High-Speed Broadband Access for All Kids: Breaking Through the Barriers

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Executive Summary

High-speed broadband access and connectivity are vital for economic growth, global competitiveness, education, innovation, and creativity. Ensuring high-speed broadband access for all students has become a critical national issue especially when considering preparing our students for work and life in the 21st century. SETDA members and the greater educational community recognize that robust high-speed broadband access in all of our nation's schools will accelerate our teachers' ability to teach and our students' ability to learn. SETDA identifies the key issues facing the educational community relating to robust connectivity and recommends how states and districts can successfully implement high-speed broadband in their schools as well as recommends what stakeholders and policymakers can do to support bringing this critical issue to a national policy level.

Key Issues

- Schools need high-speed broadband access to effectively create rigorous, technology-infused learning environments
- Students need affordable, high-speed broadband access at home to extend learning 24/7
- Teachers need guaranteed, long-term access to high-speed broadband to enrich the curriculum to include technology applications such as videoconferencing and distance learning
- Teachers need high-speed broadband access for professional development, and engaging in professional learning communities as well as accessing new educational resources such as curriculum cadres and education portals
- Administrators need high-speed broadband access to conduct online assessments and to access data for effective decision making
- Students need high-speed broadband access in their schools to take advantage of a wide range of new and rich educational tools and resources available for anytime, anywhere learning
- Students need high-speed broadband access to overcome the digital divide in rural and low socio-economic areas

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Key Recommendations

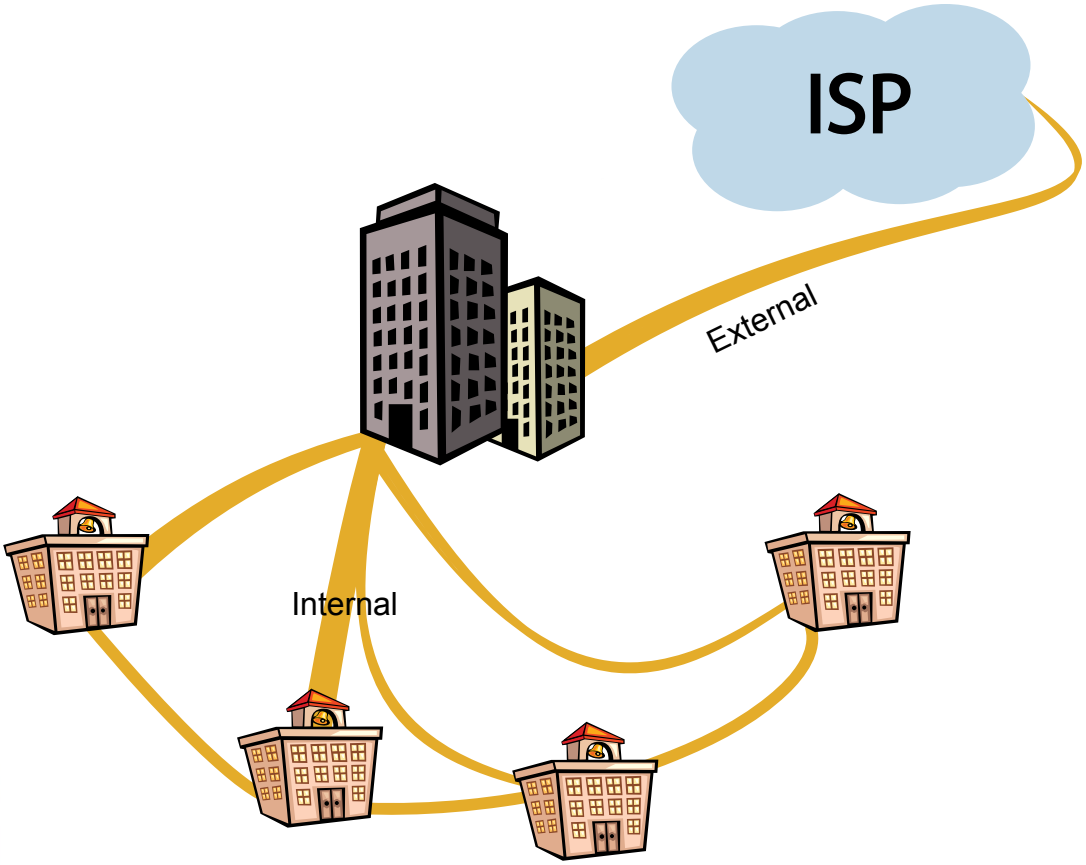
High-Speed Broadband Requirements

In a technology-rich learning environment for the next 2-3 years, SETDA recommends:

- An external Internet connection to the Internet Service Provider of at least 10 Mbps per 1,000 students/staff
- Internal wide area network connections from the district to each school and between schools of at least 100 Mbps per 1,000 students/staff

In a technology-rich learning environment for the next 5-7 years, SETDA recommends:

- An external Internet connection to the Internet Service Provider of at least 100 Mbps per 1,000 students/staff
- Internal wide area network connections from the district to each school and between schools of at least 1 Gbps per 1,000 students/staff



Implementation Tips

To help school districts implement high-speed broadband in schools, districts should consider successful district, community, and statewide models as resources

Broadband is critical to providing Bering Strait School District (Alaska) students with the same high quality educational opportunities as non-rural communities.

Policy Tips

When developing policies supporting the implementation of broadband, school districts should:

- Develop a coordinated planning effort with state and local government, the community and private sector
- Include appropriate stakeholders in the process and obtain stakeholder commitment

Strong leadership from key executives is critical for implementing high-speed broadband access.

Funding Tips

SETDA recommends that states and/or school districts:

- Leverage E-Rate and other federal, state, and local funding sources
- Partner with others in the state and community to aggregate demand and create economies of scale
- Negotiate on-demand fee structures with broadband providers

*High-speed broadband access is similar to a utility - it is **essential** for operations.*

E-Rate Recommendations

- Keep E-Rate as part of the universal service fund
- Advocate that policymakers update the universal service program to increase available funding
- Provide administrative funds to states
- Encourage states to have a State Level E-Rate Coordinator
- Simplify and streamline the E-Rate application and approval process

What Is Broadband?

Broadband is defined as high-speed Internet access, leading to the immediate questions: "what is high-speed?" and "why is it important?" The Federal Communications Commission (FCC) defines speed in terms of the maximum download time and recently updated its definition of basic broadband from 200Kbps in any one direction to a range of 768Kbps to 1.5Mbps.[1] Speed is important because it determines what applications and functionality is possible through the Internet connection. For educational purposes, broadband speed at this definition is still much too slow to facilitate a robust, interactive learning environment necessary to improve student achievement and create tomorrow's innovators. Such a connection could not accommodate many technology applications that have been found to save money and improve teacher effectiveness such as high-definition videoconferencing and online learning. The constraints that inadequate broadband connections pose are vast when considering the trend towards online high stakes testing, database management, school Web presence and communication with parents, collaborative research projects, and video streaming. In fact, between 2003 and 2008 the average size of a web page has grown 233% and the number of objects on the average web page has doubled.[2]

Update the Definition of Broadband to Truly Reflect High-Speed Access

Many industry leaders believe that the definition of broadband needs to be increased significantly in the next few years. Most believe that the definition of high-speed broadband should be at least 10 Mbps by 2010.[3] Others support creating big broadband networks of at least 100Mbps[4]. Some countries have already established goals of 100 Mbps, while other countries have established goals of 10 Gbps.[5] In contrast, the National Academy of Sciences does not define broadband with a fixed speed – instead it defines broadband as the ability to access service that enables the creation of necessary applications and content.

Current State of Broadband

Access versus Adoption

- *Access is the physical availability of high-speed broadband services*
- *Adoption is the subscription to and use of high-speed broadband services*

Access

In 2004, President Bush called for a national *goal* of affordable access to broadband for all by 2007.[6] Unfortunately, we have not yet achieved these goals with broadband services available to only 80-92% of households at speeds both above and below the current FCC definition of broadband.[7] Rural areas often have more limited access to broadband than other areas in the country. Often times, high-speed broadband access is not available for that "last mile" and in order to have any access at all, rural households have to pay more for slower speeds of broadband service.

High-speed broadband access in rural communities can provide distance learning opportunities that would otherwise be unavailable to those students.

Adoption

In addition to access, there are issues of broadband adoption. The U.S. is ranked 16th in the world in broadband adoption.[8] Ninety-one percent of the variation in broadband adoption rates among individual states is attributable to economic and demographic conditions, such as household income, education, and income inequality.[9] Affordability of high-speed broadband is a critical factor in adoption. For example, higher income households are more likely to adopt broadband services, with 62% of households with incomes over $100,000 subscribing to broadband compared to 11% of households with incomes less than $100,000.[10] Clearly the digital divide remains a significant obstacle to overcome.

Create a National Policy?

The U.S. does not have a national policy addressing high-speed broadband; however, several national organizations such as EDUCAUSE, the Alliance for Public Technology (APT), and Speed Matters believe that in order to achieve affordable access for all, the U.S. needs to develop a comprehensive national policy that addresses the issues surrounding deployment, affordability, adoption and speed, especially as capacity and consumption expands. In fact, most economically developed nations have created national policies to promote high-speed broadband development and adoption. For example, Japan has a national initiative to build fiber networks to every home and business.[11] In the United Kingdom, through regulatory and funding initiatives created by the government, broadband services are available to 99.7% of households.[12] In Korea, the government built a national Internet backbone for broadband, including the provision of broadband services to all public schools.[13]

In order to provide students with an interactive learning environment necessary to build the high level skills essential to compete in the global economy, we need to ensure that our children have access to high-speed broadband both at school and at home – with access that is affordable for all households.

Current State of Broadband In Our Educational System

In order for administrators, teachers, students, and parents to effectively use technology tools and resources, schools need high-speed broadband access. According to statistics compiled from the E-Rate program, 98 percent of schools have *basic* Internet access. However, for many of these schools, access is often limited and at low speeds. For example, access may mean that a school is considered "connected" when it only has one computer dedicated to administrators use for email purposes. In addition, in many school districts Internet access is not even baseline broadband and thus, is insufficient to handle current and emerging technology applications that demand ever increasing bandwidth, such as video streaming, video conferencing, and online interactive learning.

Based upon our observations, most schools in the country are at T1 (1.54 Mbps) connection speeds between the school buildings with some having additional capacity.[14] With these bandwidth speeds, schools are trying to accommodate the technology needs of many concurrent users. Compared to the average household with broadband access of at least 5 Mbps[15], with just a few users, bandwidth in many schools is significantly lower with many more concurrent users. Broadband connection speeds in schools are already behind average households, and in the next few years as bandwidth needs expand, schools will need to *significantly* upgrade their high-speed broadband capabilities to try to keep pace with what children are accustomed to at home. Even in schools that are sufficiently connected with broadband, bandwidth demand is quickly exceeding capacity as they utilize advanced technology tools. Simply having connectivity is not enough: without measurable upgrades in bandwidths to allow for greater speeds – or even to maintain current speeds as demand grows, teachers and students will be severely limited in the technology applications they can utilize.

Why Broadband Is Important For the Educational Community

Our education system needs high-speed broadband access for all to ensure that our administrators, teachers, and children have access to the technology resources available so that our children are competitive in the 21st century. There are many proven technology solutions that are scalable, flexible, reliable, and have the ability to cost-effectively transform education for ALL students. In order to utilize these technology tools and resources to enhance teaching and learning, our administrators, teachers and students need high-speed broadband access for:

- Online Assessments, Data, and Other Administrative Uses
- Online and Distance Learning
- Special Education Learning
- Web 2.0 Technology Tools
- Professional Development Opportunities

Online Assessments, Data, and Other Administrative Uses

High-speed broadband access for all enables administrators to utilize online assessments, which may be formative, diagnostic, or summative. Online assessments are used principally to measure what students have learned. Online assessments may also be used prior to teaching a concept to determine a students' current knowledge. Several states, such as Virginia are utilizing online assessments. High-speed broadband access also enables the use of data for administrators and teachers. Using data empowers teachers and school leaders to improve teaching practices and individualize instruction for all students. Data can also be used for reporting and analyzing to determine alternative assessments and student performance measurements.

Online and Distance Learning

High-speed broadband access also enables students to engage in online and distance learning. For example, Louisiana has successfully implemented the Algebra I Online Project, which provides Louisiana students with a certified and qualified Algebra I instructor, and a high quality Algebra I curriculum, through a year-long web-based course. The program continues to positively impact student achievement and instructional strategies of teachers seeking mathematics certification. In Alabama, the ACCESS Distance Learning program provides opportunities for Alabama public high school students to engage in Advanced Placement (AP), elective, and other courses via the Internet to which they may not otherwise have access.

Special Education Learning

Technology can make learning and participation possible for the over 2 million American children who have a disability. For print disabled students using screen readers and blind students reading the same textbook with refreshable Braille, assistive technology can provide access to the general curriculum and higher achievement. High-speed broadband provides access to the world through virtual field trips. Imagine taking a group of severely autistic students to visit the museums of New York City, London, or Nairobi via web cams and simulations. Special education personnel, too, benefit from the potential of high-speed broadband. Networked data management systems for developing and tracking Individualized Education Plans increase productivity and compliance within a district.

Web 2.0 Technology Tools

Some technology tools requiring high-speed broadband that are currently used in school districts around the country include Web 2.0 tools such as blogs, chats, podcasts, video, and wikis. Technology is providing the platform for on-going and real communication and collaboration among students and teachers with writing, research, publishing, and debating on topics in all subject areas.

For example, in a Tennessee high school in Henry County, the ninth grade journalism students use a blog to publish high school news daily, whereas in the past when they were publishing a printed hard copy, they only had the budget to publish once or twice per school year. Now the journalism class is able to produce more publications with modern tools of the trade.
See: www.henryk12.net/hchsnews and www.henryk12.net/spirit.

Students at Jamestown Elementary School in Arlington, Virginia are heavily engaged in learning through the use of technology in the form of podcasts. Students at all grade levels create podcasts in different academic content areas covering topics such as mathematics story problems, school current events, silly sentences, classroom core values and mission statements, and responses to books read.
See: http://slapcast.com/users/Jamestown?1554Nav=|&NodeID=1086.

A consortium of small rural districts in Arizona utilizes two-way interactive television to bring the outside world into their classrooms. These districts are geographically isolated and use videoconferencing to access hard to obtain educational resources such as virtual field trips and dual enrollment classes. See http://www.ade.az.gov/technology/CurrentEETT/07-09/pinal-itv-consortium.asp and http://www.pinalitv.org/Home/tabid/358/Default.aspx.

Curriculum drives bandwidth needs – Indiana's ACCESS program (one-to-one computing in high school) has shown that teachers will not revise curriculum until they have guaranteed, long-term access to technology and the Internet. Technology applications such as Moodle and Ifolder require access to high-speed broadband.

Professional Development Opportunities

High-speed broadband access for all is also essential in providing professional development opportunities for our teachers. Education portals, curriculum cadres, and online courseware are just a few examples of professional development strategies requiring high-speed broadband access.

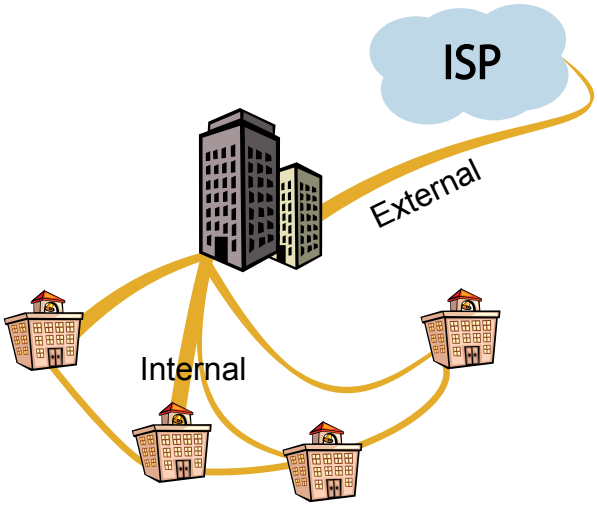
- **Education Portals –** In Arizona, IDEAL is a web portal for Arizona educators to access educational resources and services with the ultimate goal to increase the academic achievement of all Arizona students and to support school improvement efforts throughout the state. Through a single sign-on, educators enter a web environment and can access a vast array of online resources. A portal allows educators to quickly search for lesson plans or other resources by content standard, grade level, and/or topic. www.ideal.azed.gov
- **Curriculum Cadres** – The Alabama Best Practices Center designed a two-year professional development program that engages educators from participating schools in powerful conversations about 21st century learning. The Center established a virtual learning community built around an online curriculum called "Keeping Up with the Net Generation." http://www.bestpracticescenter.org/21stcentury.htm
- **Online Courseware –** In eTech Ohio has implemented a program to provide online professional development courses for all Ohio PK-20 educators and professionals. These are anywhere, anytime, asynchronous courses with eTech Ohio certified facilitators. Facilitators are online on a daily basis to respond rapidly to the needs of participants. In many cases, graduate credit is obtainable by teachers who take the courses. http://etech.ohio.gov/programs/elearning/

Recommendations

Most school districts and schools in the country are connected -- the challenge is getting adequate high-speed broadband to the school districts and schools so that they can utilize the technology tools available to enhance instruction. To help states and school districts implement high-speed broadband access in education, SETDA has recommendations in the following areas:

- Benchmarks/Goals
- Implementation Tips
- Policy Tips
- Funding Tips
- E-Rate

Benchmarks/Goals



High-Speed Broadband Requirements

In a technology-rich learning environment for the next 2-3 years, SETDA recommends:

- An external Internet connection to the Internet Service Provider of at least 10 Mbps per 1,000 students/staff
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In a technology-rich learning environment for the next 5-7 years, SETDA recommends:

- An external Internet connection to the Internet Service Provider of at least 100 Mbps per 1,000 students/staff
- Internal wide area network connections from the district to each school and between schools of at least 1 Gbps per 1,000 students/staff

In a powerful technology environment, supply also creates demand. It is critical to build scalability and flexibility in the network to ensure continuous improvement.

SETDA recommends that school districts consider the following questions when updating their broadband access:

- How many students use your network?
- How many teachers and administrators use your network?
- How many computers are connected to the Internet in your school district?
- Based upon the number of students, teachers, administrators, and computers, how many concurrent users are on the network at any given time?
- What technology applications do you use?
- What technology applications are planned for the future?
- How much bandwidth is required for each technology application?
- How can you build scalability and flexibility in the network to ensure continuous improvement?

Typical Bandwidth per User
Email and Web Browsing (50kbps)
VoIP (Voice over IP) (50kbps)
Online Learning (100kbps)
Audio Streaming (100kbps)
Online Assessment for each Student (100kbps)
Student-created Content (150kbps)
School Portals (150kbps)
Virtual Field Trips (250kbps)
TV-Quality Video Streaming to a Desktop (250kbps)
Interactive Video at a Desktop (300kbps)
Source: School 2.0 Bandwidth Calculator

Based upon the answers to these questions, school districts can determine approximate bandwidth usage, and then use this information to scale the bandwidth required to meet anticipated technology needs in the next three to five years. In a powerful technology environment, supply also creates demand – as schools see the benefits of utilizing technology applications, they will want to use even more technology tools and resources. School districts should consider this concept when projecting necessary bandwidth requirements over the next few years.

States and/or districts can also access the School 2.0 Bandwidth calculator to determine the amount of bandwidth needed to run your current and/or future applications at http://etoolkit.org/etoolkit/bandwidth_calculator/index.

Approaches to Exemplary High-Speed Broadband Access

While the vast majority of schools and school districts do not have the high-speed bandwidth required to create modern learning and administrative environments, there are several exemplary examples of education agencies that have been able to implement a vision for ubiquitous high-speed bandwidth connectivity. This section highlights these model approaches for implementing high-speed broadband access in our schools:

- District Models
- Community Models
- Statewide Models

District Models

Charles County Public Schools, Orange County Public Schools, and Bering Strait School District are examples of exemplary district models used for implementing high-speed broadband in our schools.

Charles County Public Schools

Five years ago, Charles County Public Schools (CCPS) in Maryland initiated a program to provide broadband access to all 37 schools in the district. CCPS utilizes Network Maryland, a statewide high speed network that provides basic network connectivity for all public entities in the state, including government, courts, libraries, and schools. Network Maryland was created to provide economies of scale for public agencies throughout the state and to help communities gain access to broadband. CCPS currently receives 40 Mbps of internet bandwidth to the students and staff of approximately 30,000. CCPS manages the external 40 Mbps Internet bandwidth by paying for services based upon current demand. CCPS monitors demand, so that administrators, teachers, and students are not overtaxing the system with excessive use of non educational content. Internally, CCPS maintains a 2 Gbps connection between all school sites to provide access to applications and content.

> *"The bottom line for all of these technologies is that if they're not used for the purposes of instruction, it's all a waste of money"*
> —Bijaya Devkota, CIO for Charles County Public Schools

> *"Key to successful implementation was the leadership and vision from the district superintendent of education working in partnership with the CIO"*
> —Charles County Public Schools

In addition, CCPS has built out a voice, data, and video network infrastructure providing universal access to instructional and administrative resources. CCPS has also implemented universal wireless access throughout the school district, further enhancing the capabilities of teachers and administrators to access information anytime, anywhere. The overall cost of implementation was $6 million, which was financed through loans. When implementing the wireless networks, CCPS experienced some school infrastructure issues, such as cinderblock walls blocking signals, creating the need for additional wireless hotspots. Additionally, CCPS discovered that they needed to upgrade the power and electrical outlets in the schools to accommodate the new, more robust, network capabilities.

> *"We try to use the technology and tools to initiate enthusiasm from teachers and students"*
> —Bijaya Devkota, CIO for Charles County Public Schools

Learning Environment

CCPS believes that high speed broadband access for every school in the district is necessary to meet instructional requirements, including distance learning. CCPS recently started digitizing the core subject areas and mapping

it to state curriculum. After professional development training, teachers were able to create lesson plans in hours instead of days, and easily use streaming technology to provide voice, data, and video to the classroom environment. With wireless networks, CCPS created an on-demand, anytime, anywhere instructional model -- teachers can conduct lessons anywhere in the school. As these applications are utilized by teachers, students, parents and administrators, it is important for school leaders to look forward and anticipate the growing capacity needs. Taking this notion another step, CCPS is considering the broadband needs relating to data warehousing as online assessment programs are planned for the future.

Orange County Public Schools

In October of 2007, Florida's Orange County (Orlando) Public Schools (OCPS) completed its new, district-wide, high-speed Internet connectivity solution, known as the Managed Broadband Internet Access (MBIA) project. The project was architected by the Information Technology Department with an objective to completely upgrade the district's wide area network to provide a minimum of 10 Mbps of connectivity to each school – to increase productivity and enhance teaching and learning throughout OCPS schools. The highly scalable network is not only capable of securely supporting data, voice and video on a single network but is also able to meet the growing needs of their diverse and rapidly expanding student population that numbers over 176,000. The long term vision is to reach a goal of increased Internet service capacity with a high speed network designed to scale to 10 Gbps of connectivity and beyond.

"The long-term goal is to provide a robust, reliable and monitored network that we can easily expand as our needs and requirements increase. We also want to provide a network that allows us to centralize services at the district office in order to alleviate some of the technology administrative needs at the sites"

– Hermes Mendez, Director of Customer Support Services, Orange County Public Schools

"The Managed Broadband Internet Access project has significantly increased access to Web-based resources and applications for the classroom. Prior to the new network, it was simply not possible for an entire classroom of students to effectively access a website simultaneously. Our goal is fostering constant innovation and utilizing educational technology to prepare our students for the 21st century, and this increased bandwidth to all our schools enables us to make that a reality." Before MBIA implementation, the bandwidth leaving the district out to the Internet was about 150 Mbps. Today it is 950 Mbps, nearly six and half times greater."

– George Perault, Director, Instructional Technology & Library Media Curriculum Services, Orange County Public Schools

Learning Environment

OCPS' is already an experiencing a return on the investment in MBIA. Today, students and teachers are enjoying vastly increased Internet capacity and thus benefiting from important classroom applications and rich online resources that previously were unavailable to them due to insufficient online access.

Building Literacy and Skills through Technology, BLASST is a reading program that's been given an enormous boost by the new super-charged MBIA network. In the BLASTT classroom, students develop their reading, writing, research, presentation and technical skills while working on projects in a variety of core subject areas. Instead of utilizing lectures, textbooks and worksheets, the curriculum incorporates word processing, spreadsheet and presentation software, databases and laptop computers wirelessly connected to the Internet to delve deeper into content as well as build 21st Century skills.

"The progress of the BLASTT class is unmistakable. We keep stringent data on each student's growth throughout the year, and without a doubt, the BLASST class has shown outstanding growth – the most of any students on our campus. FCAT test results confirm it - the first-year BLASTT students improved their scores by 86 percent and the second-year students posted increases in the 70-percent range. It's an outstanding opportunity for me to offer something like BLASTT and this wirelessly connected classroom to my students. Especially to a school of this nature, a Title 1 school, where kids don't often get the opportunity to be exposed to these kinds of technologies."

– Nelson Pinder, Westridge Middle School Principal

Bering Strait School District

Broadband is critical to providing Bering Strait School District (Alaska) students with the same high quality education opportunities as non-rural communities. BSSD is located in coastal northwest Alaska covering an area of approximately 80,000 square miles (about the size of Great Britain), with fifteen schools and about 1,800 students. BSSD utilized SchoolAccess, a high speed satellite network that provides basic connectivity, managed services, and videoconferencing. SchoolAccess was created to allow rural communities to access broadband connections over satellite through E-Rate funding. Today, BSSD has 3 Mbps connections from each school to the district office in Unalakleet that are heavily relied upon to create a coherent sense of community throughout the district, provide educational opportunities to students, and allow teachers and administrators to meet without having to fly between communities.

With the addition of new applications and uses, flexible bandwidth has been a key to success.

Learning Environment

BSSD uses high speed broadband access for every aspect of their school day; it is integrated into instruction and is a key to the district's standards based education model. BSSD has used a number of open source technologies to provide support for the unique demands of their rural district. BSSD has implemented an instruction management tool that allows tracking and reporting of learner progress based on goal areas, helping teachers to plan instruction based on their students' areas of content strength and weakness. BSSD uses a wiki-based system for collaborative writing and curriculum enrichment across the district. Moodle online learning environments are used for instruction and learning management, as well as portfolio creation and tracking. With videoconferencing, BSSD delivers classes in Algebra and Spanish to students across the district and applies learning standards in flexible ways so students create new media products by videoconference, podcast, vodcast, and wiki for an authentic audience. The BSSD has been a key leader in having students broadcast the iDitaProject connecting mushers on the Iditarod Trail with schools across the country, with BSSD students producing, managing and distributing all content. Broadband is critical to providing BSSD's students with the same high quality education opportunities non-rural communities can more easily take advantage. In addition, the BSSD Student Broadcast Team with sponsorship from GCI SchoolAccess broadcasts sporting events which allow communities all over the state of Alaska to view these live events such as state and regional basketball and volleyball tournaments via video conference and streaming to individual village sites.

> *"District connectivity has changed the level of technology integrated into our education system over the years"*
> —John Concilus, Technology Coordinator for BSSD

Community Models

OneCommunity, Lemon Grove Lemon Link, and DeltaNet are examples of exemplary community models used for implementing high-speed broadband in the schools and community.

OneCommunity

OneCommunity, serving Northeast Ohio, is an example of a successful community model bringing broadband access to the local community and school districts. OneCommunity is a nonprofit organization connecting nonprofit and public organizations to a fiber-optic network. OneCommunity will soon connect more than 1,500 sites in 22 counties, including schools, libraries, higher education institutions, hospitals, governments, and arts and

OneCommunity Founding Members

NorTech
Cuyahoga Community College
Cleveland State University
Greater Cleveland Regional Transit Authority
Cleveland Municipal School District
ideastream (the local PBS and NPR affiliate)
Cuyahoga County Public Library

cultural organizations. OneCommunity started in 2002 when Lev Gonick, CIO at Case Western Reserve University, developed a vision to connect nonprofit institutions together into a common community network. The vision expanded to include the public and private sector, with Cleveland's Mayor as a key supporter of the vision.

Highlights

- OneClassroom was created to motivate students, enhance educational experiences, and increase the adoption of technology
- Cleveland Mayor Jane Campbell embraced the project as a one of the key transformational efforts for the community.

Learning Environment

OneCommunity launched OneClassroom, a shared community platform for teachers to access educational resources and offer distance learning to their students. OneClassroom utilizes a broadband network in a secure Web-based environment. Some of the resources available through OneClassroom are:

- Digital Resource Library
- Free Content
- Professional development resources

More than 115 public schools in Cleveland are connected to the OneCommunity broadband network. Teachers are able to integrate technology into the curriculum that engages students through the use of the network. For example, through its partnership with Cleveland Clinic, OneClassroom teachers use curriculum developed by the clinic to connect students to researchers and surgeons at the clinic. Students are able to watch and interact with surgeons during a live webcast of surgery. Cleveland students also benefit from distance learning programs provided by arts and cultural institutions in the OneCommunity network.

OneCommunity has received funding from a variety of sources. Cleveland Clinic provided a $2 million grant to bring technology to 1,500 schools over four years. Businesses have donated refurbished computers to the schools, and telecommunications and utility companies have donated more than 500 miles of fiber-optic rings throughout the region. OneCommunity has also received millions of dollars in in-kind donations of network and advanced computing resources.

"..all of a sudden Cleveland did a leap-frog over other urban districts."
(Cleveland historically lagged other large districts when it came technology.)
—Dan Burns, chief operating officer of the Cleveland schools

Lemon LINK - Lemon Grove School District

Lemon Grove School District, east of San Diego, California is a successful community model bringing high-speed broadband access to the school district and the community. Lemon Grove School District created a Connected Learning Community, Lemon LINK, to connect all schools and the city via an infrastructure that includes microwave, fiber-optic and laser technologies. The community network reaches all schools and city government facilities, including city hall, fire stations, public works, recreation, and community centers.

Highlights

- Business partnerships that provide hardware, software, and telecommunications services have been essential for the project's success
- The school district's Director of Information Systems, Darryl LaGace provides the leadership and vision for this project
- The community network supports connections from 100Mbps to 1Gbps for each location in the community

In Lemon Grove, the school district serves as the communication hub for the whole community, with a common portal linking the city to the educational system. Every classroom in the school district is connected to the network, and all computers in the classroom are connected to the Internet. Through a partnership with a local broadband provider, Lemon Grove provides high-speed *Intranet* connectivity between the students' homes and the school district. The Intranet enables parents, teachers, and the community to correspond and interact on a regular basis.

Learning Environment

With sufficient numbers of computers (2:1 students to computer ratio) in the classroom and access to high-speed broadband at far above average speeds, teachers report that they are integrating technology in the curriculum at every grade level. Teachers are developing web-based instructional units, and students are able to regularly access the Internet throughout the day. Student achievement has increased in both math and reading for 3rd grade through 6th grade. In 2001, three of the four district's Title I schools received state awards for "High Achieving Title I Schools."

DeltaNet - School Districts in the Yukon Kuskokwim Delta Area

DeltaNet is a successful community model bringing low latency, high-speed broadband access to school districts, health clinics, and the communities of the Yukon Kuskokwim Delta area in Southwestern Alaska. DeltaNet created the equivalent of a terrestrial broadband network, connecting remote communities together via an infrastructure that include microwave and fiber technology. The network reaches all 30 schools in 5 districts schools and districts, over 50 health clinics, government facilities, and residences through 42 communities.

Highlights

- E-Rate provides critical subsidies to provide broadband connections essential for successful distance learning.
- The DeltaNet supports connections up to 10 Mbps for each community

In Bethel, the regional and communications hub of the Yukon Kuskokwim Delta, the DeltaNet is connected via satellite to the Internet backbone. Every classroom in the city is connected to the network, and all computers in the classroom are connected to the Internet.

Learning Environment

Based on the geographic remoteness and rural nature of the region, school districts within the Delta rely on interactive videoconferencing to provide students with access to highly qualified educators. Teachers augment in-class education with the creation of instructional materials which students can access through the Internet day. Student achievement has increased in both math and reading for 3rd grade through 6th grade.

Statewide Models

Tennessee's K-12 Network and ConnectKentucky's broadband initiatives are examples of exemplary statewide models used for implementing broadband in the schools and community.

Benefits of a Statewide Network

- Provide equitable and reliable high-speed connectivity for all schools
- Support 21st century collaborative learning environments
- Enable increased educational outcomes
- Deploy mission-critical applications in a cohesive manner
- Facilitate education initiatives
- Leverage existing infrastructure
- Maximize E-Rate funding
- Create significant cost savings and efficiencies
- Enable network-based safety and security features
- Establish single point of accountability for service and support

Tennessee K-12 Network

One of the first statewide K-12 networks in the United States was started in Tennessee in 1996. The original vision of the network was to provide ubiquitous and equitable Internet access to every school in the state. That vision has been expanded to not only provide flexible, high-speed connectivity at speeds of at least 10 Mbps to every school in the state, but also to deliver services that meet the unique needs of K-12 education. Today's demands on network services, reliability and bandwidth growth are tremendous. It is becoming increasingly difficult for individual school districts to cost-effectively provide the support services and scalability required to support a 21st century education system.

The availability of a strong statewide K-12 centric network accessible to all districts and reaching to the end school site has fueled the ability to deliver high-value resources and tools to every classroom such as *Unitedstreaming*, netTrekker, interactive weblogs and podcasts, as well as enabling many

exciting new technologies and education-delivery systems such as video conferencing and distance learning. With this level of robust infrastructure, the playing field is leveled. Schools and districts can share the same tools and resources regardless of a school's size or geographic location, enabling every student access to a 21st century learning environment.

Most schools and school districts in Tennessee receive network and Internet access through a wide variety of transport methods including fiber, Wide Area Ethernet, wireless and T-1 through DS3 connections. The connections themselves are provided by over 40 different underlying service providers, each with specific regional strengths, but the overall network structure, accountability and services are provided by one managed internet service provider—Education Networks of America (ENA). Through multiple statewide and district wide contracts ENA connects over 4,500 school and library sites serving 450 school districts, 230 libraries, over 2.2 million students, teachers and administrators and more than 6.2 million librarians and patrons in four states.

Creating a Big Broadband Vision for K-12

"High-speed access for schools and libraries is truly no longer a luxury, but rather a requirement. Over the past seven years, we have experienced between 45 and 75% annual traffic growth on our backbone as our network members demand higher-capacity connections. Clearly, it's time for a new definition."

—Bob Collie, ENA, SVP of Technology/CTO

ConnectKentucky

ConnectKentucky is a statewide public/private partnership created to "accelerate the growth of technology in support of community and economic development, improved healthcare, enhanced education, and more effective government."[16] ConnectKentucky is an effort to ensure that every household has a form of broadband access. The *Prescription for Innovation* comprehensive plan includes the following goals:

- Full broadband deployment
- Dramatically improved use of computers and the Internet by all Kentuckians
- Online presence for all Kentucky communities
- eCommunity Leadership Teams in every county[17]

Highlights

- Since the start of this plan, statewide broadband availability has increased 53% and adoption has increased 73%.
- ConnectKentucky's NCLO initiative has provided approximately 2,000 home computers to students.
- 95% of Kentucky households can access broadband Internet up from 60% only three years ago. The percentage of citizens using broadband has increased by 100%

ConnectKentucky, a non-profit organization, works with state and local governments, and private providers to achieve their mission. ConnectKentucky addresses both adoption (demand) and deployment (supply of broadband infrastructure). ConnectKentucky works with all broadband providers (cable, DSL, wireless, satellite, and cellular) to determine underserved areas and how many households are in those areas.

Project Sponsors

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University of Louisville
Morehead State University

Learning Environment

No Child Left Offline (NCLO) is a public/private partnership created as part of ConnectKentucky to address the lack of computers in underprivileged households. NCLO leveraged financial resources exceeding $2.2 million to refurbish and distribute computers to middle school students in poor counties in Eastern Kentucky. NCLO also provides printers and software, including Internet security suites and educational applications for these students. NCLO has expanded the program to provide new computers to a larger segment of disadvantaged students throughout the state. As a result of the NCLO program, entire households have the opportunity to utilize technology that they would not normally have access.

"Kids need to have access to learning 24/7 – inside and outside of school. Computers can be used to expand educational opportunities. When kids have computers at home, it allows them to get more practice and learn more experientially."

—Kentucky resident and teacher, Pete Hawfield

Implementation Tips

This paper presents district, community, and statewide models as references to help school districts implement high-speed broadband in our schools. School districts should choose a model (or a combination of models) that best matches and meets their situation and needs, keeping in mind current broadband use as well as planned future use.

SETDA recommends that school districts consider the following questions when choosing an implementation model:

- Does your school district have a technology plan?
  - If so, does the technology plan provide for the expansion of Internet access to meet minimum broadband standards (see Benchmark/Goals section)?
- Is your technology plan linked with your educational or instructional plan?
- Are there existing statewide models that school districts can access?
- Are there community models that will work in your area?
- Are there district models that will work for your district?
- Does your superintendent support integrating technology systemically?
- Do stakeholders (administrators, teachers, students, parents) support a technology infused learning environment?
- Does your community support public/private partnerships?

Policy Tips

One of the pitfalls of implementing a model for high-speed broadband access is that school districts are often just trying to keep up with current technology applications and use. Often times, policymakers and leaders have not provided the vision for developing a long term strategic plan specifically addressing broadband needs in school districts. High-speed broadband access enables administrators, teachers, and students to use the technology resources available to help achieve educational goals. When developing policies supporting the implementation of broadband, school districts should be strategic in their plans and include appropriate stakeholders in the process. SETDA recommends that states and/or school districts:

- Develop a coordinated planning effort with state and local governments, community, and/or the private sector
- Develop a long-term (3-5 year) technology plan that specifically addresses high-speed broadband requirements
  - Utilize Benchmark/Goals checklist to determine broadband needs
- Encourage the local school superintendent and other administrative leaders to be advocates for implementing high-speed broadband in the schools
- Encourage local school leaders to meet with legislators to advocate for funding to implement high-speed broadband in schools
- Encourage the local school superintendent to meet with the State school superintendent to promote high-speed broadband access in schools throughout the state
- Create a Steering Committee to oversee the implementation of high-speed broadband in schools
  - Include administrators, principals, teachers and key instructional people on the committee
  - Listen to the needs of the individuals utilizing the system
    - What do administrators, parents, teachers, and students need?
    - What types of technology tools will administrators, teachers and students be using?
    - What are the bottlenecks in the system?
  - Hold bi-monthly meetings with Steering Committee to update members and to hear concerns
- Obtain stakeholder commitment

Funding Tips

When considering funding options supporting the implementation of high-speed broadband in schools, SETDA recommends that states and/or school districts consider both funding needs for the initial implementation to provide high-speed broadband access and the on-going costs to maintain and continuously improve the network.

The first step in funding high-speed broadband in schools is to develop a 3-5 year budget plan that specifically addresses current and future high-speed broadband needs, including the cost of Internet service, connections, hardware, software, maintenance, and staff time for the network.

Implementation Funding

- Leverage E-Rate and other federal, state, and local funding sources
- Utilize existing statewide high speed networks that provide connectivity (MD, WA, UT, TN, and IN are some of the many statewide networks serving education)
- Partner with other local school districts and/or the community to aggregate demand and create economies of scale
- Act as anchor tenants by purchasing enough statewide service to create the demand required for the private sector to develop infrastructure in underserved areas
- Develop a community model and share the costs among state/local government and nonprofit groups
- Create a public/private partnership to share the funding of the network
- Solicit in-kind donations

On-Going Costs

- Recognize that high-speed broadband is similar to a utility (electricity, gas, water) that is essential for operations
- High-speed broadband is not a one-time cost, but an on-going expense
- Include funding for high-speed broadband in the operating budget
- Negotiate on-demand fee structures with broadband providers - minimum usage fees with additional fees based upon increased demand

E-Rate

E-Rate is a part of the universal service program, a support mechanism designed in the 1930s to ensure that rural consumers had affordable phone service. The E-Rate program, authorized under the Telecommunications Act of 1996, represents an extension of universal service. E-Rate is structured based upon a priority system favoring the most disadvantaged applicants and provides public and private schools and libraries with discounts of 20%-90% for:

- Telecommunications services
- Internet access
- Internal connections
- Maintenance of internal connections

Over the last 10 years, funding has remained fixed at $2.25 billion without any adjustments for inflation. Demand for the program often exceeds available funding. For the 2008 E-Rate funding year, nearly 40,000 applications were filed requesting $4.3 billion in funding– $2 billion more than was available. Forty-three percent of school districts report that E-Rate funding will be insufficient in the near future.[18]

SETDA Recommendations for E-Rate

- Keep E-Rate as part of the universal service fund
- Advocate that policymakers increase the total size of the pool for E-Rate funds to meet current and future high-speed broadband needs
- Advocate that policymakers, at a minimum, adjust the E-Rate pool of $2.25 billion for inflation
- Advocate that policymakers update the universal service program funding structure, so that all providers of broadband contribute (not just phone companies)
  - Assess fees based on a broad base of contributors
- Advocate that policymakers update the E-Rate program to provide administrative funding for states
  - States assist local school districts with applications and appeals process
- States should have a federally funded State Level E-Rate Coordinator
  - Especially in states that utilize a significant portion of E-Rate funds to provide broadband
  - State Level E-Rate Coordinators assist local school districts with the application process
- Simplify and streamline E-Rate application and approval process
  - Allow schools and school districts and libraries to focus resources on providing funding for high-speed broadband connectivity, not unnecessarily bureaucratic processes
  - Simplify the application process for multi-year contracts

Additional Resources

1) CoSN Broadband Knowledge Center - http://www.cosn.org/broadband/index.php?option=com_frontpage&Itemid=1
2) School 2.0 Bandwidth Calculator - http://etoolkit.org/etoolkit/bandwidth_calculator/index
3) Speed Matters: High Speed Internet for All - http://www.speedmatters.org
4) U.S. Internet Industry Association (USIIA) - http://www.usiia.org/
5) Broadband Fact Library - http://www.internetinnovation.org/Editor/News/tabid/56/articleType/ArticleView/articleId/52/Broadband-Fact-Library.aspx
6) America's Digital Schools 2008

Endnotes

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