market, then consumers need a third option; wireless broadband that is less expensive and which doesn't depend on DSL or cable modems. It offers the best and perhaps now the only way to close the digital divide" (Banos, 2006, p. 2).

Culture

Perhaps some of the most difficult barriers to overcome are not technical in nature, but have more to do with human nature (Turner, Thomas, & Reinsch, 2004). Perceptions by those in rural areas are often driven by traditions that are not entirely trusting of technological advances and fail to understand the potential of, in this instance, high-speed Internet (Obilade, 2001). People often see these advances as necessary for the improvement of public education but do not

have any notion of the potential beyond K-12. Perhaps being perceived by their peers as a technical "geek" or as one who "thinks they are smarter than everyone else" is also an inhibitor (Ball, 2005). Convincing people of the value proposition is closely related to the cost of Internet access as evidenced by the ConnectKentucky Technology Assessment Study (2005). Even when people can afford broadband, this doesn't automatically mean that they will subscribe. Culture plays a huge role in such decision-making. Many senior citizens are intimidated by technology and often barely know how to send and receive email (Phang, Sutanto, Kankanhalli, Li,Tan, & Teo, 2006), plus those who struggle to read might also avoid computer technology. There are numerous reasons that disabled Americans, certain religious-oriented citizens, and even some minority groups might avoid active, persistent use of the Internet (Donat, Brandtweiner, & Kerschbaum, 2009).

Topography

Significant topographical considerations become apparent when one examines the deployment of rural broadband capability. Mountainous terrain dominates much of eastern Kentucky, and in many cases, many miles of cable must be attached to utility poles or direct buried, which can be cost prohibitive. It doesn't require a mountain to cause concern; dense foliage is also a key consideration, especially when wireless connectivity is the primary option. Often, residents simply live too far from the necessary equipment for DSL service or the terrain isn't suitable for wireless connectivity (Dern, 2005). Satellite reception requires a clear view of particular regions of the sky which isn't always viable in mountainous or heavily forested regions and can be expensive. Wireless communications in some form may offer the most hope for serving the largest number of consumers for the least cost according to Joe Mefford, Statewide Director for Broadband Deployment for ConnectKentucky (personal communication, October 8, 2006). In fact, in a second conversation with Mefford, he confirmed that private wireless providers are interested in the county and that AT&T is not likely to expand DSL coverage into rural areas (personal communication, May 11, 2007).

Competition

The issues surrounding implementing broadband Internet to rural America are more complex that one might imagine. Beyond the political wrangling for funding and *turf* control (Levin & Schmidt, 2010), there are other and perhaps more difficult issues lurking. Politicians are often concerned with only constituents in their district or are under pressure from lobbyists who have only a particular industry's best interest at heart as opposed to the citizenry. But national surveys performed by the National Telecommunications and Information Administration (NTIA) do indicate that providers of DSL and cable are correct in their assertion that the interested consumer base is too small or disinterested to rationalize the expansion into rural areas (Grubesic, 2003). Further examination of this issue might lead one to conclude that state and local governments will need to be involved as in the cases of Virginia (where Internet service demand is aggregated in with governmental agencies) or Maryland, and West Virginia who share resources like statewide fiber networks (Strover, Oden, & Inagaki, 2001). Rural cooperatives already serve 1.5 million constituents in Kentucky (KAEC, n.d.) and many are interested in providing high-speed Internet access. Rural cooperatives have traditionally provided basic power needs, primarily electricity, but many also provide propane gas and water. Because of their unique position already serving rural residents, they should be considered prime

contenders for assisting in closing the gap of the under-served (Gabel & Huang, 2008; Parker, 2000).

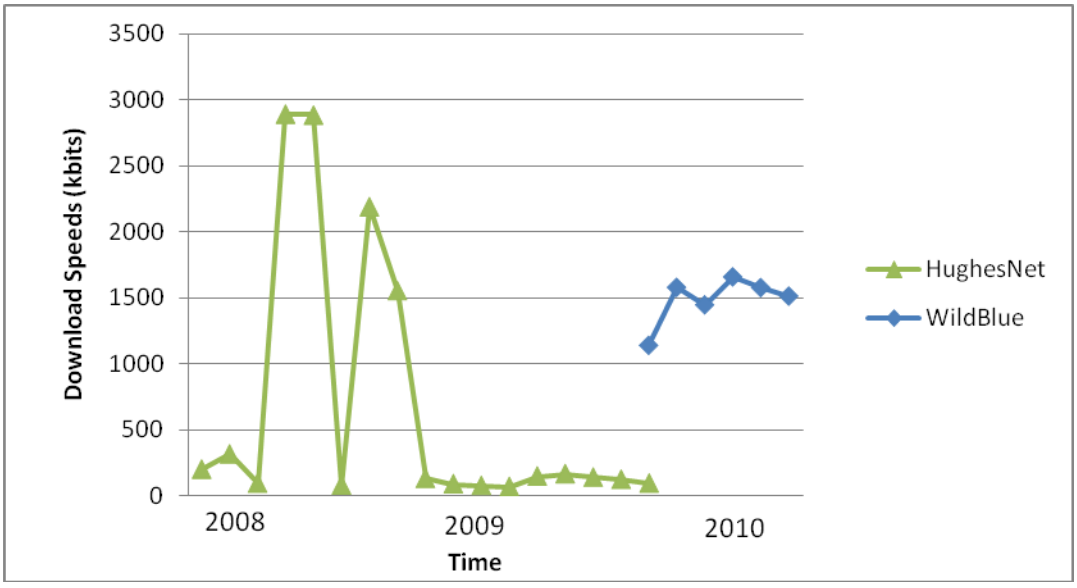
STATE OF ACCESSABILITY

Broadband availability in rural areas continues to be a major topic of concern among many people. Several grassroots organizations, including the Wireless Communication Association International and the Rural Broadband Coalition, were created for the sole purpose of closing the digital divide for rural Americans. Most states and often small towns have found that they are on their own when it comes to servicing their constituency. In many cases, current telecommunication providers have been contacted and deals have been established to provide service. In other cases, utility cooperatives, government owned cable or telephone companies, and private citizenry groups have succeeded in establishing high-speed options for consumers (Malechi & Bousch, 2003). The federal government is supporting efforts to offer broadband to the masses, but in some cases special legislation is required to pave the way. Economic stimulus money is being made available for continued expansion but may not be reaching areas with the greatest need. Providers often accept federal stimulus funds intended to expand service into rural areas and then use it instead to upgrade existing networks (Tessler, April 10, 2010).

SATELLITE INTERNET – THE SOLUTION FOR RURAL AMERICA

Because satellite Internet is touted as the solution (Bryer, 2003) for those residents whose only other option remains a dial-up telephone connection, a series of actual speed tests offered as a benchmark will be presented to compare the two dominant satellite providers. HughesNet and WildBlue are the basis for the samples. Both downlink and uplink speeds were measured. HughesNet data was collected over a 3 year period with the WildBlue data collected during approximately 10 months.

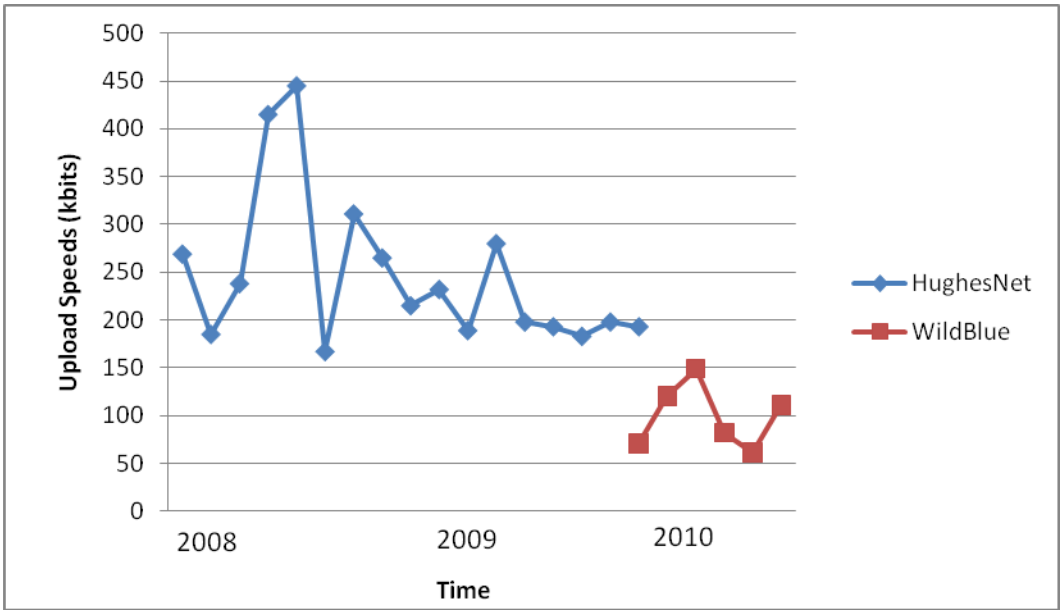
Figure 1: Comparison of 2 Dominant Satellite Internet Providers Download Speeds



HughesNet download speeds were very inconsistent, especially at certain times of the day. All providers warn of a slight decrease in stated plan performance during “peak usage

periods", usually 20% - 30%. WildBlue has proven, so far, to be more consistent in the stated plan download speed performance. They use Ka band technology that they describe as "spot beam architecture" that covers more narrow areas and is touted as being more efficient.

Figure 2: Comparison of 2 Dominant Satellite Internet Providers Upload Speeds

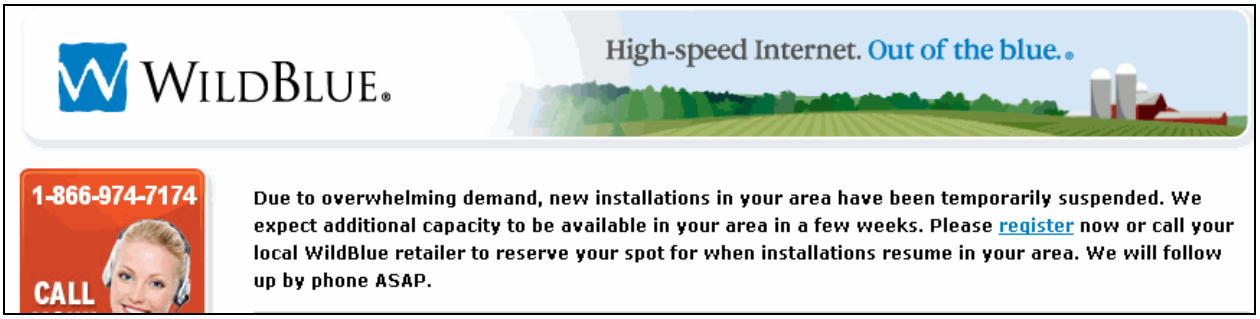


In both cases, HughesNet data were collected over a longer span of time. Collection began for HughesNet in late 2008 and continued throughout early 2009 when the service was replaced with WildBlue. Speed test data continues to be collected for WildBlue's service.

Fair access policies are also a potential issue. Based upon the plan a consumer selects, there is a monthly quota placed on how much data may be download and uploaded. If this limit is exceeded then the service is reduced for some period of time. This policy varies between HughesNet and WildBlue slightly, but both providers have and enforced their stated policy. This is a potential problem for many Internet users because these measures count all data being passed through the connection including email, attachments, Internet surfing, video streaming, and operating system and other software updates. As an example, HughesNet's low end plan allows for 200 megabytes (or 200 million bytes) within a 24-hour period. A single video viewed for educational purposes might exceed 100 megabytes! HughesNet resets their fair access policy after 24-hours. WildBlue's basic package allows for 7.5 gigabytes (7,500 megabytes) within a rolling 30-day period which is slightly more confusing because the policy doesn't reset as quickly, but instead the oldest day in the rolling period is dropped and a new day is added. Once again, 7.5 gigabytes may seem like a large volume of data, however averaging that amount over a 30-day period is 250 megabytes daily.

Satellite Internet is weather affected. Thick clouds, rain, and snow all have the potential to adversely affect service. Services like voice over IP or VoIP may not be utilized due the latency created by the use of low-orbit satellites. Yet another problem is availability. Figure 3 is an excerpt from the WildBlue website and uses zip code to determine current availability.

Figure 3: WildBlue Satellite internet Availability Statement 4/22/2010

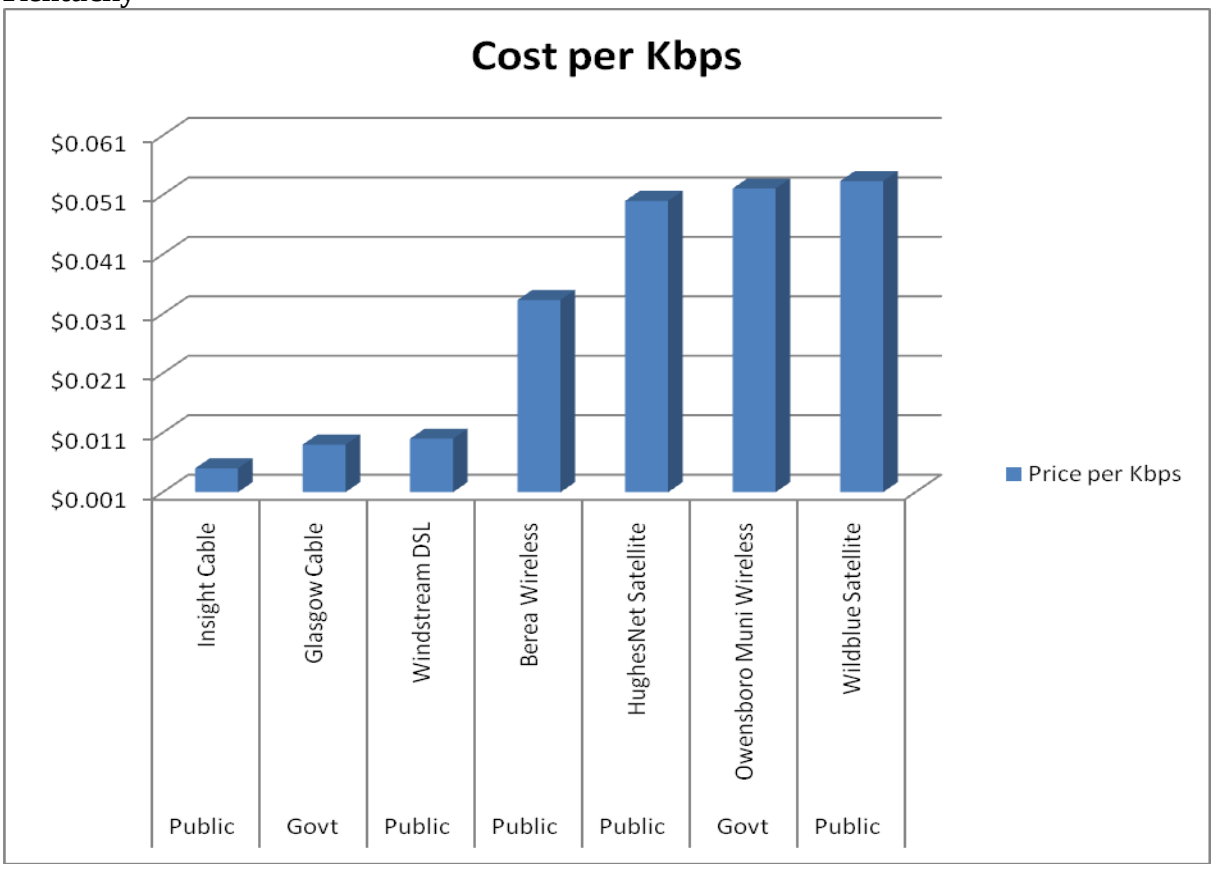


Source: www.WildBlue.com/getWildBlue/availability.jsp

Because the number of satellites and available bandwidth is limited people in rural areas may again be left with only dial-up service as their only alternative. Numerous Kentucky zip codes were entered into this site only to receive the same message depicted in Figure 3.

Finally and perhaps most importantly, is the issue of price. HughesNet offers three residential packages that start at around $60 with the most expensive package costing $80 monthly. WildBlue also offers three residential packages that range from $50 to $80. Additionally, there is some set-up fees for both providers that vary based on current promotions, but typically range from $100 to $200. Cost, as mentioned earlier as a key obstacle, remains a factor for either of these potential providers as a solution for most rural residents. An analysis of the data presented in Figure 4 indicate that consumers with only satellite Internet as an option for high-speed pay between two to five times as much as people with access to cable, DSL, or wireless Internet services. Figure 4 depicts several Internet service providers that are available in selected areas around the commonwealth.

Figure 4: Comparison of Select Internet Providers of Kentucky



There are examples of both public and private companies as well as examples that include wireless, DSL, and cable Internet. Both satellite providers rank at the high end of cost per kilobits per second. This was matched only by an example of a municipal utility wireless offering that has since been acquired by another wireless venture.

CONCLUSIONS AND RECOMMENDATIONS

One consideration that is often resisted by officials in rural communities is the possibility of funding an initiative internally, either with a low-interest loan or through a property tax increase. However, in today's political environment, tax increases are often not well received by constituents. Among the advantages to using quasi-government entities to borrow money are the tax savings that benefits the citizenry of the served community. The most successful wireless in western Kentucky is the multi-county initiative known as ConnectGRADD. The Green River Area Development District partnered with Norlight, a division of Windstream, to provide wireless Internet across their own service district as well as several counties that voluntarily joined the effort. This project requires capital investment from interested counties with most participants using coal-severance as their revenue source. Local leaders should continue to seek available state and federal funding in an effort to duplicate the model already established by GRADD.

Sustainable lifelong learning is critical to ensure prosperous communities, to facilitate the education of K-12 age children by fostering educated parental ranks, and to create a feeling of connectedness among community members (Ryman, Burrell, Hardman, Richardson, & Ross, 2010). Online learning is not the solution for all learning scenarios and it certainly isn't suitable for all topics. However, working adults with busy schedules will continue to pursue formal and informal education using this venue. For now the question is simply, can the digital divide finally be closed with satellite broadband offerings in rural America that is expensive and burdened with operational issues?

REFERENCES

Agee, J. (2005). Literacy, aliteracy, and lifelong learning. *New Library World, 106*(5/6), 244-252. Retrieved October 26, 2010, from ABI/INFORM Global. (Document ID: 867907631).

Ball, S. R. (2005). The role of organizational culture in innovation adoption: Teaching through the internet in specialized schools of business. *Dissertation Abstracts International, 66* (09). (UMI No. 3186569). Abstract retrieved Nov. 13, 2006, from ProQuest Digital Dissertations database.

Banos, M. (2006, Feb. 26). Wi-fi for white space. *American Chronicle*, p. 1. Retrieved Oct. 10, 2006, from http://www.americanchronicle.com/articles/viewArticle.asp?articleID=6095

Bryer, A. (2003). Broadband via satellite catches on in Denver area. *The Denver Business Journal*, *54*(38), A6. Retrieved October 10, 2006, from ABI/INFORM Dateline database. (Document ID: 325281581).

ConnectKentucky Bulletin. (2005). Barriers to Broadband Access in Kentucky. 12.

ConnectKentucky, (2008). Setting the Pace: Accelerating Broadband Expansion. 2008 progress report posted to http://connectkentucky.org/news_&_events/Publications/connectKentucky_progress_reports.php

Donat, E., Brandtweiner, R., & Kerschbaum, J. (2009). Attitudes and the Digital Divide: Attitude measurement as instrunent to predict Internet usage. *Informing Science , 12*, 37-56.

Dern, D. P. (2005, Oct. 21). Speed bumps on the wireless superhighway: Obstacles on the road to WiMAX. Informit Network, Retrieved July 5, 2006, from http://www.informit.com/articles/article.asp?p=420074&rl=1

Gabel, D., & Huang, K. (2008). Promoting innovation and the deployment of advanced telecommunications services to businesses. *Contemporary Economic Policy, 26* (2), 229-247.

Galloway, L. (2007). Can broadband access resue the rural economy? *Journal of Small Business and Enterprise Development , 14* (4), 641-653.

Gillett, S., Lehr, W., & Osorio, C. (2006). Municipal electric utilities' role in telecommunications services. *Telecommunications Policy*, *30*(8/9), 464-480. Retrieved Tuesday, October 31, 2006 from the Academic Search Premier database.

Grubesic, T. H. & Murray, A. T. (2004). Waiting for broadband: Local competition and the spatial distribution of advanced telecommunication services in the United States. *Growth and Change, 35*(2), 139-165. Retrieved Oct. 5, 2006, from http://ejournals.ebsco.com/direct.asp?ArticleID=4341B73BAA1D43713A97

Grubesic, T. H. (2003). Inequities in the broadband revolution. *Annals of Regional Science*, 37, 263-289. Retrieved Oct. 31, 2006, from http://www.tonygrubesic.net/

inequities_broadband.pdf
Hammond, A. S. (1997). The Telecommunications Act of 1996: Codifying the digital divide. Federal Communications Law Journal , 50 (1), 179-215.
Kentucky Assocation of Electric Cooperatives [KAEC] (n.d.). Service Areas of Members Cooperatives. Message posted to http://www.nsr.com/Reports/SatelliteReports/SatelliteReports.html
Levin, S., & Schmidt, S. (2010). Telecommunications after competition: Challenges, institutions, regulation. *Info, 12* (2), 28-40.
Malechi, E., & Bousch, C. R. (2003). Telecommunications infrastructure in the southeastern United States: Urban and rural variation. *Growth and Change, 34* (1), 109-129.
Obilade, A. O. (2001). Culture, technology, and multivocality in an Internet-age organization. *Dissertation Abstracts International, 62* (10), 3240. (UMI No. 3030916). Retrieved Oct. 17, 2006, from ProQuest Digital Dissertations database.

Parker, E. B. (2000). Closing the digital divide in rural America. *Telecommunications Policy*, *24*, 281-290, Retrieved October 15, 2006, from the Academic Search Premier database.
Phang, C., Sutanto, J., Kankanhalli, A., Li, Y., Tan, B., & Teo, H. (2006). Senior citizens' acceptance of information systems: A study in the context of e-government services. *IEEE Transactions on Engineering Management*, *53*(4), 555-569.
Rural Broadband Coalition. (n.d.). *Rural Broadband Coalition Overview*. Retrieved June 20, 2006, from Rural Broadband Coalition: http://www.ruralbroadbandcoalition.net/
Ryman, S., Burrell, L., Hardham, G., Richardson, B., & Ross, J.. (2010). Creating and Sustaining Online Learning Communities: Designing for Transformative Learning. International *Journal of Pedagogies & Learning*, *5*(3), 32-45. Retrieved October 2, 2010, from ABI/INFORM Global. (Document ID: 2122167231).
Stenberg, P., Morehart, M., & Cromartie, J. (2009). Broadband Internet helping create a rural digital economy. *Amber Waves , 7* (3), 22-27.
Strover, S., Oden, M., & Inagaki, N. (2001). *Telecommunications and rural economies: Findings from the Appalachian region*. Paper presented at the 29th Telecommunications Policy and Research Conference, Alexandria, VA.
Turner, J. W., Thomas, R. J. & Reinsch, N. L. (2004). Willingness to try a new communication technology. *Journal of Business Communications*, *41*(1), 5-26. Retrieved Nov. 14, 2006, from Business Source Premier Database.
WildBlue.com. (2010). Retrieved April 23, 2010, from Availability & Offers: www.WildBlue.com/getWildBlue/availability.jsp