

# Success Factors of a Digitally Connected Community

Infrastructure, Network Management, Funding, New Partnerships



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# EXECUTIVE SUMMARY

The Internet has shown great promise for education in terms of enhanced teaching and learning, effective assessment, professional development, operational efficiencies, and access to information and resources. Among the teaching and learning trends that have been greatly enhanced thanks to the Internet are mobile and distance learning, collaborative programs created by an alliance of local entities, online testing, and access to a global cornucopia of remote resources, such as rich media and remote experts, that can be brought directly into the classroom in a powerful and interactive way. Of course, such initiatives can have an equally powerful effect on the economic health of a given area through empowering job training and research into matters such as family health, finances, and home businesses.

Operationally, local educational institutions can also benefit from the Internet through the use of cloud services, software as a service, or voice over IP (VoIP) communications, all of which can enable an institution to enjoy vast and cost-efficient improvements in day-to-day operations. And of course, professional development is yet another aspect of education that can benefit from online training and testing, distance and mobile learning, and access to remote resources.

However, many educational institutions have found it challenging to obtain the bandwidth necessary to take advantage of everything the Internet has to offer. In fact, 80 percent of schools and libraries believe their current IT networking bandwidth is insufficient to meet even present needs, much less future ones.\*

Meeting this challenge alone is beyond the resources of many local institutions; alliances are a vital part of ensuring that society at the local, state, national, and global levels realizes the maximum benefit from all that the Internet has made possible.

At the state level, such public, private, and nonprofit alliances have enabled California's research and education communities to realize the benefit of advanced networks through the creation of the statewide advanced California Research and Education Network (CalREN), thanks to the nonprofit Corporation for Education Network Initiatives in California (CENIC) and its private sector allies. These allies include commercial service providers who offer leased circuits on "lit" fiber, dark fiber providers, and network hardware manufacturers such as Cisco. CENIC

itself was created and is governed by multiple segments of Californian research and education communities, from K-12 to post-graduate universities. More than 10,000 schools, colleges, universities, libraries, and research centers are connected to CalREN, and the network serves over 10 million Californians every day.

Just as CENIC represents an alliance between members of the research and education community, and as CalREN was created through public, private, and nonprofit alliances, it is through the creation of local consortia and other partnerships that small local institutions can connect to the high-performance CalREN and bring the world into their classrooms—and extend schools' reach out into the world at the local, state, national, and even global level.

This white paper will discuss the challenges currently facing local educational entities, describe 10 exemplary local alliances that enabled connection to CalREN in California, and finish with a set of recommendations for other local entities wishing to create a successful local consortium that could duplicate this success for themselves and for their local educational ecosystems.

The local consortia covered herein encompass K-12 schools and higher education institutions, libraries, museums, arts and cultural institutions, segmental projects and programs, and private sector companies:

1. [Imperial County, California](#)
2. [Scout from University of California](#)
3. [Ventura County Office of Education](#)
4. [SFJAZZ](#)
5. [Peninsula Library System](#)
6. [Clovis Unified School District](#)
7. [Sacramento Educational Cable Consortium \(SECC\) and BESTNet](#)
8. [Exploratorium](#)
9. [California Community Colleges Statewide Online Education Initiative](#)
10. [eTranscript California](#)

Each consortium is considered in detail, including its particular challenges, the means by which these challenges were met, and the end results. Finally, readers will find conclusions and recommendations that will enable them to take the next steps to duplicate such success for their own institutions and local communities.

# INTRODUCTION

## *The Educational Promise and Challenge of 21st-Century Communications*

Educational IT departments are being asked to do more as demand for services soars, but IT budgets are failing to keep pace. The Internet has shown great promise for enabling institutions to offer a richer and more interactive educational experience to students and better operational and professional development to faculty and staff, and to do so cost effectively through collaboration, cloud use, distance education, and more. However, many of these new teaching, learning, and operational applications are pushing existing network infrastructures to their limits.

### Recent examples include:

- Online testing initiatives
- 1:1 initiatives in which each student works on a laptop or tablet
- Mobile and distance learning and blended classroom initiatives that promise extended community reach to educational institutions
- The flood of personal communication devices being brought onto campus by students, faculty, and administrators known as the bring-your-own-device (BYOD) trend
- Access to remote resources through virtual field trips and videoconferencing with remote experts
- Remote training or professional development classes.
- Use of cost-effective cloud services or VoIP for leaner and more predictable budgeting

School systems are typically connected together electronically by a local network ring that allows the schools to communicate and also provides a means for Internet access. If these networks are then connected to high-speed statewide and global networks, individual schools within the local network can access a world of rich teaching tools and informative content. Students and teachers will have global access to experiences, expertise, rich multimedia digital collections, and research resources.

Many schools would need to upgrade their connectivity to take advantage of such bandwidth-hungry applications. In many school systems, Internet connectivity is woefully inadequate, often less than 1.5 Mbps. In too many cases, the promise of cost-effective, collaborative digital education for every student in America remains just that—a promise, and not reality. Cisco CEO John Chambers aptly sums up the crossroads that our education system currently faces:

***“Learning is critical to the future of our world, and yet our current education systems are facing unprecedented challenges. I believe that the effectiveness of how the world achieves genuine lifelong learning is reliant, to a substantial degree, on how well we harness the power of the network to connect and engage learners and educators alike, and to provide access to our collective resources and knowledge. It comes down to scale. Traditional education systems alone, despite the essential role they have played, and will continue to play, in learning, are simply not capable of serving the world’s growing and changing needs.”***

One might imagine that educators can simply make-do with the IT assets that they currently have, but with new network-dependent educational and operational innovations occurring daily, making-do will surely translate to being left behind, and at an ever-increasing pace.

Fortunately, making-do is not the only option, particularly when schools and other educational institutions come together to aggregate costs, strengthen their ability to advocate for themselves, and otherwise take advantage of economies of scale.



## MEETING THE CHALLENGE THROUGH STATEWIDE PUBLIC, PRIVATE, AND NONPROFIT COLLABORATION

Within California, this has already taken place on a large scale in the form of the CalREN, a high-bandwidth, high-capacity, fiber-based Internet network specially designed to meet the unique requirements of research and education, and to which the vast majority of the state's educational institutions are connected. Used by more than 11 million Californians every day, CalREN is owned, designed, implemented, and operated by the nonprofit CENIC, the membership of which consists of the California K-12 system, California's community colleges, the California State University system, the University of California system, and private universities such as Caltech, Stanford University, and University of Southern California, among others.

CENIC is governed by its member institutions, and functions as a unique and irreplaceable technological roundtable where all research and education segments throughout the state can come together to examine, respond to, and shape the 21st-century technological landscape.

Implementing such a vast vision requires commitment from the private sector, and CENIC has been fortunate to have strong private sector allies fully committed to educational networking for the public good. These allies include commercial service providers who offer leased circuits on "lit" fiber, dark fiber providers, and network hardware manufacturers such as Cisco. With Cisco's private sector resources and passion for education technology, CENIC has enabled Californian research and education communities to leverage their networking resources to obtain cost-effective, high-bandwidth networking to support their missions and respond to the needs of their faculty, staff, and students. The value of open and collaborative alliances between the public, private, and nonprofit sectors in ensuring that Californian education communities stand ready to play their vital role in the coming century is clear.

In order for local schools and other educational institutions to enjoy economies of scale and connect to and benefit from CalREN, connectedness among local communities enabled by these public-private alliances is essential. Physical connectivity to each other with high bandwidth

and low latency enables collaboration because all partners in a project have the connectivity to interact in real time. As Louis Fox, president and CEO of CENIC has noted:

***"Talent is pretty equally distributed across populations. You'll find talented, creative, imaginative, motivated individuals everywhere: in urban areas, in rural areas, among a rich populace and a poor populace, across all cultures and in all communities. The problem is that opportunity is not evenly distributed. The network has the power to bring opportunity to talent by connecting various kinds of talent across communities, across ages, and across cultures. That's the really exciting thing that CENIC is about."***



## THE VITAL NEXT STEP: THE DEVELOPMENT OF LOCAL CONSORTIA

One of the greatest challenges to network penetration, and one that is well recognized in many contexts, is the last-mile problem. In short, the 3800-mile, fiber-optic-based CalREN backbone can and does penetrate throughout California, but connecting to the network across the remaining gap between the backbone itself and the local site is often the most challenging part of obtaining high-quality networking for many institutions—especially when such institutions are attempting to bridge this gap alone.

Several California education institutions have proven that by connecting and collaborating with other education entities within their local education ecosystem, they can overcome many of the common challenges associated with low bandwidth. By building out a local high-speed network dedicated to education and research, which can then connect to CalREN or other networks like it located across the country, users on the local network can collaborate with individuals and organizations around the world.

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Communities begin by building multi-institution consortia of education institutions that are willing to work together to build and manage a local broadband network. A consortium can include any interested local K-12 entities, community colleges, 4-year colleges and universities, public libraries, and even museums and performing arts centers. Once a consortium is formed, members can identify the most reliable and most cost-effective options for obtaining a last-mile connection to CalREN. Available, unused dark fiber places the greatest degree of control into the hands of the consortium, while also requiring the consortium to shoulder the greatest responsibility for support. Where affordable, leased circuits, purchased from commercial service providers, using lit fiber can be equally effective.

By using fiber for the local network, bandwidth and speed will be dramatically increased and capable of supporting online testing. The local network would enable instructors to make use of enriched curriculum and multimedia teaching, professional development, and operational support tools, improving the teaching and learning experience for students, faculty, and staff alike. The network would be able to support new educational resources as they become available, and could even encourage the development of new innovations at the local level, which could then be leveraged by others in the same community and beyond. In addition, high-speed Wi-Fi can be set up to support the ever-growing BYOD trend, thus enabling the institutions to serve as vital anchor institutions within their communities.

In a real sense, the world can come to the classroom—and the classroom can extend out into the world.

## HOW TO MAKE IT HAPPEN: WHAT YOU WILL FIND IN THIS WHITE PAPER

As longtime allies in enabling access to advanced networks for California research and education, Cisco and CENIC have combined efforts in this white paper to highlight exemplary collaborative efforts underway in California to:

- Show what is possible when people truly collaborate and combine efforts to access high-speed networks and then put them to use to support teaching, learning, and research and to create new and innovative ways to carry out all three
- Bring to light the largely behind-the-scenes efforts to expose the network “plumbing” and make the invisible visible
- Inspire others who are dealing with aging IT infrastructure and stagnant IT budgets to build partnerships among local research and education organizations, strengthening the entire community ecosystem

These examples are intended to lay the groundwork for action. *Discuss* how you can work together. *Learn* how other communities have done so and what advantages they found. *Investigate* whether high-speed fiber is available locally, and how you can build and manage a local high-speed education network. *Reach out* to those individuals involved with operating a statewide research and education network, like CENIC, and seek their advice on setting up your local network and linking to their statewide network.



## CENIC AND CISCO: ALLIES ON BEHALF OF CALIFORNIA EDUCATION

CENIC | [www.cenic.org](http://www.cenic.org)

California's education and research communities leverage their networking resources under CENIC to obtain cost-effective, high-bandwidth networking to support their missions and respond to the needs of their faculty, staff, and students.

CENIC designs, implements, and operates CalREN, a high-bandwidth, high-capacity Internet network specially designed to meet the unique requirements of these communities, and to which the vast majority of the state's research and education institutions are connected. More than 11 million Californians use CalREN every day. In order to facilitate collaboration in education and research, CENIC also offers connectivity to non-California institutions and industry research organizations.

CalREN consists of a CENIC-owned and operated backbone to which schools and other institutions in all 58 of California's counties connect via leased circuits obtained from telecom carriers or fiber-optic cable. CENIC is governed by its member institutions. Representatives from these institutions also donate expertise through their participation in various committees designed to ensure that CENIC is managed effectively and efficiently, and to support the continued evolution of the network as technology advances. For more information about CENIC and its high-speed broadband network, CalREN, visit [www.cenic.org](http://www.cenic.org) or send an email to [info@cenic.org](mailto:info@cenic.org).

Cisco | [www.cisco.com](http://www.cisco.com)

Cisco has a proven commitment to education and has been a leader in developing creative and effective public-private alliances. The company's founders were members of Stanford University's IT staff, and the first to provide computers with the ability to speak to one another. They invented the routing and switching technologies that Cisco sells today and that form the foundation of the Internet.

Cisco cares deeply about students and educators and has made, and continues to make, major investments of time and resources to improve education globally. Not only have these investments improved education and helped to develop lifelong learners, but they have also provided Cisco with valuable insights into how to integrate technology with sound curriculum and teaching methods.

Cisco's experience working with the educational community to provide next-generation learning opportunities has provided important insights into both the successes of modern learning systems and the improvements that are necessary to increase opportunities for success.

For more than 20 years, education systems around the world have collaborated with Cisco to address challenges and achieve strategic objectives. By working closely with thought leaders in education, Cisco gains valuable insights into designing, executing, and testing solutions based on best practices and input from its education stakeholders. These ongoing, proven relationships have resulted in a broad range of success stories across a variety of education systems, providing continuous innovation in how education communities are managed and renewed.

Cisco can help build the right infrastructure and implement technologies to meet specific educational needs. Cisco provides:

- Leadership in IP networking technology, with more than 15,000 engineers and more than a \$4 billion R&D budget
- Strong understanding of and commitment to education
- End-to-end network architecture, which offers superior quality of service, availability, and security
- A broad, deep product line, featuring interoperable, standards-based technologies
- Global community of trained and certified partners.
- Cisco Capital® finance programs



## Example 1: Imperial County, California



Imagine growing up and being interested in learning everything you can about protecting the environment. Classes, textbooks, and the Internet can certainly provide a wealth of information for eager learners, but imagine being in the 11th grade and getting the opportunity of a lifetime—speaking face to face with President Jimmy Carter and asking him questions about his Alaska National Interest Lands Conservation Act and the creation of the U.S. Department of Energy. Thanks to Imperial County's access to high-speed broadband, Southwest High School students Alexis Estrada and Pablo Zapata were thrilled to have had this opportunity recently, via video teleconference.

### CHALLENGE

Located in the far southeast of California, Imperial County borders Arizona and Mexico and extends more than 4597 square miles. The county has around 175,000 residents and 64 total schools with approximately 37,000 students. Of the 16 school districts within Imperial County, about half are in rural, remote locations. With Imperial County being a relatively large geographic area with a very small population in a remote area, it had little chance for a commercial build-out of fiber infrastructure. Imperial County needed to build its own last-mile fiber network for supporting local government functions, the local school system, and other community needs.

### SOLUTION

In 2001, as part of a much-needed IT infrastructure upgrade, a number of entities, including the Imperial County Office of Education (ICOE), the Imperial Valley College, San Diego State University-Imperial Valley Campus, and several local government agencies joined together to form a consortium (the Imperial Valley Telecommunication Authority) to build and manage a county-wide network for education and government use. The effort utilized existing private fiber from the local utility district, which provided substantial cost savings (Figure 1).

Figure 1. Imperial Valley Telecommunication Authority Infrastructure



The first phase of the IT upgrade consisted of a pilot construction project that connected the Calexico Unified School District office to the local fiber network. The subsequent two phases connected six high schools, three elementary schools, and the Imperial Valley College to the fiber network. Since that time, 68 school sites have been connected to the local network, as have 31 city and county offices, including several public libraries.

Interconnecting this county-wide infrastructure to CENIC's CalREN infrastructure efficiently extended the reach of the Imperial County network, allowing members of the local network consortium to connect to sites nationally and globally (Figures 2 and 3).

Figure 2. CENIC's CalREN Network Authority





Figure 3. CalREN's Global Reach



Without this consortium, a school might have paid as much as \$156,000 per year, per site for a 155 Mbps (\$84 per Mbps per month) connection. The consortium, however, charges only \$5000 per year, per site for much broader bandwidth 1 Gbps connections (\$0.42 per Mbps per month). The collaboration among strategic partners and the county-based consortium that built and has managed the dark fiber system independently for more than 13 years has enabled the parties to markedly reduce operating costs. The dramatic cost savings are achieved by leveraging available resources from the community such as existing fiber optic cable and utility poles, skilled technical staff, and an economy of scale created by aggregating purchasing capacity.

## RESULTS

Imperial County has demonstrated that even remote communities can effectively plan, build, and manage the full benefits of a community-owned fiber IT infrastructure through a consortium model and leverage strategic partnerships, seek technical expertise, and achieve economies of scale for rural and remote communities. This fiber infrastructure enables students, teachers, administrators, and the public to communicate and collaborate across time and distance in a remarkable number of ways.

Lauding the programmatic activities and projects available with the broadband connectivity, Superintendent Anne Mallory emphasizes that “we have students who have never left the boundaries of Imperial County and recently one of our high schools was afforded the opportunity, via the

*“Those kinds of opportunities to bring the outside world into the county, and to really give our kids a sense of what’s going on out there, have been huge.”*

*Anne J. Mallory, Superintendent, ICOE*

CENIC connection, to have President Carter speak to its class via video teleconference.” The El Centro students and students from six other schools around the country watched President Carter speak about his land conservation efforts via video conference through the broadband network, after which they were able to interact with him during a Q&A session.

Once thought next to impossible to pull off, these types of exciting and engaging opportunities are becoming more common as a result of high-speed broadband connectivity. For example, United States Poet Laureate Philip Levine connected via broadband video conference with AP English students at Brawley Union High School and Southwest High School to discuss the creative process generally and poetry, in particular. Similarly, Heber Elementary School students spoke with former Governor Arnold Schwarzenegger live from the state capital and took a video tour of the governor’s office. Luis Wong, chief technology officer for ICOE, praised the positive effects of such activities, noting that “the network brings these opportunities to the students that otherwise they simply wouldn’t have.”

For Imperial County K-12 schools, the high-speed broadband network provides a platform for rich collaboration and communication tools for teachers and administrators that improve productivity and the teaching experience. Conferences can be attended remotely, thus reducing travel-related costs. Online assessment programs are conducted via the network.



One local initiative that benefits from this collaboration is the Imperial Valley P-16 Council, a preschool through higher education community collaborative which promotes a college-going culture. The council’s vision is to significantly increase student eligibility, admittance, and attendance at post-secondary institutions. The Imperial Valley P-16 Council conducts remote video interviews with recent high school graduates to seek feedback about the high school experience and how well it has prepared them for further study. Remote teaching even acts as a staff multiplier for underserved disciplines such as Science, Technology, Engineering, and Math (STEM).

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For research needs and other projects, students take advantage of Internet2—a dedicated education network with speeds thousands of times faster than commercial, commodity Internet with no congestion. That means that live, interactive, high-quality video is possible without the lag and delay, which can cause synchronization issues. It provides immediate access to experiences, expertise, and rich multimedia digital collections and resources.

The local public libraries provide free public access to Wi-Fi, even after hours. Computers are available that enable citizens to look for jobs, apply for jobs, write resumes, and more. For K-12 students, both live and remote tutorial and homework assistance are available. The libraries' card catalogs are interconnected with the local K-12 schools via the broadband network, enabling students to check book availability, place a book on hold, and obtain the book via interlibrary loan. For those seeking to improve their English language skills, access is provided to tutors in Nevada, Alameda, and Stanislaus counties.

Beyond K-12 and public libraries, Imperial Valley higher education assets are also connected to the broadband network. San Diego State University (SDSU) has two satellite campuses within the county with a total enrollment of about 900 students. On-campus instructors are complemented with live broadcasts via high-speed broadband from the main SDSU campus in San Diego. In addition, about 9000 students are typically enrolled at Imperial Valley College, making the college another important member of Imperial Valley's broadband community.

One of the many tremendous benefits afforded by the network is in the interdependent educational activities that have been developed as a result of the ubiquitous nature of the network. When educators and collaborative partners are unhindered by adverse technical limitations, which would otherwise constrain their efforts to reach students, a tremendous amount of positive, progressive work can be accomplished among cross-segmental partners.

The BorderLink project is one such example. BorderLink, which was in place from 1999–2005, was a federally funded Technology Innovation Challenge Grant designed to impact the lives of students within Imperial County and San Diego County through the use of technology in education. One of the project's principal efforts was to

provide equipment and support to all high schools and middle schools in Imperial County to enable them to take advantage of videoconferencing opportunities.

Cooperative instruction occurred in situations such as Seeley Union School District students receiving algebra instruction from a teacher at another district (a highly qualified algebra teacher was not on the roster at the time). More recently, a few years after the BorderLink grant had finished, Holtville High School and Imperial High School utilized videoconferencing to share a physics teacher. This allowed a master teacher in physics to mentor a new teacher while also providing high-quality instruction remotely. It required additional alignment of schedules and materials, but truly helped solve a need in a coordinated and cost-effective manner.

An additional benefit that resulted from the good work started by BorderLink was the development of an extensive cross-segmental group dedicated to creating a college-going culture in Imperial County. Several agencies and partner groups, such as the Imperial County Partnership for Higher Education (ICPHE) and the P-16 Council, coalesced to spearhead student-focused events, many of which relied on connectivity to support digital applications, tools, and processes. Higher Education Week, Cash for College, and the ICPHE Parent Conference, for example, provided opportunities for hundreds of students to work with post-secondary staff, recruiters, and local counselors to submit critical documentation and applications online in preparation for college admissions and enrollment.

At the same time, these concerted college-going efforts also helped bring to the county online courses provided by University of California College Prep, which were delivered and monitored through the University of California Early Academic Outreach Program. Over the course of several summers, numerous students participated in asynchronous online courses in environmental science with teachers of record monitoring and grading their work from other parts of the state.

Without the necessary infrastructure and the reliable connectivity afforded by the telecommunications partnerships in place across the county, such opportunities may not have been possible and the establishment of a true college-going environment across Imperial Valley would have been hindered.

### CHALLENGE

Given today's budgetary constraints, school districts are often forced to limit the number of classes they offer, reduce or eliminate summer school programs, and restrict the number of students permitted to take classes. Add to that the scheduling conflicts, limited classroom space, and accommodations for students with special needs and English-language learners, and it is easy to see why painful and limiting decisions must often be made.

### SOLUTION

Scout from University of California (UC) is a member of the Student Academic Preparation and Educational Partnerships (SAPEP) program, which seeks to raise student achievement levels generally and to close achievement gaps between groups of students throughout the K-20 pipeline. In partnership with K-12, the business sector, community organizations, and other institutions of higher education, Scout works to ensure that a higher proportion of Californian young people, especially those who are first-generation, socioeconomically disadvantaged, and English-language learners, are prepared for post-secondary education and can pursue graduate and professional school opportunities and achieve success in the workplace.

Scout is a full-service online learning provider for middle school and high school students interested in AP, honors, credit recovery, and "a-g" college prep courses and for teachers looking for online curriculum for their classrooms. The rigorous course of study provided by Scout helps students on their road to graduation and prepares them for college.

Located in Santa Clara, California, in the heart of Silicon Valley, Scout's headquarters houses the academic, administrative, and technical infrastructure that supports the development of new online content and services. The in-house technical network infrastructure is connected via high-speed fiber which runs from Scout's Santa Clara facilities to UC Santa Cruz. From there, Scout is connected to the statewide CENIC network, CalREN. Scout's high-speed fiber connection and CalREN's always-on, high-speed network provide crucial benefits that support Scout's efforts:

- High-speed broadband connection enables streaming of Scout's media-rich educational courses
- Highly secure network provides protection of personal information (alleviating FERPA concerns) and protects Scout's courses, which are valuable intellectual property

### RESULTS

Following a soft opening in April 2013, Scout officially opened its doors in November 2013, estimating that 1000 students would take advantage of Scout's learning opportunities during the first six months. In reality, during this period, there were approximately 6000 student enrollments through May 2014 and more than 12,000 course orders were placed for the 2014 summer session.

Scout's Dean, Lynda M. Rogers, a passionate advocate for Scout and similar efforts, notes: *"We all want our children to achieve their greatest potential, but the reality of education in California is that resources are limited. That is why I am so excited about the possibilities Scout presents. Scout increases students' access to high-quality educational resources. Resources to which they may not otherwise have access. The program has proven it can impact education in a positive way by providing students access to high-quality college prep and AP courses like they've never had before."*

For more information about Scout, visit [www.ucscout.org](http://www.ucscout.org) or watch this video to get a behind-the-scenes look at the program: <http://youtu.be/ZWb3u13ZMJY>.

## Example 3: Ventura County Office of Education



### CHALLENGE

Ventura County, California is made up of a combination of urban and suburban areas, but also contains several very remote areas including school districts in the Las Palmas and Ventura County mountains that have traditionally been unserved and underserved. For many years, the Ventura County Office of Education (VCOE) has acted as the Internet service provider for the 20 school districts contained within the county. Nine years ago, the VCOE and the Ventura County school districts were all sharing a 45 Mbps Internet connection.

Seeking faster speeds, an effort was made to draw major service providers into the county to provide greater bandwidth and speed. The available service providers, however, determined that without an existing presence in the county, it would be cost-prohibitive for them to lay out high-speed fiber. Negotiations eventually broke down.

### SOLUTION

At the same time, park officials at Channel Islands National Park were working to come up with a solution so that its remote underwater dive tour program could be viewed by tourists, students, and others on the mainland. Discussions with VCOE officials spawned a joint proof of concept effort in which a licensed microwave tower was placed atop Anacapa Island, the island closest to the mainland, to send live audio and video feeds of diving activities. The VCOE handled the switching side of the project, including providing a media server for streaming live feeds, while the National Park Service provided audio and video gear to capture the dive tours. As a result of these efforts, not only could people on the mainland watch the dives, they could also interact with the divers via audio/video question and answer sessions.

Following the success of the Channel Islands underwater tour project, Steve Carr, VCOE Chief Technology Officer, contacted the county's school districts in an effort to interest them in a similar microwave network build-out to link the school districts to the VCOE system to improve connectivity, speed, and bandwidth. After gaining the school districts' buy-in, a microwave network was built out with towers on the tops of four mountains spread across the county. The microwave build-out dramatically improved the districts' connectivity, with each district enjoying up to 400 Mbps connections.

While the microwave-based network model has been highly successful for its eight years, new statewide technology-intensive initiatives, such as Smarter Balanced Assessment System testing (online administration of required standardized tests) and Common Core State Standards, are now demanding schools to have even greater bandwidth. In response to this need, VCOE recently issued an RFP seeking Internet service providers capable of bringing high-speed fiber to the community. Now business models have changed and AT&T and Time Warner Cable are now providing 1-Gbps circuits, which VCOE maintains. VCOE provides connectivity to each of the 22 school district offices. Each individual school district office then provides connectivity to the schools within its district.

### RESULTS

VCOE's network evolution has progressed dramatically in the past few years, from sharing a low bandwidth connection among the districts to its present day hybrid network, which uses both the microwave network and more recently the 1 Gbps connections and high-speed fiber. VCOE uses both systems and can shift traffic between microwave and fiber based on demand and specific speed requirements, routing traffic in optimal ways and meeting the challenges posed by California's latest initiatives, as well as the exponential growth in demand and expectations for high-speed connectivity.

VCOE continues to act as the Internet service provider for all school districts in the county and is a node site for access to CENIC's CalREN network. Carr is now seeking to bring the Ventura County Community College District and the California State University Channel Islands assets into the fold and is exploring opportunities for co-locating fiber termination points on their campuses.





### CHALLENGE

SFJAZZ, the San Francisco Jazz Organization, has a rich 32-year history of presenting live jazz music in the San Francisco Bay area as a nomadic presenter of events, festivals, and concerts, but without a place to call home. Seeking to elevate jazz above the festival and club scenes, several years ago Executive Artistic Director Randall Kline embarked on a capital campaign to raise funds to design and build a multi-function facility dedicated to jazz. After several years of fundraising, planning, and designing, the SFJAZZ Center held its grand opening in January 2012. The center features an intimate 700-seat flexible music hall that hosts up to 200 performances per year. In addition, more than 150 shows take place in the smaller, 100-seat performance space.

While presenting live jazz is SFJAZZ's most visible focus, SFJAZZ also has a strong education component, including workshops, master classes, and jazz appreciation classes that are available to both children and adults. As the SFJAZZ Center was being built, Mount V. Allen III, certified facility executive (CFE), knew he wanted to ensure that the SFJAZZ Center was connected to the broader music education community to maximize SFJAZZ's reach and its opportunities for collaboration. Simply stated by Allen, he wanted to "turn the center's 700 seats into 7 million seats via high-speed fiber connectivity."

### SOLUTION

As a member of the International Association of Venue Managers and a member of its Performing Arts Centers Committee and Chair of its Universities Committee, Allen was aware of the potential advantages of connecting SFJAZZ to a high-speed research and education network. He successfully encouraged the SFJAZZ board to install a high-speed fiber IT infrastructure within the Center. Allen then reached out to CENIC to discuss the potential benefits of connecting SFJAZZ to CENIC's dedicated education network, CalREN. SFJAZZ and CENIC formed a strong relationship, which according to Allen, "provides SFJAZZ with a foothold to the greater global community to spread the word about jazz."

### RESULTS

While SFJAZZ's experience with high-speed broadband is still in its early stages, Allen is confident that it's the right thing for the organization. SFJAZZ is now looking at partnering with secondary schools, community colleges, and universities, recognizing CalREN's broad reach across the state of California. Ongoing discussions are taking place about using the network for remote auditions with the goal of getting more students into higher education music programs. In addition, Allen is seeking to build partnerships with members of California's education community, which are interested in serving underserved K-12 communities.

Sherilyn Evans, CENIC vice president and COO, had this to say about the SFJAZZ and CENIC relationship:

***"Organizations, such as SFJAZZ, are very rich in content and have the ability to be rich content providers to the rest of the education community. At the same time, SFJAZZ also has an educational component and CENIC provides the linkage for them to create the professional network to engage educationally with other entities that are interested in what they are doing."***



### CHALLENGE

Founded in 1971, the Peninsula Library System (PLS) consortium has enabled residents of San Mateo County, California to borrow books from and return them to any of its member libraries. Originally made up of 33 public libraries, three San Mateo County Community College District libraries joined with PLS in 1984, bringing the total number of libraries in the consortium to 35.

The member libraries agreed to a Joint Powers Authority, which combined and automated all of the card catalog systems, expanded access to library materials for faculty and staff of the community colleges, and enabled the community colleges to benefit from the cooperative bulk buying power of PLS. San Mateo Community College District, in turn, brought the PLS into its telecommunications system, providing space for the PLS IT team, servers, and Internet access, as well as training and management of PLS's IT team.

This mutually beneficial partnership has served the parties well for many years. During the last few years however, the libraries' IT systems have struggled to keep up with bandwidth demands, often resulting in poor service and complaints from patrons. The libraries have more than 1600 work stations available to the public, which coupled with all of the IT traffic traversing the libraries' Wi-Fi systems, have resulted in exponential growth in usage, often exceeding available bandwidth. Bandwidth for individual libraries in the past has ranged from 5 Mbps for smaller libraries to 20 Mbps for larger ones. This bandwidth, less than what is common in a typical American home today, is woefully inadequate for the needs of today's libraries and their patrons.

### SOLUTION

As a result of continually growing network usage and resulting bandwidth challenges, PLS was forced to look for a better solution to meet demand. Frank Vaskelis, CIO of San Mateo Community College, and Linda Crowe, executive director of the PLS, entered into discussions with CENIC seeking network design best practices and other recommendations. After considering various solutions, the libraries took advantage of AT&T's OPT-E-MAN Service offering, which enables each library to

incrementally adjust its bandwidth on its LAN up to 1 Gbps, as needed. The libraries are consolidated on a PLS 10-Gbps OPT-E-MAN circuit and connected via a 10-Gbps circuit directly to CENIC and its CalREN network.

### RESULTS

The results so far have been very positive—bandwidth use is up and complaints are infrequent. "It's the best thing that has ever happened to us. It's a game changer for us to be a part of the CENIC community and have considerable connectivity," notes Crowe. Librarians are now investigating and implementing new programs and services with their increased bandwidth as a result of the partnership with CENIC, including:

- Video game creation and other technology programs for teens
- Cloud hosting
- Reinventing reference
- Videoconferencing for meetings, staff training, and public programs
- Collection development: E-books, digital magazines, and digital music
- Supporting individual and group online learning
- Digital content creation
- Supporting the development of small businesses
- Digitizing community history
- Enhancing library security
- Mobile computer lab
- Expanding computer tutorials, equipment, and software
- Genealogy research
- Library use of social media

Beyond this set of new services and programs, the PLS libraries now have the ability to collaborate more seamlessly with one another, as well as to draw on content, expertise, and opportunities from schools, colleges, and universities. These benefits are extended to library patrons, enhancing their access to information, research, and learning.

### CHALLENGE

Located in Fresno County, California the Clovis Unified School District (CUSD) serves approximately 40,000 students. For several years, the district relied on a 40 Mbps Internet connection which was often at capacity and was barely sufficient to meet district needs. On top of this already straining network, several new sources of bandwidth demand were added:

- 6500 new laptops were purchased by CUSD to support classroom curriculum
- California's Smarter Balanced Assessment System online testing requirements
- The ever-increasing traffic load stemming from personal cell phones, tablets, and laptops

It quickly became clear to district administrators and faculty that more bandwidth was necessary.

### SOLUTION

In March 2011, Dan Resciniti, CTO for CUSD, approached Raj Sra, administrator of the Fresno County Office of Education's (FCOE) Information Systems and Technology Department Services, about getting Clovis' circuit connection to Fresno upgraded to provide more bandwidth and thus faster Internet speeds. The two looked at all viable, affordable solutions to upgrade CUSD's connection. They determined that by using fiber to connect the FCOE and CUSD networks, CUSD would be able to dramatically increase its bandwidth to 1 Gbps. FCOE is a CalREN node site and so with increased bandwidth, CUSD would be able to take full advantage of all that CalREN has to offer.

While investigating the various options available to connect the two entities, it was discovered that both the City of Fresno and the City of Clovis had fiber pathways that could be tapped into and that the two fiber networks had a handoff junction box connecting them (CUSD has schools located in both Fresno and Clovis). The district approached both cities with a proposal for the high-speed connections that would ultimately benefit their respective students. Once permissions were granted by each of the two cities to share some existing pathways and dark fiber, FCOE and CUSD just needed a way to connect to each city's fiber pathway.

In CUSD's case, its data center was located just a few hundred yards from the City of Clovis' fiber network. CUSD used funds from its operating budget to run fiber connecting CUSD's data center to the City of Clovis' network. Likewise,

FCOE was located just a block and a half from the City of Fresno's fiber pathway. Sra worked with the City of Fresno's IT department and various city officials to get approval to run metal conduit and fiber into FCOE facilities.

### RESULTS

Both Sra and Resciniti agree that the project has been a great success. CUSD students can now access and use online resources previously unavailable due to CUSD's former low-speed bandwidth, Resciniti notes:

*"It has worked flawlessly. With increased bandwidth, CUSD students and staff are now able to access media-rich sources of online information and use web-based collaborative learning applications such as Google Docs, Office365, Edmodo, and numerous other forms of instructional technologies. High-speed access really opens the door for classroom technology and providing all students with a quality education."*

Commenting on the relative ease with which the project came together, Sra notes:

"What we were trying to do was for the betterment of the entire community. Everyone is busy and they have their own projects and limited resources. This was the first time we've tried to do something like this and it was really encouraging to see everyone step up to the table and make resources available even if they personally had nothing to benefit as an agency. It's worked flawlessly, and I was surprised to get it done with different agencies."

The joint project has translated to cost savings for CUSD. Previously, the district had to lease circuits from a service provider for a slow 40 Mbps connection. Now, with the fiber connection in place, CUSD pays for Internet service only and has a 1 Gbps bandwidth connection (as well as a second 1 Gbps circuit for redundancy), thus saving money, while increasing bandwidth 25 fold.

Both Sra and Resciniti acknowledge that their joint project has led to a better, more collaborative relationship between the cities, CUSD's IT department, and FCOE.

### CHALLENGE

The challenge for Sacramento Educational Cable Consortium (SECC) has been succinctly outlined in its mission statement, “to provide quality educational resources to learners of all ages in the greater Sacramento community primarily through video and other information and communication technologies via cable systems and networks.” SECC’s story is an important one because it truly shows the power of forward-thinking and the power of collaboration in accessing high-speed broadband necessary to fulfill the organization’s mission.

### SOLUTION

In contrast to the other success stories outlined in this white paper, the SECC and its high-speed network have a long history beginning in the 1970s. Anticipating that commercial cable service would soon come to the Sacramento area, a group of Sacramento area educators formed the SECC comprising the area’s educational institutions to negotiate as one with cable franchising authorities and help define the original franchise agreement.

The initial SECC consortium consisted of the county’s K-12 school districts, three community colleges, UC Davis, the Parent-Teacher Association, libraries, two small private schools, and California State University (CSU) Sacramento (CSUS)—the consortium’s original leader. Beyond providing educational programming, the consortium also anticipated the benefits of having an Intranet among the consortium members and in 2002 created a pilot project to explore a shared network infrastructure backbone among the consortium members, which they named Broadband Education Services Technology Network (BESTNet).

Proceeding from the original cable franchise agreement, initial SECC members had to brainstorm about what exactly an Intranet should be and be capable of doing. These discussions formed the basis for a pilot project for a network backbone connecting the larger school district offices, the Sacramento County Office of Education, two of the community colleges, and Sacramento State.

The consortium, in cooperation with the Sacramento Metropolitan Cable Television Commission (SMCTC), the local cable franchising authority, met with AT&T to discuss which parts of its vision were actually obtainable, what the costs would be, and to define the responsibilities of the various parties. It should be noted that during this process, AT&T was conducting a fiber overbuild for Sacramento and its agreement mandated that any dark fiber be made available for local educational use. Access to dark fiber was a crucial factor in the original success of BESTNet.

The entire SECC project consisted of three phases:

- Phase I: The pilot project (network backbone) was funded by AT&T as was required under the original franchise agreement.
- Phase II: Middle schools and high schools were connected to the network. Here, Comcast provided dark fiber and at-cost construction, SMCTC allocated \$3 million, and the schools provided a matching \$3 million.
- Phase III: Elementary schools are now being connected to the network to be completed by 2016 under the same funding model as Phase II.

### RESULTS

Elizabeth Rhodes, executive director of SECC, notes that BESTNet has been very successful and that the fiber is highly reliable. The network initially supported 1 Gbps bandwidth, but the backbone bandwidth has been increased to 10 Gbps with an eye toward an increase to 40 Gbps. She cites the valuable partnerships with all of the school entities and cable companies that have been involved along SECC’s journey. Member institutions have changed over time with Sacramento State having recently left the consortium. This has happened from time to time and remaining partners have been willing and able to step up and take on additional responsibilities and leadership roles.

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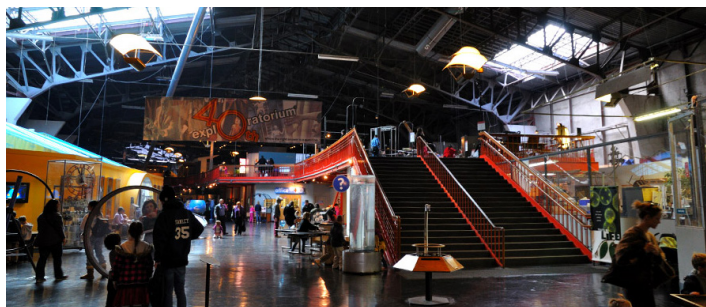
*“In a world where there are not a lot of good, solid collaborations this has truly been a positive one,” Rhodes says. She notes that “we have some smaller districts, like Robla, Natomas, Galt Elementary, Elverta, and Galt High, that don’t have full-blown IT departments that can oversee their networks. The larger districts and the Sacramento County Office of Education play ‘big brother’ and step in to help. Elk Grove works closely with Galt, Twin Rivers with Robla and Elverta. These are really nice partnerships and collaborations. And no funding is even exchanging hands. It’s about the success and utilization of BESTNet.”*

The network provides high-speed Internet access to all of its K-20 member institutions and also access to the CENIC research and education network, CalREN. Students and teachers all benefit from media-rich instructional materials and streaming video. Electronic field trips via the California State Parks PORTS project are popular among students, as are opportunities to watch live space missions. Classes have even included live video chats with students in the United Kingdom and China. Educational programming production has increased over time and is now shown on two channels and aired 24/7. Programming highlights include:

- **The CSUS String Project:** Provides carefully structured group lessons in violin and cello for children in the fourth grade and up. The lessons are taught by the dedicated and talented CSUS School of Music undergraduate and graduate students and supervised by experienced teachers. Each year, friends and families enjoy the annual concert by the students of the CSUS String Project which is broadcast via the consortium’s network: <http://www.secctv.org/video/?p=1730>.

- **Teach 21: The Life Cycle of the Monarch Butterfly:** Students learn about the life cycle of a butterfly through a variety of sources such as videos, diagrams, books, and a video conference with a state park ranger. They observe the metamorphosis of live caterpillars and butterflies and document this metamorphosis through written journals, pictures, and video. The students then create a film (using Movie Maker) that serves as a documentary of the life cycle of a butterfly. It includes the pictures, videos, and writing they accumulate over the period of observation: <http://www.secctv.org/video/?p=1038>.
- **Stand Up. Speak Out. Lend a Hand:** Elk Grove High School students recently had the opportunity to join secondary schools across the nation for an interactive video conference with Holocaust survivor, human rights activist, and Academy Award-winner Gerda Weissmann Klein. As part of her Stand Up, Speak Out, Lend a Hand project, Klein shared her story of survival and resilience with students in Bob LeVin’s 11th grade English class and Erin Goldman’s U.S. History class: <http://www.secctv.org/video/?p=908>.

A BESTNet [overview](#) and a brief promotional [video](#) can give viewers a better understanding of BESTNet’s wide breadth of educational tools and programming offerings.



### CHALLENGE

Since 1969, San Francisco's Exploratorium has influenced generations of entrepreneurs, artists, scientists, teachers, students, children, and museum professionals. The Exploratorium strives to bring a vast array of high-quality scientific programs, teaching tools, and experiments alive. Part science museum, part learning center, its stated mission is to change the way the world learns, not only for those in San Francisco, but to an online, global audience as well.

The Exploratorium is a private museum funded by federal agencies, philanthropic foundations, membership fees, donations, and admission fees. In part an interactive learning environment and a science museum, the Exploratorium engages learners of all ages.

One of the first museums to establish an online presence, the Exploratorium has been connected to the Internet since 1993. Staff members have been dedicated to building the online environment, translating various learning and educational resources into online resources, and developing resources designed specifically for the web. The Exploratorium's popular and highly trafficked website, [www.exploratorium.edu](http://www.exploratorium.edu), has more than 11 million visits annually and enables the museum to reach a broad, worldwide audience.

### SOLUTION

Since 2005, the Exploratorium has been connected to CENIC's high-speed CalREN network, thanks to a National Science Foundation grant with which the museum installed last-mile fiber. Having spent 44 years in the Palace of Fine Arts, in April 2013 the Exploratorium changed locations and set up shop at Pier 15 on the waterfront along San Francisco's historic Embarcadero. The new facility is located within a few feet of an endpoint in San Francisco's fiber ring, which made Internet connectivity simple and inexpensive.

The Exploratorium's IT infrastructure can be described as a hybrid infrastructure in that it has a connection to the high-speed CalREN network, but it also has a secondary commercial Internet service provider, which is used for virtual private cloud services, web publishing, and co-location.

### RESULTS

The Exploratorium's connection to CalREN enables the museum to provide a wide variety of fascinating exhibits and programs. According to Rob Rothfarb, project director in the Exploratorium's Online Media Group, "Some projects are enhanced by CalREN, but others absolutely require this high-speed connection."

One project which takes advantage of the connection to CalREN is Wired Pier, an initiative to capture and share data about the physical environment of San Francisco Bay. It features state-of-the-art marine, weather, and atmospheric sensors and other scientific instruments that provide observable information about the bay. The high-speed CENIC connection allows scientists and research intuitions around the world to collaborate with the Wired Pier to better understand the coastal marine environment.

The museum's Hyper-media Wall is another exhibit that relies heavily on the high-speed CalREN network. The Hyper-media Wall is composed of a wide variety of real-time data, imagery, and video streams from Exploratorium partners, including ships at sea in remote research locations. CalREN enables access to real-time HD imagery from oceangoing research vessels such as the NOAA Okeanos Explorer, Bob Ballard's Exploration Vessel Nautilus, and others.



## Example 9: California Community Colleges Statewide Online Education Initiative



### CHALLENGE

California's Community College system (CCC) was originally created in 1967 and consists of 112 community colleges organized into 72 community college districts. The largest higher education system in the world, CCC has grown steadily since its inception, peaking during the 2007-2008 school year with 2.6 million students. Subsequently, however, the economic recession and resulting financial hardships faced by higher education systems resulted in reduced class selection. Reductions in class selection, in turn, caused a significant reduction in student enrollment, which decreased to 2.1 million following the peak of the recession.

CCC has been offering online courses for more than 20 years, providing instruction to hundreds of thousands of students. Up until recently, however, there has been little coordination among the state's many community college districts regarding common online teaching platforms and related services.

### SOLUTION

As the nation eased out of the recession and recovery began, Governor Brown was advised by the state's business community that the state needed a substantial increase in the pool of potential employees with bachelor's degrees in order to grow businesses and thereby grow the state's economy. The Governor and his staff worked with the leadership of Foothill-De Anza Community College and Butte College Districts and together they came up with the statewide Online Education Initiative.

The primary goal of the Online Education Initiative is to increase the number of students who earn two-year Associate Degrees for Transfer and then transfer to four-year institutions and obtain bachelor's degrees. The Associate Degree for Transfer is a very specific degree format, which when obtained, guarantees that the student's community college credits will receive full credit at California's four-year colleges and universities.

Once in place, the Online Education Initiative will enable students attending any local community college to shop from a large selection of online classes offered by the Online Education Initiative and populate their schedules

with the best possible classes that suit their needs based on general education requirements, major requirements, and also personal scheduling needs. Students will be provided with the tools to know how to find classes that meet their needs and be able to access them and register for classes, all from a single online portal.

### RESULTS

The Online Education Initiative is expected to enable the CCC system to leverage its size, collectively, to help contain costs, reduce redundant efforts, and provide better services to students. For example, the Online Education Initiative has an RFI in place seeking vendors who can provide a single common course management system for all 112 community colleges.

In support of Governor Brown's push for more support for online education, in 2013 the California legislature set aside \$16.9 million for the Online Education Initiative's first year and \$10 million for each of four subsequent years. Beyond the common course management system RFI described above, many other online services are currently being evaluated, including:

- Professional development for faculty certification and course design
- Support for creation of accessible instructional materials and provision of accommodations
- Online tutoring, proctoring, advising, and counseling
- Support for basic skills instruction
- Online library services
- Instructional design support
- Support for administering credit by exam or assessment of prior learning
- Student orientation to and preparation for online learning

CCC's connection to CENIC and access to CalREN is one of the most crucial drivers for success of the Online Education Initiative. Simply put, all of the services noted above have to be centrally located and then delivered online.

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Recently, Joe Moreau, vice chancellor for technology at Foothill-De Anza Community College District, emphasizes how increasingly crucial having a robust, reliable statewide IT network is for the Online Education Initiative:

*“As we really ramp up the common course management system, desktop videoconferencing, online course counseling, etc., and start supporting academic engagement strategies like group online collaboration activities, these projects are going to continue to emphasize the role of the statewide network [CalREN] in serving students in ways that have been important for a long time, but will become increasingly more important by an order of magnitude over the next five years.”*

Moreau also notes that:

*“If we don’t have that solid, robust, reliable, ubiquitous network connecting the state that students can tap into, whether at home, at work, on campus, or wherever they might be, we would really fall short of expectations. The network becomes the most critical asset in delivering on the promise of improved access to quality online instruction.”*

In addition to a robust statewide network, each community college’s local IT network must be capable of handling the entire throughput of its students and faculty. While students will be able to access instructional materials for online course from anywhere via the statewide network, support services such as a professor providing office hours via live chat, rely on the local IT infrastructure.

### CHALLENGE

Following the completion of the two-year course of study at California's Community Colleges, students commonly transfer to a four-year institution to obtain a four-year degree. During the application process, transcripts must be sent from the college a student is leaving to the college or university the student is applying to. Going back decades, a student would typically go to the community college's records office and pay for the records office to mail the transcript for the student.

Although this is a relatively simple process, with 112 community colleges serving around 2.5 million students and millions of transcripts being sent out each year, the effort was massive. Mailed items can occasionally get lost, resulting in anxious students scrambling to meet application deadlines. Mistakes can be made in entering the transcript data into the recipient school's records system. Fees charged to students for this service continued to increase. In 2007, eTranscript California was created to help alleviate some these issues.

### SOLUTION

The initial concept of eTranscript California was born out of the simple idea that the flow of student records information among California's higher education institutions should be free and that a more streamlined process would help reduce the workload involved with the transcript process. With these ideas in mind, a diverse selection of California school entities created a steering committee to work out a process for electronically sending transcripts. The coalition currently consists of admissions and records representatives and IT managers from California State University, the University of California, the California Community College System, K-12, and several private colleges.

The coalition worked closely with XAP Corporation to develop the eTranscript California system and XAP now hosts and maintains the process. Coalition institutions use CENIC's CalREN network to transfer transcripts out to XAP where the documents are stored. XAP then notifies the recipient school of the transcript. The recipient school then downloads the awaiting document. CalREN's high bandwidth helps ensure that the process flows quickly and smoothly for the schools involved.

### RESULTS

The eTranscript California program has been very successful in several important ways, including:

- **Increased speed and accuracy:** Mailing paper transcripts took time for delivery and they then had to be scanned or entered by hand, both of which introduce the possibility of errors.
- **Reduced communication churn:** Paper transcripts can get lost in the mail, forcing students to follow up with calls and emails in an effort to meet application deadlines.
- **Increased security and trust:** Since no one is handling the transcripts, mistakes and potential fraud are eliminated. In addition, fake documents available online have no way to enter the process.
- **Reduced use of paper products:** Paper transcripts typically consist of highly processed, watermarked paper stock, which is expensive and unsustainable.
- **Reduced costs to students:** With the eTranscript California system, the cost of processing a typical electronic transcript has been reduced from anywhere from \$7 to \$12 to less than fifty cents, with many institutions passing savings on to students.

While the eTranscript California system has been widely adopted throughout California, some community colleges have yet to sign on, the income derived from transcripts having become an important component of their admissions and record departments' budgets. Far from being discouraged by this, Tim Calhoon, director of the California Community College Technology Center, praises the success of the eTranscript California program and adds that "California's 112 Community Colleges trade millions of transcripts each year, and we're trying to go paperless. That's a significant effort. We're taking the long view and know we can't change it all overnight, but the infrastructure we've built makes success inevitable."

## Conclusions and Recommendations

What do these case studies teach us about how to further strengthen the education ecosystem in California through high-speed broadband?

### CONCLUSIONS:

- Education and research organizations, whether K-12, community colleges, universities, public libraries, or museums/performance halls, are a part of an education ecosystem in their communities and share common challenges in carrying out their missions.
- These organizations are often faced with budgetary constraints which impact their IT infrastructure including equipment, staff support, and bandwidth.
- The Internet can enrich education and support research, but its power is constrained by the limitations of local IT infrastructure.
- Private-public partnerships are essential to this work. Without the goodwill and cooperation of telecommunications companies, cable companies, dark fiber providers, and equipment manufacturers, a state-wide, high-speed research and education network would not be possible.
- When education and research organizations join with private sector allies, these challenges can often be overcome. By partnering and working together, institutions can increase the effectiveness of their IT infrastructure, increase bandwidth, and save money through economies of scale.
- These collaborations allow organizations to better serve their constituents with new programs, coordinated services across communities, and cost savings to reinvest in the organization and its mission.

### RECOMMENDATIONS:

- **Form a county-wide or regional consortium** of research and education institutions to build and manage a local, last-mile broadband network, using existing fiber where possible. This can result in significant cost savings and serve as a platform for collaboration.
- **Link this county-wide or regional network** to a statewide high-speed broadband network that has partnerships with other networks around the globe, such as CalREN. This provides users in your county the ability to collaborate with individuals and organizations around the world on a private, high-speed network.
- **Use these networks to access experts and resources** anywhere in the world to inform and enrich educational programs. In a real sense, the world can come to the classroom. When documented and shared, these uses can inspire others.
- **Identify other organizations with a common mission** who are a part of your broadband network. What challenges do you share and what joint action to respond to these challenges does broadband make possible? How might you use the network as a platform for collaboration?
- **Consider how potential collaborations supported by high-speed broadband could allow your organization or community to share existing human and material resources** in common, resulting in cost efficiencies and greater access.
- **Identify key community goals and take joint action toward achieving these goals, using the network to enable and empower the local community.** When all education sectors in Imperial County wanted to create a "college-going culture," the network was an invaluable tool. Working together using high-speed broadband networks as a platform, these educators opened up pathways to higher education and made student transitions from one educational institution to another more seamless and successful.

## Appendix A: Acronyms

<b>AP</b> Advanced Placement	<b>IP</b> Internet Protocol
<b>BESTNet</b> Broadband Education Services Technology Network	<b>ISP</b> Internet Service Provider
<b>BYOD</b> Bring Your Own Device	<b>IT</b> Information Technology
<b>CCC</b> California Community Colleges	<b>NOAA</b> National Oceanic and Atmospheric Administration
<b>CENIC</b> Corporation for Education Network Initiatives in California	<b>PLS</b> Peninsula Library System
<b>CEO</b> Chief Executive Officer	<b>PTA</b> Parent Teacher Organization
<b>CFE</b> Certified Facility Executive	<b>RFI</b> Request for Information
<b>CIO</b> Chief Information Officer	<b>RFP</b> Request for Proposal
<b>CSU</b> California State University	<b>SAPEP</b> Student Academic Preparation and Educational Partnerships
<b>CSUS</b> CSU Sacramento	<b>SDSU</b> San Diego State University
<b>CTO</b> Chief Technology Officer	<b>SECC</b> Sacramento Educational Cable Consortium
<b>CUSD</b> Clovis Unified School District	<b>UC</b> University of California
<b>FCOE</b> Fresno County Office of Education	<b>VCOE</b> Ventura County Office of Education
<b>FERPA</b> Federal Educational Rights and Privacy Act	<b>VoIP</b> Voice over Internet Protocol
<b>HD</b> High Definition	<b>WAN</b> Wide Area Network
<b>ICOE</b> Imperial County Office of Education	<b>XAP</b> XAP Corporation
<b>ICPHE</b> Imperial County Partnership for Higher Education	



## Appendix B: Resources and Contact Information

### CENIC

[www.cenic.org](http://www.cenic.org) or by email [info@cenic.org](mailto:info@cenic.org)

### Cisco

[www.cisco.com](http://www.cisco.com)

[www.cisco.com/web/strategy/education/index.html](http://www.cisco.com/web/strategy/education/index.html)

### Imperial County Office of Education

[www.icoe.org](http://www.icoe.org)

### Scout from University of California

[www.ucscout.org](http://www.ucscout.org)

### Ventura County Office of Education

[www.vcoe.org](http://www.vcoe.org)

### SFJAZZ

[www.sfjazz.org](http://www.sfjazz.org)

### Peninsula Library System

[www.plsinfo.org](http://www.plsinfo.org)

### Clovis Unified School District

[www.cusd.com](http://www.cusd.com)

### SECC

Sacramento Educational Cable Consortium

[www.secctv.org/](http://www.secctv.org/)

### YouTube

[www.youtube.com/user/SECCEducationalTV](http://www.youtube.com/user/SECCEducationalTV)

### Facebook

[www.facebook.com/SECCEducationalTV](http://www.facebook.com/SECCEducationalTV)

### Twitter

<https://twitter.com/secctv>

### Exploratorium

[www.exploratorium.edu/](http://www.exploratorium.edu/)

### CCC's Statewide Online Education Initiative

<http://ccconlineed.org/>

### eTranscript California

[www.etranscriptca.org](http://www.etranscriptca.org)

