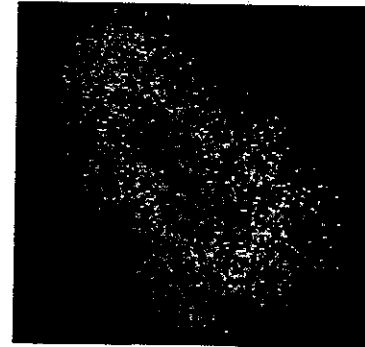
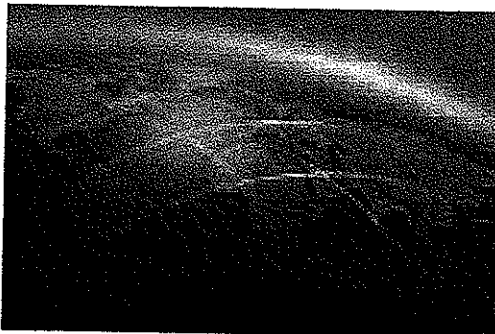


EAGLE-Net

Colorado enjoys a reputation as a high-technology growth center. Alternative energy, space exploration, communications and nano technologies are only a few of the cutting-edge industries in our state. Yet Colorado students rank 29th in the nation in science, technology, engineering and mathematics (STEM) scores and ours is one of only 12 states that do not currently have Internet2 available to its K-12 students, placing them at a serious disadvantage.



Today's children have been bombarded with technology their entire lives. From computer games to Wii, kids are ravenous hi-tech consumers who are instantly captivated by crisp, fast-paced, interactive visuals that entertain and educate them. High-speed connectivity combined with advanced applications brings new life to learning, virtually transporting students to interact with another environment.



EAGLE-Net (Educational Access Gateway Learning Environment Network) is a Colorado cost-sharing, non-profit consortium. A fully collaborative and secure high speed broadband network, EAGLE-net provides educational benefits and services to connected Colorado school districts. Enabling access for technology-rich, quality education to every student in all 178 Colorado public school districts via broadband network services, advanced applications and Internet2 connectivity, is the mission of EAGLE-Net.

Internet2 is comprised of over 200 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies – 147 Sponsored Participants (K-20 schools, museums, libraries, hospitals, zoos) and 37 Sponsored Educational Group Participants (aggregations of educational and education-related organizations and state/local government institutions within a state).



EAGLE-Net is the K-12 statewide cost-sharing, non-profit consortium for high-speed broadband connectivity for schools, BOCES and school district networks to the Commodity Internet and Internet2. K-12 membership in Internet2 will be active in July 2009.



Over 50 Colorado school districts and BOCES are in the process of becoming EAGLE-Net members or currently participate through high-speed broadband connections to EAGLE-Net. Of the current participants, 25% are urban and 75% are considered rural.

EAGLE-Net and Internet2 Benefits

<i>Student Benefits</i>	<i>Teacher and Administrator Benefits</i>
<ul style="list-style-type: none"> ■ Any Fourth Grade class can take an interactive, high-definition virtual field trip to the Smithsonian Museum or a Federal Reserve Bank. 	<ul style="list-style-type: none"> ■ Professional Teacher and Administrative Training with IT systems and Tech Tools. ■ Access to extensive electronic content, curriculum and online assessments and testing.
<ul style="list-style-type: none"> ■ A high school biology class can explore the human immune system with an emergency room doctor who answers their questions – in real time. ■ Students can operate remote instruments around the world to collect data and perform problem-based experiments 	<ul style="list-style-type: none"> ■ Teachers are able to receive live, interactive professional development from NASA, Library of Congress and more. ■ Live participation events to share knowledge and ideas in a cost-effective, instantaneous format.
<ul style="list-style-type: none"> ■ Musically gifted children can attend regular classes at the Cleveland Institute of Music to study under music masters. ■ U.S. K-12 schools are able to experience night-time, southern-hemisphere astronomy observations with Australian observatories in real-time, during U.S. school hours. 	<ul style="list-style-type: none"> ■ Distance learning dramatically enhances collaboration ability and professional networking groups within Colorado and ALL Internet2 connected states.
<ul style="list-style-type: none"> ■ Unencumbered by geography, EAGLE-Net students, teachers and administrators statewide are empowered and engaged by technology with Internet2 and other worldwide educational resources from over 40 countries. 	<ul style="list-style-type: none"> ■ Technical resource sharing and application-development collaborations. ■ Comprehensive information-systems coordination. ■ Member-driven, district level participation in programs for technical and instructional application and development.

For any questions or how to become an EAGLE-Net member, please contact:

Denise Atkinson-Shorey - (303) 772-4420 ext 2344

Email: connect@co-eaglenet.net

The Need: Where we are now...

- The **need** for Broadband connectivity in schools will **increase more than 700%** by the year 2011
(2007 America's Digital Schools (ADS) 2007 survey - from 6.0 kbps to 45.0 kbps)
 - **Colorado** districts average **approximately 55%** of the national average bandwidth
(Jan 2009 ADS report - 3.57 kbps for Colorado and 6.48 kbps national average)
 - Prior to July 2009, **Colorado** was one of only 12 states **not offering Internet2** connectivity to K-12 schools and districts across the state. In July 2009, the *Internet2 Gateway* connection was established for Colorado with the funding of the first year annual membership fee.
 - **Only a limited number of districts** in the state are connected to the *Internet2 Gateway* and can provide advanced educational opportunities, such as full screen high definition **interactive video conferencing** over Internet2, that exist for 50,000 other schools and districts across the country.
 - Even with the *Internet2 Gateway* connection, there are still **significant broadband / middle and last mile connectivity issues** impacting access to advanced educational opportunities.
 - Full term **course offerings** and short-term distance learning opportunities for classrooms is difficult to find and does not always meet students and/or staff needs. Low bandwidth opportunities are **unreliable**.
 - Students' bandwidth at home or on their personal cell phone often out performs the connectivity and content available to them in school. Many **families cannot afford Internet** service at home.
-

The Plan: What we need to do...

Business Case

- Reduce duplication of resources across the state
 - Cost of ownership 10 times greater than cost sharing through a consortium
- Leverage cost of bandwidth
 - Nebraska and Utah are examples where costs are leveraged
(\$15/Mbps in Nebraska vs. \$800/Mbps in some districts in Colorado)

Instructional Case

- Improve access to educational resources
 - CDE initiatives: Assessments On-Line, Data Analysis/Sharing, Online Learning, Video Conferencing, State-wide IEP
 - Utilize existing consortium model, continue development of Eagle-Net managed through BOCES
- Ensure long term opportunities for students and staff
 - Instructional need for bandwidth outpacing funding

Develop Partnerships

- Public/Private Leveraged Resources
 - Aggregate Points in a Community to a common High Speed Broadband Connection
 - Multi-Vendor collaborative Partnerships with Higher Ed, Front Range GigaPop (FRGP), University Corporation for Atmospheric Research (UCAR), Public Libraries, Museums, Fire/Safety, Healthcare, Colorado TeleHealth Network
-

The Benefits: What it would look like...

Bandwidth Vision

- High speed broadband infrastructure
- Affordable content options to retain and enhance local control and provide a sense of community
- Essential model for rural, declining and small districts
- CAP4K, Concurrent Enrollment, Online Learning, and College Course Pre-Graduation initiatives can only happen if Colorado meets the bandwidth needs

Collaborative Vision

- Partners for strong statewide infrastructure connectivity currently include Higher Ed, Colorado Tele-Health Network, Public Libraries, Community Colleges, Fire and Safety
- Provide on-net connectivity prior to accessing a gateway to the Internet

Economic Development Vision

- Private sector and housing values in rural / underserved areas will benefit and promote economic development
 - Provides for expansion, growth and future partnerships
-

Closing Colorado's K-12 Education Broadband Internet Gap

To support a technology-rich learning environment for the next 2-3 years in Colorado for K-12 Education:

- An Internet connection of at least 10 Mbps for School Districts that are 250 students or less to accommodate advanced technologies for instructional uses including High Definition Video Conferencing for Distance Learning and Professional Development. For School Districts that have more than 250 students, the American Digital Schools (ADS) figure of 40 kbps/student should be used to determine the recommended bandwidth for an Internet connection.
- Internal Wide Area Network (WAN) connections from the School District to each school and between schools of at least 100 Mbps.

To support a technology-rich learning environment for the next 5-7 years in Colorado for K-12 Education:

- An Internet connection of at least 100 Mbps for districts that are 250 students or less. For School Districts that have more than 250 students, 400 kbps/student should be used to determine recommended bandwidth for an Internet connection.
- Internal WAN connections from the School District to each school and between schools of at least 1 Gbps.

The Recommended Bandwidth for K-12 School Districts by 2015 is 400 kbps/student with a minimum connection of 100 Mbps for districts 250 or smaller, internal WAN connections from the district to each school of 1Gbps

Guidelines and strategies to support successful implementation of broadband:

- Develop a coordinated planning effort with existing regional K-12 consortiums, local and state government, community development/community resource agencies, and other public and private sector profit and not-for-profit entities.
 - Aggregation of multiple, simultaneous uses will make broadband networks a necessity in schools, businesses, and home use
- Include appropriate stakeholders in the community during the planning process, to establish depth and breadth of the collaboration and consortium capabilities and to obtain stakeholder commitment.
 - Demand Aggregation Programs. States have created programs to encourage communities to attract broadband deployment by bringing together local institutions, including municipal, county, and other governmental agencies. In some cases, the state has acted as the anchor tenant
- Partner with others in communities, geographical regions, and the entire state to aggregate demand and create economies of scale.
 - Public/Private Partnerships. Similar to demand aggregation programs, these models bring together government, industry, community institutions, and others to accelerate deployment. The programs often focus on data collection, community implementation surveys, and bringing together providers with potential customers in underserved areas. Some include direct relationships in which the state contracts for the deployment of broadband in exchange for offering use of the network
 - Statewide Networks. Many states have some form of large broadband network running over common shared broadband infrastructure. These are usually dedicated to educational purposes or for connecting government agencies, or both. Some states allow access to these networks by non-profit organizations
- Strong leadership from key executives is critical for implementing high-speed broadband access.
 - High-speed broadband access is similar to a utility - it is essential for operations, rural development and growth, business and economic development, education, and community stability
- Leverage E-Rate and other federal, state, and local funding sources under the consortium and collaboration model.
 - Provides for broader and more inclusive scope of planning to obtain properly designed and implemented broadband networks
 - Sustainability is achieved by a combination of planning and leveraging of consortium cost sharing that ultimately reduces the annual expenditure of general fund dollars for each collaborating entity
 - Negotiate on-demand fee structures with broadband providers, to force lower costs as access to larger amounts of bandwidth increases
 - Design and build scalability and flexibility in the network to ensure continuous improvement

K-12 Broadband Cost Study

Starting Points

- There are over 800,000 students in K-12 in Colorado.
- The current Internet Bandwidth average per student in Colorado is 3.5 kbps or 2.7 Gbps of total Internet Bandwidth for Colorado Students.
- By 2011 the need for Bandwidth (from Americas Digital Schools Survey) will be 40 kbps per student or up to 32 Gbps of bandwidth for Colorado Students.
- By 2015 the need for Bandwidth will be 400 kbps per student or up to 320 Gbps of bandwidth for Colorado Students.

The Costs

Costs shown here are based upon the assumption that the E-rate filings are inclusive of correct combinations of Internet bandwidth costs and Internet connector transport costs per each district. Data gathered regarding past E-rate practices have shown that many districts have not had sufficient understanding of the two components that comprise the connections and may not be filing for E-rate on both E-rate eligible components.

- Estimated Internet costs for 2008 is \$6 million / year for 3.5 kbps / student.
- Current Internet Cost per student per year in Colorado is 7.50 / student or \$2.10 per kbps / student per year (\$0.18 / kbps per student per month).
- At this rate to meet the 40 kbps needed by 2011 the annual cost of Internet Service will be \$80 million per year.
- The cost for bandwidth by 2015 will grow to over \$800,000,000 to deliver the required bandwidth for Colorado Students at current rates.
- Estimated cost to build fiber to 178 school districts for broadband connectivity at \$325,000 per site is \$57,850,000.
- Estimated cost to build fiber to 2,000 schools at \$325,000 per site for broadband connectivity is \$650,000,000.

Comparisons

- At current rates, Colorado Schools would pay \$80 million for 32 Gbps of Internet bandwidth. Comparing this to rates in states with cost sharing non-profit statewide consortiums (paying \$80 per Mbps) the cost would be \$30 million per year for 32 Gbps.
- Utah students currently average 9.3 kbps of Internet bandwidth at a cost of cost of \$0.77 per student per month (or \$0.08 per kbps per student per month).
- Utah will upgrade their network to a 1 Gbps connection for all 450 schools in the next 12 months at a cost of \$7 million annually.
- The Internet bandwidth cost per student per year in Nebraska is \$0.08 per kbps per student per month. Nebraska accomplishes this by offering incentives to school districts to join the statewide cost-sharing consortium. The cost-sharing consortium E-Rates the backbone, which provides the school districts a 65% discount for Internet connectivity. Of the remaining 35%, the State subsidizes 80% of the cost. This means the school districts pay less than 5.4% of the total statewide cost for Internet bandwidth.

**U.S. CONSUMERS PAY MORE FOR SLOWER SPEEDS
and
SCHOOLS IN COLORADO PAY EVEN MORE THAN CONSUMERS FOR SLOWER SPEEDS.**

Cost Per Connection

- In the U.S.:
 - DSL generally reaches speeds of up to 3.0 Mbps at a price averaging \$50 per month (not including fees)
 - Cable modems generally reach speeds of 6 Mbps for \$50 per month.
- In Japan:
 - An average connection with a speed of 51 Mbps costs about \$22 per month
- In Colorado Schools:
 - A school connection with an average per student speed of .0035 Mbps costs up to \$800 per Mbps per month

Average Cost Per 100 kbps Connection

- Available bandwidth in a U.S. home is 6 Mbps at a cost of \$0.72 per 100 kbps.
- Available bandwidth in a Japanese home is 51 Mbps at a cost of \$0.06 per 100 kbps.
- Available bandwidth to a student in Colorado Schools is .0035 Mbps at an average cost of \$21.00 per 100 kbps.

Type of Internet Access	Bandwidth	Cost	Comparison
U.S. DSL Home Use	3.0 Mbps	\$50.00 per month	Cost of \$1.44 / 100 kbps
U.S. Cable Home Use	6.0 Mbps	\$50.00 per month	Cost of \$0.72 / 100 kbps
Japan Home Use	51 Mbps	\$22.00 per month	Cost of \$0.06 / 100 kbps
Colorado K-12 Schools	.0035 Mbps per student	Up to \$800.00 per Mbps per month	Cost of \$18.00 / 100 kbps

*At home, Japan has 8.5 times the speed at 1/12 of the cost compared to U.S. homes.
U.S. homes have up to 1700 times the speed at 1/25 the cost of a student in Colorado Schools.*

CWA Speed Matters

K-12 Bandwidth Application and Software Analysis - School District with 250 Students

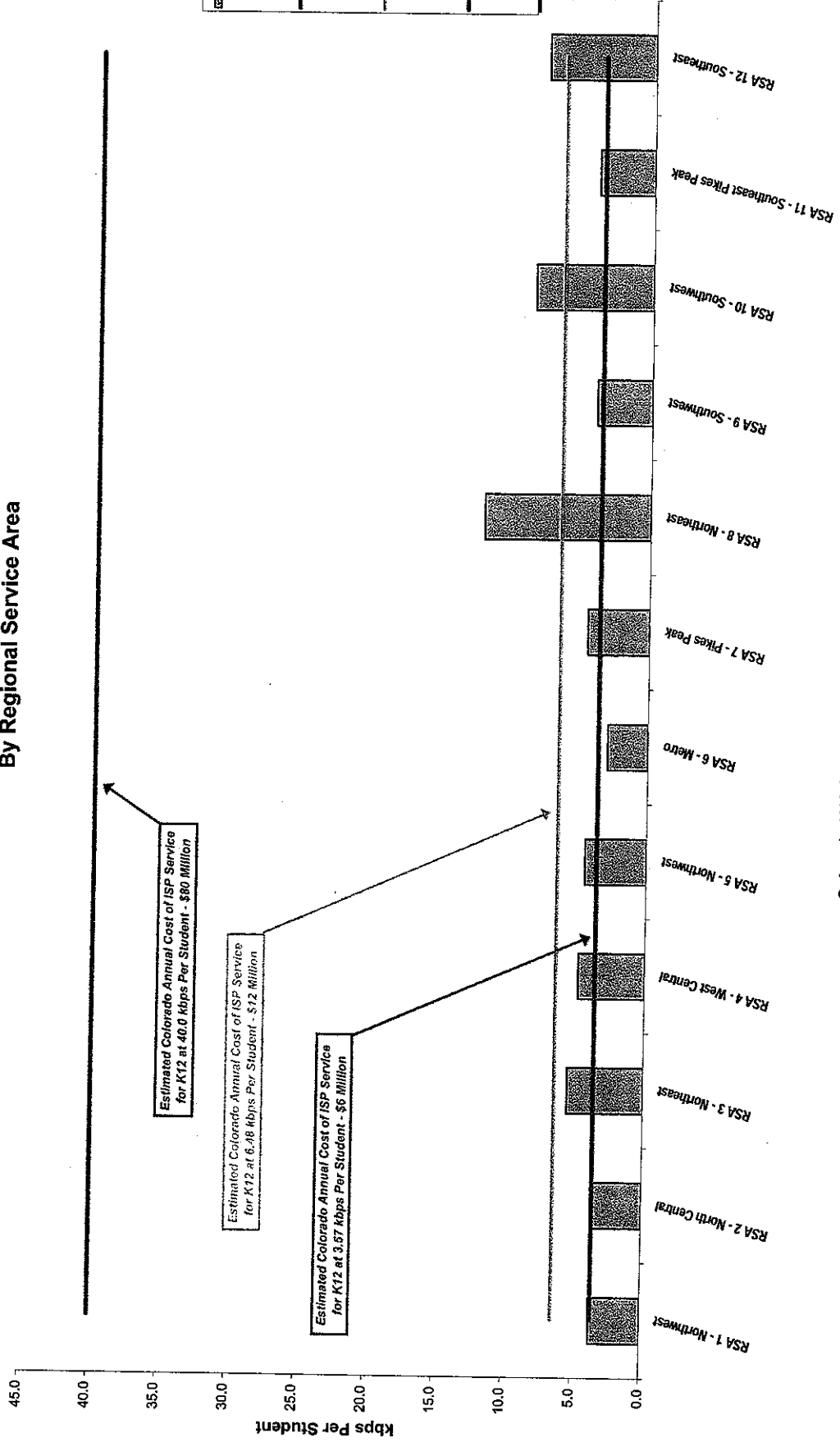
Application *	Per User*	One T-1 (1.5 Mbps)	Two T-1s (3 Mbps)	Four T-1s (6 Mbps)	10 Mbps Ethernet	20 Mbps Ethernet
VoIP	50 kbps	■	■	■	■	■
Email and Web Browsing	50 kbps	■	■	■	■	■
Audio Streaming (MP3)	100 kbps	□	■	■	■	■
School Portal	100 kbps	□	□	■	■	■
Student Created Content	150 kbps	■	□	■	■	■
Online Learning	150 kbps	■	■	□	■	■
Virtual Field Trips	150 kbps	■	■	□	■	■
Web/School 2.0 Tools	250 kbps	■	■	■	■	■
Online Assessment	250 kbps	■	■	■	■	■
TV-Quality Streaming Video (320 x 240)	250 kbps	■	■	■	■	■
Interactive Video at a Desktop Standard Definition Good Quality	250 kbps	■	■	■	□	■
DVD Quality Streaming Video (640 x 480)	1040 kbps	■	■	■	□	■
1/2 HD Quality Streaming Video (1024 x 720)	4977 kbps	■	■	■	■	■
H.264 HD (1080 P) Video Conference	6000 kbps	■	■	■	■	□
Full HD Quality - Streaming Video (1920 x 1080)	13998 kbps	■	■	■	■	□

KEY

- - Full Functionality
- - Problematic
- - Unable to utilize with concurrent users

* Source - School 2.0 Bandwidth Planner/Calculator and
Video Bandwidth Estimator - Sorenson Services USA

Current Colorado School District Internet Bandwidth kbps Per Student By Regional Service Area



2008 Colorado Average School District kbps Per Student

2008 Colorado Average - 3.57 kbps Per Student - Estimated Colorado Annual Cost of ISP Service for K12 of \$6M

2008 National Average - 6.48 kbps Per Student - Estimated Colorado Annual Cost of ISP Service for K12 of \$12M

2011 Projected kbps Required Per Student - 40.0 kbps - Estimated Colorado Annual Cost of ISP Service of \$80M

Source for 2009 National Average and 2011 Projected kbps: America's Digital Schools 2008 Internet Bandwidth Report

Colorado K12 School District Regional Service Area

How Colorado School Districts Compare to Colorado's State and National Average Bandwidth

State Map of School Districts

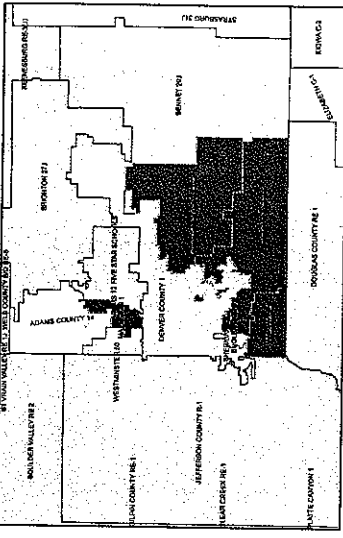


Legend

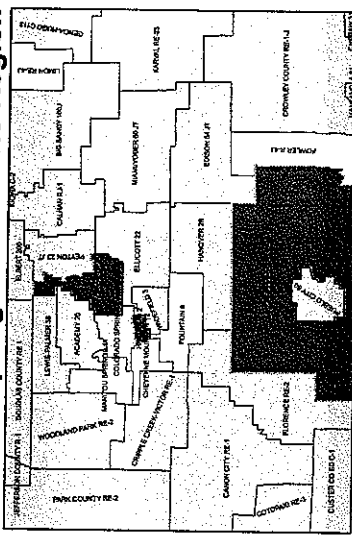
- School Districts District Office
- Bandwidth Less Than the State Average
- Bandwidth Greater Than the State Average but Less Than National Average
- Bandwidth Greater Than the National Average but Less Than Projected Need by 2011
- Bandwidth Equal to or Greater Than 2011 Projected Bandwidth Required

* Colorado School District Average Bandwidth per Student = 3.57 kbps
 * National School District Average Bandwidth per Student = 6.48 kbps
 * 2011 Projected Bandwidth Required per Student = 40.0 kbps

Denver Region



Colorado Springs and Pueblo Region



* Source of Colorado Data - 2009 Survey or Interview of School Districts

* National Average Bandwidth and Projected Bandwidth Requirement - America's Digital Schools 2008 Internet Bandwidth Report

**Broadband Technology Opportunities Program (BTOP)
Broadband Infrastructure Grant Application**

Summary of Grant Application filed by CBOCES/EAGLE-Net on behalf of the Colorado Community Anchor Broadband Consortium:

Program Overview: National Telecommunications Information Administration (NTIA) BTOP funds are available through three categories of eligible projects:

- 1) Broadband Infrastructure - \$1.2B
Middle Mile Projects and Last Mile Projects
- 2) Public Computer Centers – no more than \$50B
- 3) Sustainable Broadband Adoption. – no more than \$150M

Defined Need: According to the “state of broadband” a survey conducted by Akamai in 2008, Colorado ranked 42nd out of 50 states in broadband connectivity. Schools in Colorado average 3.5 kbps of Internet bandwidth per student. This is 55% of the national average of 6.4 kbps. While Colorado schools are underserved in delivery of broadband, the cost to deliver this service is 10 times that of states to both the east and west. Bandwidth in 39 libraries in Colorado is less than the minimum broadband speed of 768 kbps making many of these sites unserved. According to the 2007 National Digital Schools survey, the need for Broadband connectivity in schools will increase more than 7 times by the year 2011.

Opportunity: Through the CBOCES/EAGLE-Net state-wide non-profit cost sharing consortium, create a public private collaboration that leverages existing infrastructure with newly deployed infrastructure to serve existing K-12, health care, library, museum, municipal, town and other non-profits entities with affordable high capacity broadband Internet service.

Initial Service Delivery: CCABC will provide access to high capacity broadband Internet service to 178 School Districts, 26 libraries, 12 BOCES, located within 177 Colorado communities with an opportunity to expand service to an additional 150 to 250 Community Anchor locations. Community Anchor locations will initially receive up to 20 Mbps of Internet and Internet2 service. CCABC will also enable/deliver an additional 10 to 100 times the broadband capacity for growth for Community Anchors with additional high capacity Internet bandwidth available to private Middle Mile and Last Mile broadband service providers for distribution to their home and business customers. Additional services that may be offered include expanded Distance Learning through Community College and University partners; cloud computing services for education anchors and library anchors and broadband long haul and middle mile transport.

Grant Request (Infrastructure/Implementation of network 36 month capital costs): \$178,500,000 and projected on-going costs of \$19,675,000 per year (in lieu of the estimated \$80 million per year at current costs to meet the 40 kbps per student [from America’s Digital Schools Survey 2008] which equates to a Colorado statewide total of 32 Gbps needed by 2011).

Public and Private Collaboration Entities Interested in Participating: IBM, BNI, Conterra, Adesta, Qwest, tw telecom, Comfluent, Level 3, Comcast, US Cable, Bresnan, PC Telecom, KCI, SECOM, Platte River Power Authority, Longmont Power & Communications, Sun Wireless, Pinpoint communications, Plains Telephone Cooperative, UNITE Private Fiber Networks, Viaero, Colorado Tele-Health Network, Denver Museum of Natural History, CSU, UNC, CU, Front Range GigaPoP, Colorado Community Colleges, Colorado Online Learning, Catalyst@EDU, Colorado Department of Education, Colorado State Library, Governor’s Office of Information Technology, Colorado Education Association, Colorado Association of School Boards, Colorado Association of School Executives, Colorado Board of Cooperative Services Association.

