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Welcome to CENIC Today, the monthly newsletter of the Corporation for Education Network Initiatives in California.

IN THIS ISSUE:

CENIC News

President's Message

I've been asked over the last few months my thoughts on the possible modification to the Telecommunications Act of 1996 that is under consideration. So, I thought I'd take this opportunity to comment on Federal legislation that may have an effect on us. Having recently participated in an Educause Broadband Policy seminar, I feel my information is reasonably current and also wish to applaud the work of Educause to communicate and advocate on this issue on behalf of the higher education community.

First, it appears that some of the pressures to reform the 96 Act may be lessened as a result of various new rules/regulations issued by the FCC. For example, the Telcos are obviously pleased with the recent order that removes the requirement that they make available to other firms their owned infrastructure used to provide DSL services. In their view, this ruling puts them on a more equal footing with cable companies. Whether or not this order is good for CENIC constituents will only be known in time but some argue that this ruling permits the Telcos to compete more effectively with cable companies, to the benefit of consumers, while others believe competition is lessened and therefore customers will be disadvantaged. Regardless, this order reduces some of the pressure for immediate Telecommunications Act reform

Of course, there are other issues of interest to those interested in seeing the 96 Act modified. At this point, it is not clear if there will be a major bill to modify the Act or if instead a series of smaller bills might be enacted. September is likely to be an active month. Until we see what bills may be introduced, it is difficult to take a position, of course. My guess is that a major bill will not be passed this year.

Related to Telecommunications act reform is a recently issued press release on CALEA, a bill that was originally intended to extend to IP voice services existing laws that give certain law enforcement authorities the authority to wiretap voice conversations. In a press release that was issued on August 5, this proposed legislation would appear to be much broader in scope, potentially applying to private networks such as those operated by educational institutions, and perhaps even to networks such as CalREN, instead of only to carrier provided services. The bill appears to require the installation of "CALEA compliant equipment" with the capability for law enforcement authorities to obtain copies of what is being sent over the network. As this

is written, it isn't clear exactly what the final legislation and regulations might require nor whether it applies to networks such as CalREN, but it is definitely legislation that is moving forward on a fast pace and that can have a dramatic effect on us .

I've probably raised more questions than I've answered, but we simply don't have any clear directions at this time. This is a very active and yet uncertain time with respect to Federal legislation affecting telecommunications. We'll plan to include in future issues more information about Federal telecommunications legislation.

Source: Jim Dolgonas, CENIC

NOC Report

The focus of the NOC report this month is on network changes that have taken place recently. It's been a busy summer! Here is a quick summary:

UC Riverside joined the CalREN optical backbone as a new hub site with completion of the backbone redesign work in Southern California. By establishing a second, more diverse fiber path from San Diego to the LA area, CENIC has improved network robustness while simultaneously lowering the cost of access to the network for sites in southeastern California.

Through the CSU Campus Access Infrastructure (CAI) initiative second, diverse network connections are being provided to all CSU campuses and CSU Chancellor Office sites. In the short time that this initiative has been underway, four campuses have been provided dual connections to CalREN: CSU Northridge, CSU Chico, CSU Fresno and CSU Stanislaus.

After a long trek through the desert, with stops at some very out-of-the-way locations, CENIC engineers arrived in Arizona in late August, completing a 360 mile fiber path between Phoenix and San Diego. Arizona State, just outside Phoenix, is now ready to be connected to CalREN. The ongoing work to connect to the University of Arizona in Tucson is expected to be completed in October.

In other news, for those of you who receive maintenance and outage notices, improvements to these notices are coming soon! Watch for an announcement of changes in the next issue of CENIC Today.

Source: Sherilyn Evans, CENIC

CalREN Hub at UC Riverside

CENIC engineers, working with staff at UC Riverside, recently accomplished the reconfiguration of the CalREN optical backbone to include a hub site at UC Riverside. The culmination of over a year's planning and design work, this project will not only save money by providing a lower-cost aggregation point for sites in southeastern California, it greatly increases the resiliency of the network by eliminating a single point of failure in downtown Los Angeles.

CENIC extends its thanks to Jerry Keith and the staff at UCR for their invaluable assistance in this project.

Source: Brian Court, CENIC

Campus Access Infrastructure Initiative (CAI) Update

During the past month, CENIC has been able to complete acceptance testing and subsequently deliver GigE connections to four CSU campuses. CSU Northridge is the first CSU campus to have dual, diverse GigE connections to the CalREN-DC network. CSU Chico is dually connected at this time with an OC-3 and GigE circuit, and GigE connections were recently delivered to CSU Fresno and CSU Stanislaus where BGP testing is underway in preparation for operationalizing their new GigE connections.

The next two CSU campuses currently scheduled to receive their GigE connections during the month of September are Sonoma State University and Humboldt State.

In various stages of construction are the next four CSU campuses who will be getting a GigE connections via CENIC managed dark fiber connection: California Maritime Academy, Cal Poly Pomona, CSU Monterey Bay and CSU San Bernardino. Field surveys have been completed for CSU East Bay and San Jose State University. Detailed scheduling will follow contract awards.

The online CAI project schedule is available at http://www.cenic.org/projects/cai/.

Source: Ed Smith and Greg Scott, CENIC

Arizona CalREN HPR Connection

Nihar Mehta and Simon Hernandez have returned from the Arizona desert with some good stories to tell. The only one they'll let me tell is that the Layer 2 connection between ASU in Phoenix and the CalREN backbone has been established. End-end testing is underway, with ASU's connection to the CalREN HPR network scheduled for mid September.

Fiber connectivity has been established between the ASU Phoenix collocation facility and the carrier POP in Tucson. Permits for metro Tucson fiber construction are being obtained; CWDM equipment has been ordered for the four Gigabit Ethernet waves between U of A and ASU, which are scheduled to be brought up in October.

Source: Greg Scott, CENIC

Coachella Valley Project

In addition to the already active Gigabit Ethernet connection between Riverside and Palm Desert, this project will provide a second, diverse, CalREN-DC connection to the backbone. This second connection extends fiber from Palm Desert to Yuma, Arizona, where that fiber will interconnect to the fiber purchased from Phoenix to San Diego.

The Yuma to San Diego portion of the Palm Desert diverse path is complete, with Palm Desert to Yuma to follow in November following required Yuma construction.

Source: Greg Scott, CENIC

iGrid Update

This fall the double header of high-end computing and networking will occur on the West Coast. The first group to hit the field will be iGrid2005 (http://www.igrid2005.org) in the brand new CalIT2 (http://www.calit2.net) building on the University of California, San Diego campus September 26-29. This will be followed in November by Super Computing 2005 (http://sc05.supercomputing.org). In support of iGrid2005 CENIC will be provisioning 7 additional 10Gbps wavelengths from Los Angeles to San Diego and 5 additional 10Gbps wavelengths from Sunnyvale to Los Angeles. These additional wavelengths are made possible by capacity of the CENIC optical network and interface cards provided by National LambdaRail (http://www.nlr.net) and will be used to extend the various national and international networks to San Diego for the conference.

Source: Dave Reese, CENIC

Hold the Date for CENIC 2006

CENIC 2006, CENIC's annual conference, will be held on March 13-14-15, 2006 at the Oakland Marriott City Center. This is always a great event to learn about new technologies, new networking applications, and meet with your colleagues in a relaxed environment. Be sure to reserve the dates now.

National Networking News

Telecommunications Act of 1996

The Telecommunications Act of 1996 is the first major overhaul of telecommunications law in almost 62 years. The goal of this new law is to let anyone enter any communications business -- to let any communications business compete in any market against any other.

The Telecommunications Act of 1996 has the potential to change the way we work, live and learn. It will affect telephone service -- local and long distance, cable programming and other video services, broadcast services and services provided to schools.

The Federal Communications Commission has a tremendous role to play in creating fair rules for this new era of competition. At this Internet site, we will provide information about the FCC's role in implementing this new law, how you can get involved and how these changes might impact you.

This page will include information listing the proceedings the FCC will complete to open up local phone markets, increase competition in long distance and other steps. You will find copies of news releases summarizing action, announcements of meetings where these items will be discussed, and charts describing the work ahead of us and where (within the FCC) and when it will be completed. Please note: some of the links on this page lead to resources outside the FCC. The presence of these links should not be taken as an endorsement by the FCC of these sites or their content.

For more information about the referenced documents, contact the person listed on the document.

Source: Federal Communications Commission, http://www.fcc.gov/telecom.html

FCC Requires Certain Broadband and VoIP Providers to Accommodate Wiretaps

August 5, 2005: Order Strikes Balance Between Law Enforcement, Innovation

Washington, D.C. – Responding to a petition from the Department of Justice, the Federal Bureau of Investigation, and the Drug Enforcement Agency, the Commission determined that providers of certain broadband and interconnected voice over Internet Protocol (VoIP) services must be prepared to accommodate law enforcement wiretaps, the Federal Communications Commission ruled today.

The Commission found that these services can essentially replace conventional telecommunications services currently subject to wiretap rules, including circuit-switched voice service and dial-up Internet access. As replacements, the new services are covered by the Communications Assistance for Law Enforcement Act, or CALEA, which requires the Commission to preserve the ability of law enforcement agencies to conduct court-ordered wiretaps in the face of technological change.

The Order is limited to facilities-based broadband Internet access service providers and VoIP providers that offer services permitting users to receive calls from, and place calls to, the public switched telephone network. These VoIP providers are called interconnected VoIP providers.

The Commission found that the definition of "telecommunications carrier" in CALEA is broader than the definition of that term in the Communications Act and can encompass providers of services that are not classified as telecommunications services under the Communications Act. CALEA contains a provision that authorizes the Commission to deem an entity a telecommunications carrier if the Commission "finds that such service is a replacement for a substantial portion of the local telephone exchange." Because broadband Internet and interconnected VoIP providers need a reasonable amount of time to come into compliance with all relevant CALEA requirements, the Commission established a deadline of 18 months from the effective date of this Order, by which time newly covered entities and providers of newly covered services must be in full compliance. The Commission also adopted a Further Notice of Proposed Rulemaking that will seek more information about whether certain classes or categories of facilities-based broadband Internet access providers – notably small and rural providers and providers of broadband networks for educational and research institutions – should be exempt from CALEA.

The Commission's action is the first critical step to apply CALEA obligations to new technologies and services that are increasingly used as a substitute for conventional services. The Order strikes an appropriate balance between fostering competitive broadband and advanced services deployment and technological innovation on one hand, and meeting the needs of the law enforcement community on the other.

Wireline Competition Bureau Staff Contacts: Terri Natoli and Carol Simpson, (202) 418-1580

Source: Federal Communications Commission News, http://hraunfoss.fcc.gov/edocs_public/attachmatch/DOC-260434A1.pdf

FCC Seeks Public Comment on Delivery of Video Services

On August 12, the FCC announced a Notice of Inquiry (NOI) seeking information on the status of market competition for the delivery of video services. The results from this inquiry are expected to influence how the commission moves forward on encouraging broadband deployment and maintaining open access to the Internet. With telephone companies' recent investment in providing video over IP, this new service is expected to be a driver for broadband services.

The FCC is seeking public input on several issues, including data that measure the audience reach of video programming distribution firms as well as relative control over the video distribution market; information on video distributor expansion into new markets such as local telephony and high-speed Internet access; the percentage of subscribers taking these services; the competitive advantages of offering these services; and information on new technologies being considered, tested, or deployed by each type of multichannel video programming distributors for video, voice and data. In addition, the NOI looks into how the packaging of video, telephone, and data services affects consumers' rates. The NOI can be accessed at: http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-05-155A1.pdf

Source: Federal Communications Commission, http://hraunfoss.fcc.gov/edocs_public/attachmatch/FCC-05-155A1.pdf

New York University is the First University in the United States To Provide IPv6 Connectivity to a Supercomputer

NEW YORK, NY, Aug 23, 2005 – New York University (NYU) today announced that it has begun offering IP Version 6 (IPv6) Internet network connectivity to a recently-installed IBM eServer BladeCenter system. IPv6 is the next-generation replacement for IP Version 4 (IPv4), the communications system currently in use worldwide on every computer that connects to the Internet. IPv6 natively offers greater features than IPv4, such as support for much larger numbers of systems, embedded security, and native support for mobile technologies. This milestone event marks the first time a university in the United States has announced general availability of IPv6 access to a large-scale supercomputer. According to the TOP500 List, a ranking of supercomputers published at www.top500.org, NYU's supercomputer is the fastest in New York City and the 117th fastest supercomputer in the world, capable of a peak performance of 4.5 TeraFlops.

IPv6 connectivity for this NYU supercomputer will enable it to establish communications with a growing set of network-based resources both within the United States and international research and education communities. IPv6 is rapidly being adopted in Asia and Europe, and is increasingly becoming the only means of access for customers of Internet Service Providers (ISPs) in those regions that cannot obtain large numbers of currently-used Internet (IPv4) addresses. In support of NYU collaborations with organizations both in these areas of the world and the United States, IPv6 is enabling new Computer Science initiatives. NYU faculty are porting research software they've developed for IPv4 to IPv6 in the fields of network and system security, as well as exploring the use IPv6 in distributed systems in support of high-bandwidth, QoS-sensitive applications such as visualization of simulations at high levels of detail. It is expected that the use of IPv6 at NYU will increasingly foster communications with a growing population of users of the Internet.

NYU has been involved in IPv6 network development and deployment since early 1997, as one of the first universities to establish a connection to the 6bone, the world's first global IPv6 network. An early pioneer and adopter of IPv6 technology, NYU has most recently continued that trend with an ongoing collaborative IPv6 network design and engineering endeavor between NYU and NYSERNet, begun in the Fall of 2004. NYSERNet provides NYU with high-bandwidth research network connectivity through its statewide optical network, and global connections through networks including Internet2's Abilene and CANARIE's CA*Net 4. Over the NYSERNet network, NYU researchers can use IPv6 and IPv4 with equally high performance, to reach their collaborators anywhere in the worldwide research community.

The principal technology lead at NYU for IPv6 is Jimmy Kyriannis.

About NYU: New York University, located in the heart of Greenwich Village, was established in 1831 and is one of America's leading research universities and a member of the selective Association of American Universities. It is one of the largest private universities in the US and a leader in attracting international

students and scholars in the U.S.; it sends more students to study abroad than any other U.S. college or university. Through its 14 schools and colleges, NYU conducts research and provides education in the arts and sciences, law, medicine, business, dentistry, education, nursing, the cinematic and performing arts, music, public administration, social work, and continuing and professional studies, among other areas.

About NYSERNet: NYSERNet is a private New York State not-for-profit corporation created to foster science and education in New York State through advanced network technologies and applications. An Internet pioneer, NYSERNet has delivered next-generation network services to New York State's education and research community for twenty years. More information about NYSERNet can be found at http://www.nysernet.org.

Source: Jimmy Kyriannis-New York University, http://www.nyu.edu/public.affairs/index.html

Rural Telecommunications Congress Announces World-Class Agenda for 2005

Space Limited for Attendees and Sponsors for America's Finest Technology Conference

FRANKFORT, Ky., Aug. 23 /PRNewswire/ -- The 2005 Rural Telecommunications Congress is expected to be the highest-impact rural technology conference in the United States. The Commonwealth of Kentucky is hosting the Ninth Annual Congress October 9-12 in Lexington.

The October conference is set to address important technology issues including: broadband infrastructure expansion; technology-based community and economic development; state success stories; e-health and education applications; and broadband policy and regulation. Themed "States as Broadband Laboratories," the Congress will bring together government leaders from federal, state and local levels; technology professionals from a broad range of fields; and small and rural business owners to Lexington, corresponding with the fall horse racing meet at Lexington's Keeneland Race Track. Space will be limited to the first 500 registrants. To register or find additional information about the Congress visit http://www.ruraltelecon.org/conference.

Speakers at the event include Kentucky Governor Ernie Fletcher, Congressman Hal Rogers (KY-5), University of Kentucky Head Basketball Coach Tubby Smith, Appalachian Regional Commission Federal Co-Chair Anne Pope, and Office for the Advancement of Telehealth Director Dena Puskin. Each of these exciting keynote speakers brings to the conference a different and appealing perspective on the importance of broadband technology and its impact on community and economic development.

In 2004, Kentucky Governor Ernie Fletcher unveiled his Prescription for Innovation, a comprehensive technology deployment and adoption plan. The initiative was featured in July at the National Governors' Association annual meeting in Des Moines, Iowa; and the Federal Communications Commission recently recognized that Kentucky leads the nation in growth rate of broadband subscribers over the previous two years.

Congressman Hal Rogers, representing Kentucky's fifth district, serves as Chairman of the House Appropriations Subcommittee on Homeland Security and has long been a proponent of broadband technology and its positive impact on economic development in rural communities.

Coach Tubby Smith, Head Basketball Coach at the University of Kentucky, has lead the Wildcats to one national championship, five SEC Tournament titles, and six Sweet 16 finishes, since taking the job in 1997. However, it is Coach Smith's service work in the Lexington, Kentucky area that sets him apart in the ranks of college coaches. Coach Smith's charitable foundation, Tubby's Clubhouse, is dedicated to bridging the technology education gap for middle school students in Kentucky. In conjunction with Dell's TechKnow program, Tubby's Clubhouse has graduated 216 middle school students from the summer education program.

Federal Co-Chair Anne Pope leads the Appalachian Regional Commission, a federal-state partnership committed to improving the quality of life of citizens living in the Appalachian Region in nine states. Understanding the potential impact of broadband technology in rural communities, Co-Chair Pope and the Appalachian Regional Commission have long supported technology efforts and initiatives impacting the lives of Appalachian people.

Director Dena Puskin represents the Office for the Advancement of Telehealth, a division of the Health and Resource Service Administration. Dedicated to the implementation and development of telehealth services, the Office of the Advancement of Telehealth works to widen the adoption of advanced technologies. Telehealth technology assists in providing the best health services to remote areas with increased technology applications.

Those interested in registering or sponsoring this important event may contact Kyle Lanphear at 270-781-4320 or klanphear@connectky.org.

Source: PR Newswire, http://www.prnewswire.com/news/index_mail.shtml?ACCT=104&STORY=/www/story/08-23-2005/0004092903&EDATE=

Google Diversifies to Challenge Telecoms Rivals

August 24, 2005: Google is to venture further beyond its core search engine business with an instant messaging and online voice calling service that takes it into greater competition with established telecommunications companies round the world as well as a growing list of rival online services.

The new service, Google Talk, also marks an ambitious attempt to create an open platform on the web for voice calls and instant messaging, a move that could challenge the “closed” instant messaging networks run by rivals Yahoo, AOL and Microsoft’s MSN.

Last week's announcement that Google planned to raise about $4bn by selling shares fed speculation that it would use the cash to branch out into new services, perhaps by acquiring a company such as Skype, an early leader in internet telephony.

The launch of its own service, announced on Wednesday appears to indicate instead that the company intends to build a network from the ground up, using a different approach to that taken by better-established rivals.

Google took its first step into the communications business last year with the launch of Gmail although it has made no secret of its ambition to go further. Eric Schmidt, chief executive officer, has listed search and communications as the "killer applications" of the internet.

The push into communications "is extremely significant", said Allen Wiener, an analyst at Gartner. "To be a web portal or a new media company, this layer of communications and mail is essential people use it to access and share content."

Mr Wiener said that, in spite the power of its brand, Google was likely to find it difficult to build a network quickly to rival the instant messaging networks. Yahoo, AOL and MSN each has tens of millions of regular users and is adding a voice service and, in some cases, free video conferencing.

Users of these services are able to message or talk only to others on the same network, a shortcoming Google hopes to turn to its advantage.

Georges Harik, director of product management, said that, by basing its network on open technology standards, Google aimed to encourage other internet companies from operators of online games networks to internet service providers and operators of large-scale websites to build their own services on top of Google Talk. "We aim to create an ecosystem around [an open communications platform] so that it's in everyone's interest to be open," he said.

Google Talk, a free service that lets two computer users talk or exchange messages, will be available only to people who already use Gmail.

Google said Gmail, until now an invitation-only service, would be available to any internet user in the US provided they gave a mobile telephone number as a confirmation of their identity, though this would eventually be extended to users in other countries.

Besides openness, Google is counting on better sound quality to attract users. Like other online voice services, most calls will be connected over the public internet, although Google said it would use its extensive data network, built to run its search service, as a last resort to ensure calls got through as planned.

Branching out from search has prompted questions about how far Google will eventually expand from its stated goal to "organise the world's information and make it universally accessible and useful". Making it easy for people to talk and exchange information instantly online "remains well within our mission", said Mr Harik.

As part of its diversification away from the search function, Google launched on Monday an upgrade to its "Desktop" its free software that allows users to launch programs on their PCs. The move is seen as part of its latest encroachment on Microsoft the upgrade of the free software also mirrors many of the functions of Microsoft's windows.

Source: Financial Times, http://news.ft.com/cms/s/7d3fcde8-1415-11da-af53-00000e2511c8.html

NSF Preps New, Improved Internet

The National Science Foundation is backing a major initiative that could lead to a completely new internet architecture, with built-in security measures and support for ubiquitous sensors and wireless communications devices, among other things.

The Global Environment for Networking Investigations, or GENI, will include a research grant program to fund new architectures and an experimental facility, which has not yet been planned in detail.

The little-noticed initiative was announced Wednesday at a meeting of the Special Interest Group on Data Communication in Philadelphia.

The GENI experimental facility will be "designed to explore new (network) architectures at scale," according to the SIGCOMM announcement.

GENI (pronounced "genie") will "enable the vision of pervasive computing and bridge the gap between the physical and virtual worlds by including mobile, wireless and sensor networks," the NSF announcement read.

GENI came out of an idea for a "clean slate" internet, which has been discussed by NSF Networking Technology and Systems program director Guru Parulkar, MIT senior research scientist David Clark and other network architects in recent years.

Clark served as chief protocol architect for the government's internet development initiative in the 1980s. He believes that new network designs are needed to overcome the viruses, identity theft and other threats plaguing the internet's decades-old infrastructure.

The original internet was not designed for security from targeted attacks, said University of California at Los Angeles professor Leonard Kleinrock, who led the development and installation of the internet in the late 1960s.

"Security is one of those stepsisters of our field," said Kleinrock. "It was not built in to the original internet. We had a philosophy and culture of trust. Everything we do now (for security) is patchwork, which makes it much harder."

The initiative will promote network architectures that balance "privacy and accountability and vary protections for individuals based on "difference and local values," the announcement read.

A new internet could also be made to support the privacy choices of individuals and communities as sensors and communications devices become more ubiquitous, GENI organizers hope.

People already lack privacy and security on the internet, said Princeton University professor and SIGCOMM chairwoman Jennifer Rexford, one of the GENI organizers.

"(Security) is an incredibly important problem today," Rexford said. "And if you don't solve that problem, you haven't solved anything."

Princeton is one of three universities that manages the PlanetLab experimental network, which provided some of the inspiration for GENI. Princeton professor Larry Peterson, a member of the PlanetLab steering committee, is also working on GENI.

Too little privacy on the internet will further erode confidence in e-commerce, said Rexford. But too much privacy could make it difficult to detect attacks on the network. Rexford envisions a network that could strike a balance between the two "by offering a vast spectrum of opting-in and opting-out."

The GENI experimental facility will likely be connected to the National LambdaRail and Internet2 experimental networks.

But GENI will be a unique facility, with experimental hardware, "new classes of platforms and networks" and "new computing paradigms enabled by pervasive devices," according to the announcement.

GENI will also bridge the gap between current high-speed research networks and ordinary internet users. The program will invite large-scale participation from individuals drawn by exciting new applications running on the network.

"One metric of success is that (GENI) actually fills a need for people," said Rexford. "It won't just be focused strictly on nerdy users, but a broader group as well."

Similar to the PlanetLab network, GENI will allow its participants to use "slices" of server and network time simultaneously, without siphoning networking resources away from each other.

"The idea is that I can run my 10 percent and you can run your 10 percent in parallel," said Rexford. Some GENI servers and networks will work as full-time production servers, which are expected to be available to users at all times. "But we don't want that to prevent someone from doing work that is speculative, too."

Kleinrock also welcomed the GENI organizers' plans to have built-in performance-measurement capabilities for the new facility.

"Those measurement capabilities were one of the hallmarks of the early ARPANET," said Kleinrock, referring to the network that preceded the internet.

GENI organizers plan to stress the experimental architectures with artificial traffic generators, Kleinrock said.

"You want to create the conditions that might lead to deadlocks and lock-ups, which are so important in the early stages of design," said Kleinrock.

Source: Wired News, http://www.wired.com/news/print/0,1294,68667,00.html

About CENIC

CENIC is a not-for-profit corporation serving California Institute of Technology, California State University, Stanford University, University of California, University of Southern California, California Community Colleges and the statewide K-12 school system.

CENIC's mission is to facilitate and coordinate the development, deployment and operation of a set of robust multi-tiered advanced network services for this research and education community.

More information about CENIC can be found at www.cenic.org.

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