

"Education via Wireless Internet"

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Abstract

Satellite communications and other wireless systems are effective methods of delivering Internet services to meet education and communication needs in rural and remote areas. What is particularly striking, at the reunion of UNISPACE in 1999, is the abundance of supplementary delivery systems to satellite communications. In Blacksburg, Virginia, home of Virginia Polytechnic Institute & State University, (also known as Virginia Tech), we have been experimenting with community networking, virtual schools, and satellite and other wireless and wireline delivery systems. This paper attempts to summarize some of the highlights of these efforts, and the lessons learned.

A Wireless Corridor in Appalachia

The importance of competitively priced, advanced telecommunications services for economic development and quality of life is indisputable. Commerce, education and training, collaboration, and information access increasingly require access to the Internet or other networks. Unfortunately, the Appalachian region and other rural, less densely populated areas are usually left behind when new telecommunications services become available. Under-served regions run the risk of being unable to compete for their share of economic growth and to contribute to the nation's competitiveness. In addition, such regions are, by extension, under-served with respect to education and healthcare.

The Appalachian Wireless Corridor (AWC) is proposed as a large-scale and high-impact initiative to investigate, demonstrate, evaluate, and disseminate wireless solutions for the telecommunications needs of the Appalachian region and similar underserved areas. Wireless technology is well suited to overcome both technical and economic problems that limit the deployment of traditional wireline technology for the costly "last mile" of access in rural areas. Specifically, the AWC will:

- cultivate a wide range of wireless technologies, services, and applications to leapfrog the Appalachian region into the "Digital Millennium,"
- develop, integrate, deploy, and evaluate advanced wireless communications technologies in public and private sector partnerships,
- focus on public and private sector applications in three critical areas — manufacturing and commerce, healthcare, and education and training — for the purpose of improving economic welfare, jobs, competitiveness, and quality of life, and
- transfer regional solutions to national and international markets.

The initiative will be undertaken by the Appalachian Wireless Corridor Consortium, an industry, government, and university partnership. The lead institutions in this partnership are Georgia Tech, the University of Tennessee, Virginia Tech, and Oak Ridge National Laboratory and the Oak Ridge Centers for Manufacturing Technology. Oak Ridge Associated Universities will serve as the facilitator and program manager.

The AWC Consortium will conduct a series of demonstration projects throughout the Appalachian region as the centerpiece of the Appalachian Wireless Corridor. Strategic partnerships with end users, local and state governments, colleges and universities, and product and service providers will be formed for the demonstration projects. As an illustration of what can be accomplished, the demonstration projects can provide broadband network access for:

- an "e-incubator" that serves electronic commerce start-ups and a remote "workport" facility in southwestern Virginia in an area where existing services are limited and prohibitively expensive,
- health monitoring and caregiver support for long-term care patients in remote areas and immediate monitoring and evaluation for emergency medical services in eastern Tennessee, and
- manufacturers in northwest Georgia that will enable the incorporation of modern information technology into their processes and the retraining of workers.

Virginia Tech has purchased three licenses for Local Multipoint Distribution Service (LMDS), a wireless broadband service, in Appalachian region. We are in the process of testing and planning the deployment of LMDS technology and services with local public schools, local government and health facilities in conjunction with fiber optic networks and satellite communications.

Blacksburg Electronic Village - Community Network

Blacksburg is a university town in the foothills of the Appalachian mountains in southwestern Virginia (southern Shenandoah Valley) -- beautiful, but remote. Due partly to its physical isolation, Virginia Tech has been a leader in telecommunications services and innovative applications which has been very important in linking this remote area to the rest of the world.

Virginia Tech was the impetus behind the Blacksburg Electronic Village (BEV). Partnership evolved: feasibility study, beta test, preliminary evaluation; operational since Fall 1993. We have conducted longitudinal evaluation of use and impact of networking in the community and the region. We expect that some of our findings are relevant to other communities, regardless of location.

Highlights of Internet User Profiles

Recent surveys show that the majority (89%) of Internet users in Blacksburg and Montgomery County are affiliated with Virginia Tech. The percentage of survey respondents reporting they are somewhat or very interested is highest for electronic mail and the World Wide Web. We have seen in the Blacksburg Electronic Village that a community network helps build social networks. Seventy-nine percent (79%) of survey respondents report they expect BEV to be

somewhat or very helpful in social relations. Eighty six percent (86%) indicate they are somewhat or very interested in bulletin boards and newsgroups.

Community networks are clearly capable of building social trust and the norms of mutual reciprocity needed to achieve collective action. Rather than being a substitute for human connectivity, networks can enhance an individual's involvement in and sense of belonging to a community. Seventy-two percent (72%) of survey respondents report they expect BEV to be somewhat or very helpful with civic affairs.

In Blacksburg we have established a school board mailing list, email for School Board, feedback to local government via WWW, and online county surveys. These information and communication resources have increased citizens' sense of involvement in local issues and the community.

The Virtual School and Constructivism

Computer networks, most notably the Internet, facilitate constructivist teaching and learning strategies with its rich tools and opportunities for student-teacher-community interactions and negotiations to construct meaning. The context of interaction and negotiation is as close as the community and as wide as the world itself. Related, but not necessarily dependent upon constructivist notions, is the belief that students learn best when solving problems in “authentic” or “real life” situations. The power of the Internet to provide a wide range of resources in a rapid manner makes it ideal for problem-based learning activities that require external materials and mentors. The greater accessibility of online simulations of authentic situations, as well as the connection to far-flung and diverse resources expands a learner's and a teacher's actual resource base.

The new possibilities that the Internet provides for visualizing scientific data and mathematical models in space offers exciting possibilities for the way in which concepts can be imaged, understood and learned at a level beyond equations (also facilitating a "multiple intelligences" approach to learning).

The Role of Networking in Education Reform

Electronic mail and online bulletin boards are the most popular services of the Internet; they are also potentially the most profound, for education, as well as the general community. Computer networks provide a communication medium that has never existed before for small group participation, collaboration and interaction. Recent research shows that in the classroom, online interaction is more than supplemental. Computer mediated communication affects social and psychological aspects of group communication, as well as the quality and extent of discussion, in several specific ways:

- 1) increases in overall level of discussion of the entire group;
- 2) increases in student participation, especially from those who do not participate in face to face settings;
- 3) increases in understanding of material;
- 4) increases in morale, sense of belonging and motivation; and
- 5) increases in community interaction and involvement in the educational process, thereby improving the educational experience and facilitating long term sustainability of network resources in the schools.

Some of the public school systems in southwest Virginia and other rural areas are serving as community technology resource and training centers in the communities where they are located. Satellite communications and fiber optic wireline systems (such as Net.Work Virginia, which is Asynchronous Transfer Mode broadband) have been the backbone for content delivery. Not only do they offer a broader selection of courses to students (especially in rural areas and

inner cities), but they can serve needs of adults for continuing education and job skills upgrading.

Business Needs: Technology and Training

Small and medium sized businesses (SMEs) can benefit from increased access to information, such as market prices, and contact with clients and suppliers. By having easier access to information about alternative suppliers, small and medium sized enterprises can lower costs and improve service. They may also enter a larger market, regionally, or globally. We have conducted longitudinal evaluation of the use and impact of the Internet on small and medium sized businesses in Blacksburg and environs (see <http://www.bev.net/project/research>). It is clear that for some companies, the Internet is not necessary or advantageous at this point. Nonetheless, there is a growing trend toward the adoption of new information technologies and services, particularly for contact with suppliers or products, services and information. Business, like schools and community organizations, choose from a wide variety of connectivity options, including wire and wireless. These technology choices are also being made by other sectors, such as education, health, and community development. The biggest difficulty for most organizations, in the nonprofit and public sectors is learning and staying informed about the costs and benefits of so many different options and services that these new technologies make possible.

There was a time when satellite communications was the only feasible way to deliver public services to rural and remote areas. Today, at the third reunion of UNISPACE, it is gratifying that there are so many additional technologies to help satellites reach the 'last mile' and the last subscriber.

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