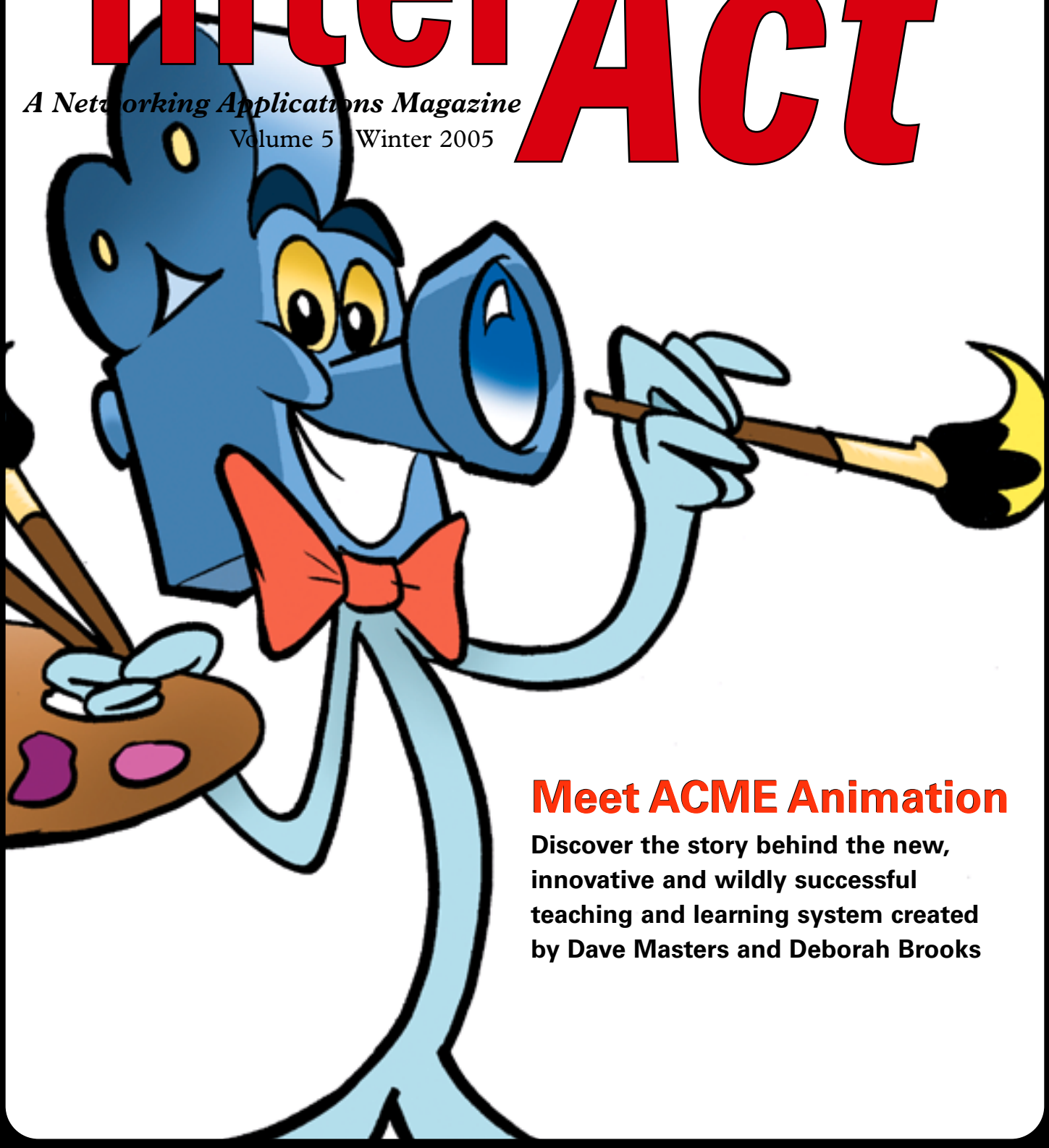
InterAct

A Networking Applications Magazine
Volume 5 Winter 2005



Meet ACME Animation

Discover the story behind the new, innovative and wildly successful teaching and learning system created by Dave Masters and Deborah Brooks

Cyber Defense Technology • OptIPuter Progress • Revolutionary Online Professional Development
Innovative Data Management Storage Solutions • 2004 On the Road to a Gigabit Winners

Table of Contents

InterAct: A Networking Applications Magazine • Volume 5 • Winter 2005

On the Cover Designed by John Ramirez, "Cammie" is ACME Animation's logo and creative mascot. See Cammie in other poses on the ACME Web site, www.acmeanimation.org.

cenic

Leading the Way to Tomorrow's Internet

InterAct is published annually by the Corporation for Education Network Initiatives in California (CENIC). CENIC is a not-for-profit corporation serving the 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.

CalREN, CENIC's advanced network, is available for qualified public- and private-sector institutions for research and learning purposes.

The California K–12 High-Speed Network creates cohesive and seamless advanced network services interconnecting K–12 schools and institutions of higher education in California.

For additional information about CENIC, see ***www.cenic.org.***

Every month, CENIC generates a wide variety of documents designed to spread the word about the latest developments in advanced network services technology. To subscribe, visit the CENIC Web site at ***www.cenic.org/pubs/index.htm.***

To receive future issues of InterAct *and similar hard-copy publications, contact* ***editor@cenic.org*** *and request to be added to CENIC's hard-copy mailing list.*

DEAR FRIENDS AND COLLEAGUES

This issue of *InterAct* reflects the maturity of CENIC via the myriad projects catalyzed by access to CENIC's network, CalREN. In addition to research and education applications, the magazine features the winners of the 2004 CENIC On the Road to a Gigabit Awards—a program honoring California visionaries who apply network technology in innovative ways and who thereby encourage the development and implementation of a ubiquitous gigabit to every home, school and business in California by 2010. The awards were sponsored in part by Cal-IT^2.

These stories show the power and the promise of CENIC and its high-performance network, CalREN. Academia in California has access to the nation's leading research and education network—offering connections to the commercial Internet, as well as unparalleled access to experimental, research and education-focused connections. Plus, by buying its own fiber and optical equipment and extending connectivity to every county in the State, CENIC has successfully encouraged local and regional collaborations throughout the education community.

CENIC's network provides a strategic advantage for educators and researchers throughout California by providing a path for cooperation among higher education institutions, K–12 institutions and research laboratories both in California and throughout the nation. From the researcher inventing new and better ways to use the Internet to the kindergartner learning how to use a mouse, CENIC's network is the catalyst—invoking new ways of thinking and defining how the commercial Internet will grow.

What's more, the stories within this issue of *InterAct* illustrate how CENIC values its partnerships with industry—partnerships critical to the success of research and education in California. By providing a goal and a purpose, CENIC has enabled solid public-private partnerships with cities, industry and academia.

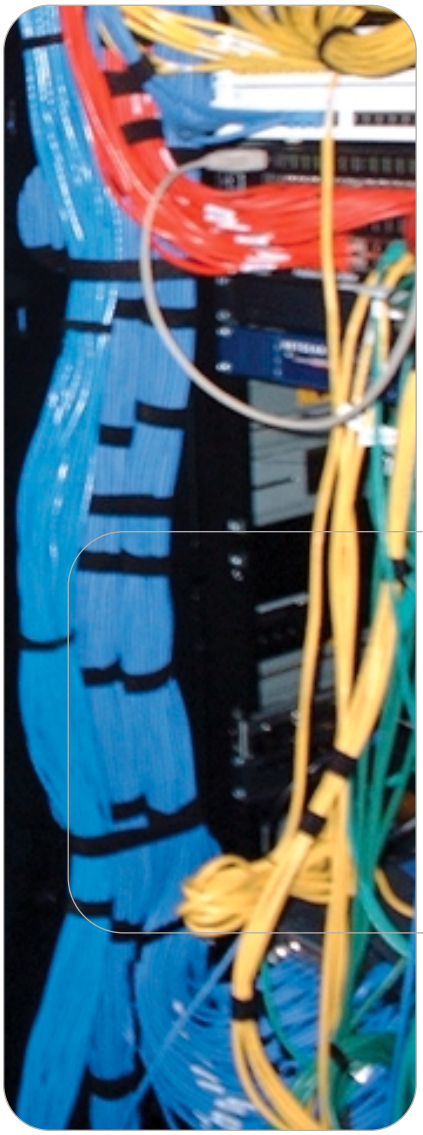
True to our slogan, CENIC is leading the way to tomorrow's Internet.

Jim Dolgonas
President, CENIC

Cyber Defense Technology

Experimental Research and Evaluation Methods for Internet Security

Almost everyone believes that in the future, high-bandwidth networks, like CENIC's CalREN, will be lifelines of commerce, communication and entertainment, as well as of research and education. But as these uses grow, so does the vulnerability of the economy they are part of to catastrophic damage from malicious code, denial of service and other attacks.



An effort to develop new tools to prevent this has begun, centered at two CENIC institutional members and funded by the National Science Foundation (NSF) and the U.S. Department of Homeland Security Advanced Research Projects Agency.

Researchers at the University of Southern California's Information Sciences Institute (USC–ISI) have partnered with researchers at the University of California, Berkeley (UC Berkeley) in the project, called the Cyber Defense Technology Experimental Research network, or DETER.

> "To make rapid advances in defending against attacks, the state of the art in evaluation of network security mechanisms must be improved."
>
> Terry Benzel
> DETER coprincipal investigator

"To make rapid advances in defending against attacks, the state-of-the-art in evaluation of network security mechanisms must be improved," says USC's Terry Benzel, a nationally recognized expert on cyber security and a DETER coprincipal investigator. "This will require the emergence of large-scale security test beds coupled with new frameworks and standards for testing and benchmarking that make those test beds truly useful."

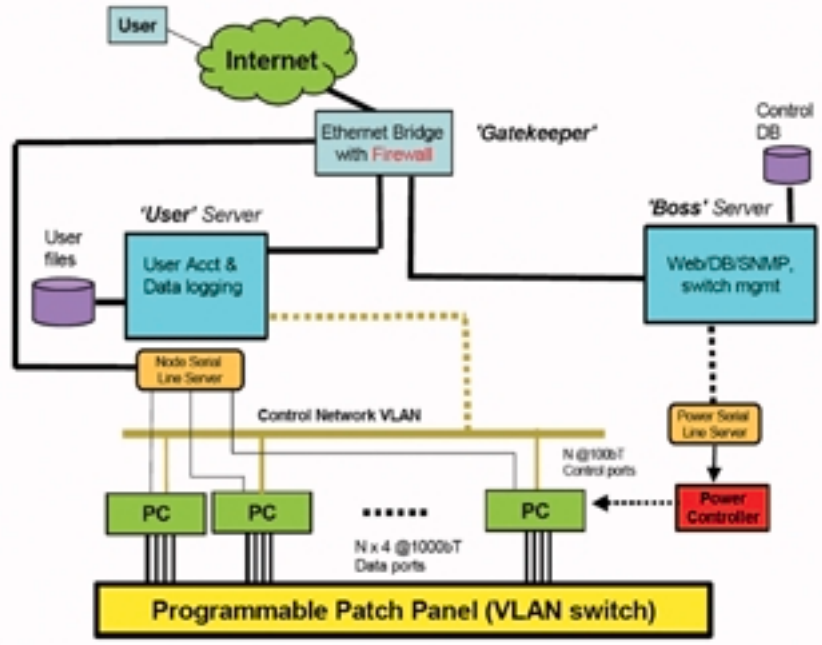
"One of the challenges of creating effective defense programs for attacks from viruses and worms is that they are only tested in moderate-sized private research facilities or through computer simulations that are not representative of the way the Internet works in reality," says Shankar Sastry, UC Berkeley professor and chair of electrical engineering and computer sciences and principal investigator of the project.

To be useful, a testbed network must provide sufficient topological complexity to emulate a scaled-down but functionally accurate representation of the hierarchical structure of the actual Internet. It must also approximate the mixing of benign traffic and attack traffic that occurs with components capable of achieving high bandwidth.

Initially, the DETER network will be homogenous. It will use approximately 1,000 PCs, each with multiple network interface cards, linked by commercial routers and programmable switches. The initial deployment at USC–ISI will be based at the University of Utah's Emulab and extended with containment and security test methodology support. In a second phase, carefully chosen, more heterogeneous hardware and software will be added.

Researchers will use this network to stage attacks and defenses. They'll record and analyze their progress in detail in the hopes of developing a

To be useful, a testbed network must provide sufficient topological complexity to emulate a scaled-down but functionally accurate representation of the hierarchical structure of the actual Internet.



deeper understanding of exactly what constitutes an effective unified defense strategy capable of withstanding a variety of attacks.

Initial focus areas will include denial-of-service, worms and attacks on the Internet's routing infrastructure, and attacks that are coordinated combinations of these three types.

In addition, the project will closely monitor new Internet security breaches, specifically attacks targeting network infrastructure, server end-systems and critical end-user applications.

In a parallel project, also funded by NSF and the U.S. Department of Homeland Security Advanced Research Projects Agency, the Evaluation Methods for Internet Security Technology (EMIST) project will develop scientifically rigorous testing frameworks and methodologies for representative classes of network attacks and defense mechanisms. The projects are working closely together to advance our nation's knowledge of state-of-the-art in information security testing and analysis.

"Our results will provide new scientific knowledge enabling the development of solutions to cyber security problems of national importance."

Terry Benzel
DETER coprincipal investigator

"Our results will provide new scientific knowledge enabling the development of solutions to cyber security problems of national importance," says Benzel.

Nine teams are involved in the combined projects of DETER and EMIST. Besides UC Berkeley and USC–ISI, they include UC Davis, Pennsylvania State University, NAI Laboratories, International Computer Science Institute, Purdue, SPARTA Inc., and SRI International. The project also includes an industrial advisory board consisting of equipment vendors, carriers and Internet service providers including America Online, Cisco Systems, Alcatel, Hewlett-Packard, IBM, Intel, Juniper and Los Nettos.

Contributed by Terry V. Benzel of the University of Southern California's Information Sciences Institute. Photos courtesy of University of Southern California's Information Sciences Institute. ●

ACME Animation Links Students with Motion Picture Executives

Seven years ago, Dave Master, an internationally recognized educator (most recently of Cal Poly Pomona) with more than 25 years of teaching experience in middle schools, high schools, universities and industry, joined forces with Deborah Brooks, a determined woman with extensive experience in teaching, business and nonprofit leadership, to create ACME Animation.

ACME Animation is a Web-based system for connecting teachers, students and mentors in the digital media arena. It's a boon to those just starting out and a virtual talent pool for industry giants. Any way you look at it, ACME's game plan has scored points for all involved.

First, ACME developed "challenges" or problems similar to those that students would find in the digital animation world. ACME then recruited the field's leading teachers and created a video-teleconferenced community comprising three California state universities, one community college in Alabama, a post-secondary occupational center in inner city Los Angeles and two high schools in California and Alabama. Communication takes place over the California K–12 High-Speed Network. Prior to their involvement with ACME, none of these schools taught animation.

Twice weekly, ACME links the classrooms to studio professionals at Disney, DreamWorks, Warner Bros., and several smaller studios. Working experts in the highly competitive field of digital animation critique student work—animations, storyboards and layouts—and provide invaluable feedback students can use to bolster their portfolios and demo reels. The most advanced students are challenged with studio-level apprentice assignments. Teachers, after-school coordinators and staff from community arts centers select from a growing list of challenges for their students. They use ACME to exhibit and discuss work within their own class or to the entire ACME community. Teachers and students adapt the ACME resource to their particular needs. History, language arts and math teachers and students also use ACME as a "reality check" for their visualizations of concepts and to process stories and events in these subjects.

The program has seen some truly outstanding results:

- Acme boasts more than 400 career placements, including 100 percent placement in one member school.
- At several studios, ACME students were the first new hires to bypass the entry-level internship process.
- The college matriculation rate of ACME high school participants has reached 91 percent.
- ACME students regularly win national and international animation festivals.
- The art department of each ACME school has strengthened, added drawing and painting classes.
- Many students have indicated that they chose to enroll in a college because of its ACME participation.
- The college programs have developed extensive connecting activities with local high schools around art and animation.

The success and efficient design of ACME Animation has attracted significant interest for its applicability beyond animation and the visual arts. So much so that Master and Brooks are presently working on SciPi—a project that focuses on science, mathematics and engineering using a botany theme. As Master notes, "This model can be applied to any career area. It's ROP [regional occupational centers] on adrenaline!"

For more information on ACME Animation, see www.acmeanimation.org.

Contributed by Stephanie Couch, director of statewide initiatives, CENIC. ●

The success and efficient design of ACME Animation has attracted significant interest... Master and Brooks are presently working on SciPi—a project that focuses on science, mathematics and engineering using a botany theme.

Image from an animation by Bruce Kuei, character animator at Omation Studios, San Clemente, CA, and participant of ACME's 2003/2004 On-Air Virtual Apprenticeship program.

OptIPuter Meeting Discusses Year 1 Progress & Plans for Year 2

DURING A THREE-DAY MEETING HELD IN 2004, SOME 70 participants from Europe, the United States and Japan met to discuss OptIPuter's first year of progress and update work plans, timelines and deliverables to the National Science Foundation (NSF) for the second year.

Cal-(IT)^2 director and OptIPuter principal investigator Larry Smarr opened the meeting by defining OptIPuter as a "revolutionary LambdaGrid architecture to support data-intensive e-Science." He discussed the goal of the project: to design a scalable system based on mass-market, open-source, commodity parts that can be easily installed and customized to any lab; and introduced group leaders of the project's four working groups, who provided a summary of progress to date.

IP-over-Lambda Connectivity

Led by Tom DeFanti, University of Illinois at Chicago; and Phil Papadopoulos, San Diego Supercomputer Center (SDSC). The IP-over-lambda connectivity work includes experimentation with multiple layer alternatives, uses of intelligent routers and passive switches, and control plane software for inter- and intra-domains. In partnership with National LambdaRail (NLR), OptIPuter became national as of October 2004 with a 10-gigabit ethernet connection between San Diego and Chicago. OptIPuter has already gone international via a trans-Atlantic OC–192 connection using Starlight from Chicago to Amsterdam. Discussions are also underway to link UCSD with NASA–Ames to provide a 400-mile link between the sites' Chiaro Networks' Enstara routers.

Open-Source Lambda Middleware

Led by Andrew Chien, UCSD. With respect to the middleware, the project involves a LambdaGrid control plane paradigm shift. Traditional provider services have been based on invisible, static resources and centralized resource management. The OptIPuter project is exploring a new paradigm based on distributed devices, dynamic services and visible and accessible resources integrated as required—and on demand—by the applications.

In the words of Chien, the middleware group is developing a unified vision of an applications interface to middleware, innovative protocols to drive high-speed optical networks and performance models for applications. Their work is based on the idea of a distributed virtual computer, a simple computing environment to support applications that leverage rich grid resources and optical networks that can be formed on demand.

Visualization, Collaborative Environments and Data Retrieval/Mining

Led by Jason Leigh, University of Illinois at Chicago. Visualization has focused on large digital montages, volume visualization on tiled displays, photonic multicasting (using photonic switches and dedicated lambdas) and development of the Scalable Adaptive Graphics Environment for high-resolution, room-sized display walls. The visualization team welcomes new members Donna Cox and Bob Patterson from UIUC/NCSA and a new driving application provided by the U.S. Geological Survey, which is mapping 133 of the largest United States cities at one foot resolution, from which it will produce a series of 10-billion-pixel images. The visualization working group will use Year 2 for full-scale visualization and collaboration trials to identify bottlenecks and usability issues with software developed in Year 1.

Large Data Objects Provided by Two Applications Areas: Neuroscience and Earth Science, and Education

Led by Mark Ellisman, UCSD; John Orcutt, Scripps Institution of Oceanography; and Rozeanne Steckler, SDSC. OptIPuter development will be driven by "decadal federal e-Science," including NSF's Earthscope and Ocean Research Interactive Observatory Networks projects and NIH's Biomedical Informatics Research Network.

With respect to education, the first year has been spent socializing teachers with the capabilities and potential uses of the Geowall installed at the Preuss School UCSD, development of curricular materials that meet both state and national standards and development of the RoomQuake project, which simulates earthquakes using PDAs as simulated seismometers.

By the end of the meeting, all group leaders had refined their sections of the OptIPuter program plan for project manager Maxine Brown to submit to the NSF. Smarr concluded the meeting by reminding attendees that a key opportunity to demonstrate OptIPuter accomplishments will come in September 2005 at the iGRID meeting, hosted by Cal-(IT)^2 in the new building at UCSD. ●

California Postsecondary Education Commission Revolutionizes Online Professional Development

Late in the summer of 2003, the California Postsecondary Education Commission (CPEC) issued a request for proposals to create professional development pilot projects that examined effective ways of supporting teaching and learning. Such grant opportunities are not unique, but CPEC's approach was.

By specifically referencing the California K–12 High-Speed Network, (formerly the Digital California Project) and its desire for proposals that addressed the use of technology in professional development programs, CPEC became the first state agency to recognize the promise of education's networked future.

In January, 2004, each of CPEC's Improving Teacher Quality Grant recipients were brought together to review their proposals. Among other things, the proposals provided a brief summary of their projects, the schools or districts being served, and the project goals and anticipated outcomes. Six of the CPEC grant recipients will utilize technology and the California K–12 High-Speed Network as an integral part of their professional development programs.

California State University, Fullerton and the Orange County Department of Education

CSU Fullerton's departments of education and mathematics, the Orange County Department of Education and a variety of other educational entities throughout California will develop and offer online professional development opportunities to middle-school mathematics teachers. A vast collection of resources—including video clips, an online instructor (who'll use the clips within an online collaboration tool), videoconferencing and Webcasting—will be aggregated in a central location for participating teachers.

California State University, Chico

Debra Barger, dean of regional and continuing education at CSU Chico, will develop online modules that support the five teacher induction standards established by the Beginning Teacher Support and Assessment (BTSA) program. The project will include a Web portal and resources to support an online professional development community of 4,000 BTSA participants and veteran teachers.

California State Polytechnic University, Pomona

Laurie Riggs, assistant professor in the mathematics department at Cal Poly Pomona, will focus on the recruitment of high school, community college and change of career adults into math and science teaching. Through the use of an online professional development program, Riggs and her team will also address the needs of current teachers who need to become fully credentialed in math and science. Other key partners include Cal Poly Pomona's College of Education, College of Science and four school districts.

Pitzer College, Claremont, California

Joan Benton, site director of Claremont International Studies Education Project, will work with three high schools in the Los Angeles Unified School District and the Claremont graduate school on how technology can support the teaching of history and social science in urban high schools. Students will participate in a model United Nations, negotiating both online and in-person. Work with teachers will address equal access to instruction and exemplary teaching. To help ameliorate time constraints, teachers will also receive support via video coaching.

California State University, San Bernardino

Jan Werner of CSU San Bernardino's Palm Desert Campus will work with teachers in the Coachella Valley Unified School District as part of a partnership with the K–12 Alliance and WestEd to:

- Help existing teachers meet the definition of *highly qualified teacher* under the No Child Left Behind Act.
- Create a pipeline of teachers from Coachella high schools to community colleges and CSU San Bernardino.
- Establish learning communities for participants via the Internet (i.e. California K–12 High-Speed Network).

University of California, Davis and the Orange County Department of Education

The UC Davis School of Education and the Orange County Department of

continued on page 20

Poway Unified School District Pursues Innovative Data Management Storage Solutions

The total cost of the No Child Left Behind (NCLB) Act is greater than first presented. The challenges associated with student assessment and "highly qualified" staff with teachers and paraprofessionals are well documented. Several other issues associated with the implementation of NCLB are equally challenging, but have not received a great deal of attention: data storage and transfer, parent access to data and the security necessary to protect that data.

As the data demands of student assessment grow, so grows the need for fast reliable storage. In the Poway Unified School District (PUSD), near San Diego, California, storage area network (SAN) technology has been introduced as the solution for data storage and to assist in data backup. Poway is working with a SAN provider, XIOTech, to create a SAN solution at each of the district's high schools and the district administration center. The PUSD staff has already connected the SAN at each site via the district's wide area network (WAN), thus making each site a back-up site for the others.

Student data must always be secure and be transferred only to appropriate parties as part of improving students' learning environments. Presently, there are several products available to electronically send high school transcripts to a student's chosen college. The student or their high school registrar can select the college of choice, access the transcriptions and send data in a matter of seconds. The college receives the transcriptions, sends a confirmation receipt and what once took weeks now takes minutes. NCLB demands parent accessibility to appropriate student and

Charlie Garten, executive director, Information Support Services, Poway Unified School District

school information. This can easily be accomplished via portal technology. A number of companies, including Blackboard.com and Microsoft, possess technologies that allow a parent or caregiver to log in and obtain the requested information. The most challenging aspect of the technology is security for the sensitive data being sent to the user.

Security is gradually becoming the number one nightmare for chief information officers. The new assessment data being generated and sent to parents—because of NCLB—must be protected and, at the same time, presented to a wide audience. This is a greater issue than spam, viruses, hackers or wireless intruders who intercept private data. It goes to the heart of protecting students and parents from embarrassment, from people intending to cause harm and from identity theft. It's a task that starts with a security audit and never ends.

Security is gradually becoming the number one nightmare for chief information officers. The new assessment data being generated and sent to parents—because of NCLB—must be protected and, at the same time, presented to a wide audience.

Addressing these NCLB issues has been difficult. However, the fast, well-running WAN made possible by last-mile funding from the California K–12 High-Speed Network (formerly known as Digital California Project), enabled the Poway Unified School District to successfully build and sustain our WAN to support all these activities.

Contributed by Charlie Garten, executive director, Information Support Services, Poway Unified School District. ●

On-Demand Infrastructure

A Basis for High-Performance Grid Computing

As computers become faster and cheaper, scientists are challenged to tackle larger problems requiring larger amounts of storage for input and output data. In order to collaborate, scientists at geographically distant locations need access to the same data. To accomplish this, they keep copies of important data at their respective locations and manually copy large datasets across sites.

Using on-demand parallel file access over a computing grid, the San Diego Supercomputer Center and IBM have demonstrated a way to share data over a wide area without copying it from one site to another (Figure 1). With the right network infrastructure, this technology can help schools and other state institutions share information as needed without incurring the cost of purchasing and maintaining local data repositories.

Increasingly, computational scientists compute, visualize, mine and store data at diverse sites. To better accommodate these scientists, various sites are joining together their unique resources in order to create a fully functional end-to-end scientific computation and visualization research environment. This new environment forms the framework for grid computing. The ability to share data efficiently and effectively across sites is crucial to improving the usability of grids. It should be possible to run jobs anywhere without manually shipping data to the chosen site. To achieve this, data access should be ubiquitous and accompanied by high transfer rates.

High-performance computing applications normally access data through a parallel file system. Such file systems allow all nodes involved in a computation to access data in parallel at high speed. Normally, parallel file systems function within a single site; making datasets from one parallel file system available to a remote system over a grid makes additional geographically distributed resources available to computational scientists. The remote systems do not need to own or manage large amounts of storage—they merely read and write to and from the parallel file systems over the wide area as if they were local.

We demonstrated this capability using IBM's General Parallel File System (GPFS). At the Supercomputing 2003 conference, we mounted an 80 terabyte GPFS file system located on disks and computers in San Diego to 40 computers located at the conference site in Phoenix. On the computers at the conference site, the GPFS file system appeared as though it was located on local disks in Phoenix (Figure 2).

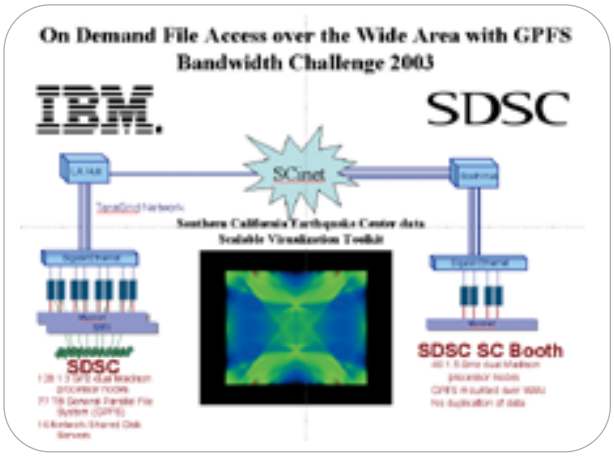


Figure 2.

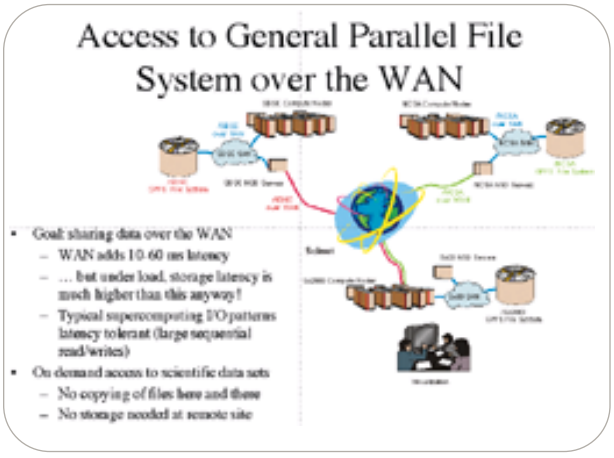


Figure 1.

In real-time, a visualization application running on the computers at the conference site read and rendered a simulation of an earthquake using datasets from the Southern California Earthquake Center (Figure 3). On a 10 gbps link, the application sustained bandwidth of over 1 gbps during our entire 90 minute entry for the Supercomputing 2003 SCinet Bandwidth Challenge. GPFS made steady use of approximately

90 percent of the available bandwidth with the only bandwidth dip due to the visualization application having fully rendered and visualized the entire dataset more quickly than originally anticipated. After restarting the visualization application, the application again achieved solid, sustained bandwidth (Figure 4).

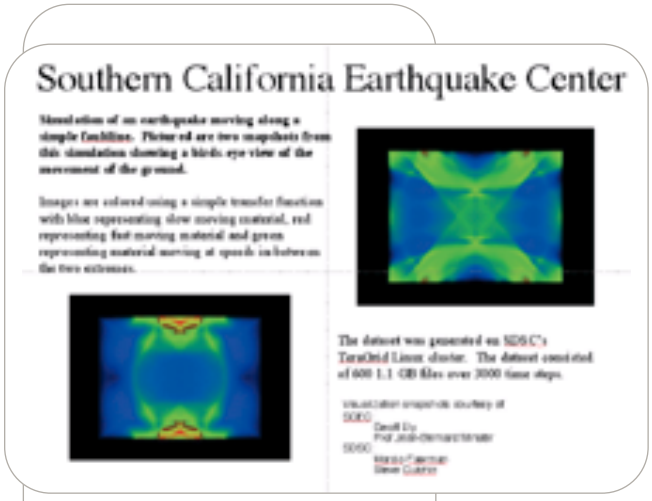


Figure 3.

The technology we have demonstrated can be applied to other resources and users throughout the state of California. Other state-wide datasets could be shared between state agencies and the public. This technology allows a variety of institutions equal—and easy—access to data, thereby efficiently leveraging California's scarce resources.

The reason that GPFS could make parallel file access over the wide-area network (WAN) look as if it were local is threefold. First, GPFS uses an aggressive prefetch and write-behind strategy that effectively masks the WAN latency for sequential I/O typical of many high-performance networking codes. Second, even for less sequential workloads (e.g., commands for listing a directory in the file system), the latency of a storage controller under normal load is often much higher than that of the WAN connection (12 milliseconds between San Diego and Phoenix), so the delay added by the WAN is not significant. Third, the network connectivity was of a nature that few if any packets were lost and the high number of TCP connections (each node had a separate connection to each storage server) minimized the TCP window size necessary to achieve the observed data rate—the effect of lost packets was minimal.

This on-demand file access saves time because files don't need to be copied multiple times to multiple sites in order to use each resource. Often the computation uses only a relatively small part of a very large dataset. On-demand file access allows the computation to dynamically access only the data it needs without copying entire datasets from the storage site to the computation site and back. In addition to time being saved, money is saved as well, by not duplicating remote storage resources locally.

The simple sharing of files between sites allows for "roaming" between sites; scientists can expect the same environment no matter where they compute. Multiple geographically distributed resources can be harnessed at the same time using the same programs and datasets. Scientists also needn't learn new commands or paradigms to make use of the computational resources.

The technology we have demonstrated can be applied to other resources and users throughout the state of California. For instance, datasets from the Southern California Earthquake Center and other scientific datasets, such as sky surveys, could be made available for real-time research and visualization in schools. Other state-wide datasets could be shared between state agencies and the public. Books could be instantly searched without being downloaded. In short, this technology allows a variety of institutions equal—and easy—access to data, efficiently leveraging California's scarce resources.

To support the sharing and transparent transferring of multiterabyte and petabyte datasets, a significant network infrastructure is critical. Increasingly, new datasets from diverse fields—such as medical science, astronomy and bioinformatics—are being available to schools and interested researchers. The only way these schools and research institutions can access and share this data is over a network. And a high-capacity network is the only pathway wide enough to make this new knowledge base a reality.

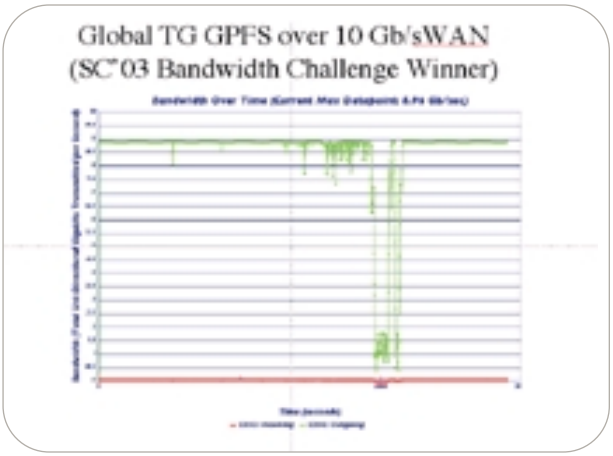


Figure 4.

Team Members Phil Andrews and Patricia Kovatch, San Diego Supercomputer Center; Roger Haskin, IBM Research. ●

LACOE's Education Technologies Network Connects Students, Staff, Administration... and the First Lady

The Los Angeles County Office of Education (LACOE) is responsible for 1.7 million public school students and provides support to teachers, administrators, parents, schools and the county's 81 school districts. The Educational Technologies Network (ETN) is the multimedia production division within LACOE. No long ago, ETN staff had an idea: introduce an interactive video system to connect schools to each other and connect districts to LACOE.

ETN asked the California K–12 High-Speed Network to provide a high-speed digital pathway between LACOE and many of the school districts. The challenge was to develop a communications solution that could traverse the existing network and provide both one-way streaming and two-way interactive video at a reasonable cost.

ETN staff designed a pilot project—an interactive staff development session to showcase high-quality video and audio communications over the new network. For this project, Pomona and Hacienda La Puente school districts and the California State Polytechnic University, Pomona used MPEG–2 encoders/decoders and a VBRICK 5300 dual decoder technologies.

Utilizing three production centers (LACOE, Hacienda La Puente and Pomona Unified), with each using multiple cameras tied to a production video switcher, sites were able to communicate two-way using MPEG–2 broadcast-quality video. The video was mixed by ETN staff at the central control center and pushed out to school districts and other local education authorities throughout the state using MPEG–4 and Real Networks proprietary formats at a rate of approximately 250 kbps. The video stream performance to the end user was well received and the MPEG–2 two-way feeds amounted to an impressive 50 mbps of content moving across the California K–12 High-Speed Net-work.

> The applications have become more familiar due in part to the initial efforts put forth with CENIC/DCP staff and other stakeholders, who saw the wisdom in utilizing the power of the DCP to move high-bandwidth video throughout California's schools and County Offices of Education.

LACOE's success with the staff development pilot allowed LACOE to move forward with the Governor's office in support of a Mentoring Conference hosted by First Lady Davis in October of 2002. This event was coordinated similarly to the staff development pilot, but involved thousands of conference attendees located at three broadcast venues throughout California. Participants of the conference were later polled. Results revealed that 95 percent agreed or strongly agreed that they were able to attend the conference due to the convenience of online participation.

LACOE's ETN division continues to utilize the California K–12 High-Speed Network in support of IP videoconferencing and various other video streaming applications. The applications have become more familiar, due in part to the initial efforts put forth with CENIC staff and other stakeholders, who saw the wisdom in utilizing the power of CalREN to move high-bandwidth video throughout California's schools and County Offices of Education.

Contributed by Richard Quinones. ●

The Teaching and Learning Interchange

Assisting California's Teachers through Online, Video-Based Professional Development

THE TEACHING AND LEARNING INTERCHANGE (TLI) represents a unique collaboration between University of San Francisco, the California County Superintendents Education Services Association, 58 county offices, 6 universities and 20 other partners invested in improving teacher preparation.

TLI members researched text- and video-based case studies, then developed a new set of comprehensive and innovative video case studies to be used as professional development tools for uncredentialed and alternatively certified teachers. Their efforts paid off. In a recent review mandated by the U.S. Department of Education, two outside universities recommended TLI as "the model for all projects seeking to use video case studies for teacher professional development. The TLI helps the state to recruit and retain qualified math and science teachers and benefits thousands of students to obtain an excellent math and science education."

But the TLI didn't stop there. In response to California's critical shortage of math and science teachers, they designed an online portal to address the professional development needs of uncredentialed and preservice teachers, as well as to provide support to teachers at any stage of professional development. Bridging time and space via the Internet, the portal offers two products.

- Mentoring and online test preparation courses to prepare uncredentialed teachers for state subject matter competency tests required to enter into a teacher credential program
- High-quality, online video-based teaching dilemmas or "cases" to explore teaching and learning subject matter in action

> Research has shown that the greatest and most powerful way to retain teachers is to break the isolation of the classroom and provide support from other professionals.

Why these two products? In California and across the nation, K–12 schools face the challenge of providing new teacher support services to classroom teachers of record who are alternatively certified pre-intern and intern teachers or uncredentialed and serving on emergency waivers. Pre-intern and emergency waiver teachers serve as the full-time teacher of record in classrooms, but hold the teacher credentialing designation because they have not yet proven subject matter competency and, as a result, cannot enroll in a state approved teacher credentialing program. During 2003, there were approximately 13,000 teachers serving in California's Pre-intern teaching positions, a significant drop from year 2000 figures, which exceeded 54,000 when the TLI project began. These remaining positions are concentrated primarily in the fields of math, science and special education.

The California Subject Examinations for Teachers (CSET) preparation courses help candidates to pass subject exams so they can enroll in a teacher training program. The Pedagogy in Practice video case studies allow under-prepared teachers to observe complete lessons in real California classrooms, thereby immediately supporting their day-to-day teaching. In the Pedagogy in Practice modules (produced by the San Diego County Professional Development Online Production group) teachers deconstruct their teaching practice by sharing how they break subject matter into mid-sized learning units. Their explanations are followed by videos of these learning units in action. Teacher reflections on assessment, classroom management, lesson planning and other resources provide the viewer with essential resources for reflection on his/her own practice. Online community tools and videoconferencing with a mentor allow for dialog, questioning and discussion. Modules include a transcript of the classroom dialog, downloadable standards-based

continued on page 20

Behind the Redwood Curtain

The Power of Community Activism in Broadband Deployment

In remote, rural California, where life is slow and change is a dirty word, we made lack of bandwidth an urgent community issue. Humboldt County has approximately 126,000 residents, about half of them concentrated around Humboldt Bay. The Redwood Technology Consortium (RTC) began as a handful of urban refugees banding together around the belief that technology was a viable alternative to Humboldt County's declining resource-based economy.

The Saga: 2001–2003

We're only 300 miles from San Jose, but business in this region had remained relatively unchanged for years. Few knew the value of a constant, fast Internet connection and fiber-optic lines weren't even on the radar screen. It was agony to move data through our one connection to the outside world: an at-capacity microwave link. Everyone from farmers to banks suffered, but few cared enough to get vocal about it—and nobody knew what to do.

But then the RTC spoke up, and people listened. Suddenly our fledgling group was taken seriously. Once a group known for infighting and failed projects, we now had a cause to champion.

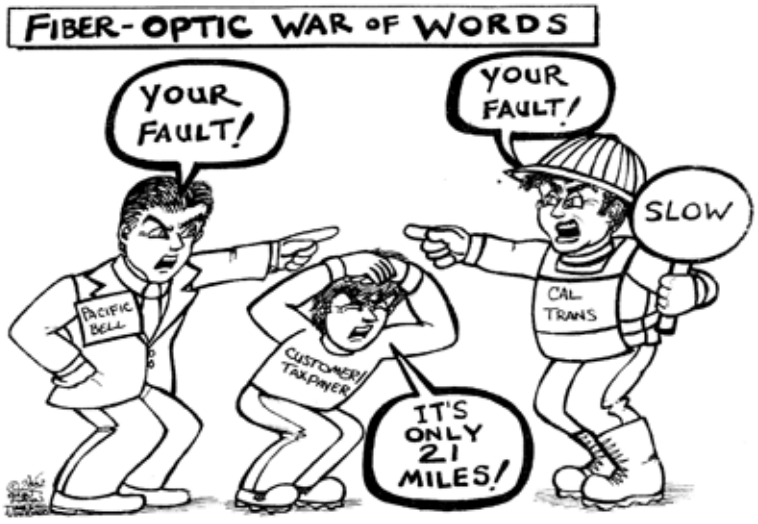
The RTC contacted the regional telephone company, SBC Communications, and quickly learned that our partially-completed fiber connection was being held hostage in right-of-way compensation issues between SBC and CalTrans, the state highway agency. CalTrans wanted millions of dollars from SBC to lay cable along "their" roads. SBC had never paid for anything before in California (other than permitting and engineering fees), and they weren't going to start paying now.

RTC tried to no avail to bring the two together. And although the local press was active, the metropolitan press gave the issue little coverage. Legislators made pleas to the governor. A bill was introduced into the state assembly. We presented reams of information to our community about the issue, gathered momentum and convinced our local Chamber of Commerce, educators and business leaders to get involved and to get vocal.

Negotiations between CalTrans and SBC continued for nearly a year. The community looked to the RTC for answers, but we were as powerless as any other small group against the Goliath organizations of SBC and CalTrans.

At one RTC meeting, someone suggested that perhaps SBC could put the money CalTrans wanted into an escrow account. The fiber project work could begin while the lawyers fought in court.

SBC and CalTrans couldn't agree on escrow terms. RTC filed a formal complaint against CalTrans with the California Public Utilities Commission (CPUC), but it was rejected. The failed complaint came to the attention of CENIC, which operates CalREN. CENIC did a study on the challenges of bringing new bandwidth to the region.



Courtesy of the Times-Standard and Karen Gordon (12/8/2002)

The study captured SBC's attention and was the motivating force we needed. Within days, SBC and CalTrans settled on escrow terms.

Construction started during the summer of 2003. This was such a big event that residents of the North Coast took "field trips" to see the fiber installed along Highway 101, a scenic area called The Avenue of the Giants. In September of 2003, the fiber connection was completed. We are now truly connected to the outside world.

Norte counties. In the past, economic growth has suffered in these counties because businesses could not purchase the advanced services required to grow and flourish in a global economy. This link now provides the basic "highway" to bring gigabit speeds to northwest California—and provides an example of grass-roots advocacy that can be used as a model for other remote, rural areas in need of better connectivity.

As an organization, the RTC is now a recognized leader in this community.

Courtesy of Times-Standard and Karen Gordon (3/2/2003)

> When the RTC started talking, everyone started listening. Suddenly this fledgling group was being taken seriously. Once a group known for infighting and failed projects, we now had a cause to champion.

In Retrospect

The SBC fiber project was the missing link for "middle-mile" connectivity from the Bay Area to Humboldt and Del

We've gained enough momentum to tackle the next obstacle: redundancy and competition. With a real connection, our schools have joined the CalREN/K–12 High-Speed Network. Prior to the project's completion, Humboldt was one of only two counties in the state that were not participating.

Today, local businesses have access to advanced telecommunications services with virtually unlimited bandwidth. The community understands that hiding behind the Redwood Curtain serves no one, that unless we embrace technology and integrate it into our economy, the world will pass us by.

In a region of extreme economic issues and even more extreme opinions, our community came together on this issue. Most now can articulate what bandwidth means to them. And everyone recognizes how important technology and telecommunications are to the support of basic business processes—and the future of our community.

The RTC saga proves that perseverance pays off. No Goliath is too large to fall when faced with an aggressive, educated and most important, active grassroots organization.

Moving Forward

Humboldt County is embarking on a project to assess its readiness to join the networked world. The plan is to use Computer Systems Policy Project (CSPP) methodology as outlined in the latest publication by CENIC's One Gigabit or Bust Intitiative, *On the Road to a Gigabit Broadband: Are We There Yet?: A Self-Assessment Guide for Communities*. The guide can be downloaded for free at www.cenic.org/guide. Outcomes are an assessment of county telecom infrastructure and usage (businesses, healthcare, government and education) and recommendations, such as telecommunications element in the county general plan, workforce development, information technology cluster development and infrastructure improvements.

The RTC is looking forward to the upcoming year of organizational development. An AmeriCorps Volunteers in Service to America volunteer has been brought on board, and the North Coast Small Business Development Center will be facilitating the effort to take the organization to the next level. You'll hear from us again!

Contributed by Tina Nerat (tnerat@cox.net), board member of the Redwood Technology Consortium (www.redwoodtech.org) and owner of NERATech, a technology consulting business. ●

Fontana Advanced Community and Educational Services

Building Community, One Connection at a Time

The city of Fontana, California, was a victim of its own success. For years, the city worked hard to overcome legacy financial problems and reputation issues. As a result, Fontana was recognized as the ninth fastest growing city in the nation. But there were still some lingering infrastructure challenges—most notably, its communications infrastructure.

In 2001, most of Fontana's 134,000 residents were unable to get either a digital subscriber line (DSL) or a cable modem. Even in new home developments, these services were unavailable. Residents, specifically those paying premium prices for new homes, were not shy about expressing their opinion to elected officials about this infrastructure shortcoming.

Officials from Fontana's Advanced Community and Educational Services (ACES) sought a solution. They researched alternatives by visiting other locations and attending seminars and conferences. Eventually, an exciting vision developed: A truly connected community touching everyone—no digital divide based on age, income or language; preventative healthcare brought home via cable TV, potentially reducing healthcare premiums; vocational and higher educational classes in the home and in real-time from the nearby major colleges and university; service choices for residential and business consumers; telecommuting opportunities for professionals, increasing family time and reducing pollution; and economic development opportunities for the city. All would be possible because instead of three mbps to every home, we would bring gigabit speeds.

The city looked to its communications incumbents, who were slow at responding. Adelphia (cable) did not complete their Powerlink build out until late 2003,

(from left to right) Fontana Mayor Mark Nuaimi, SAIC Project Manager Kirsti Spiva and Fontana City Manager Ken Hunt

providing service to approximately 70 percent of the city (geographically). As of summer 2004 SBC and Verizon still do not provide DSL to the entire city and there is a long wait list for the residential areas serviced.

Fontana considered fostering a Fiber to the Premise network. Towards that end, the city issued a Request for Proposal (RFP) for a high-level feasibility study regarding whether this was a reasonable option for a city the size of Fontana—a city without an electrical- or water-based public utility department—to undertake.

Nortel Networks Optical Systems Integrations group won the RFP. They reviewed what other communities were doing across the nation and conducted a carrier-access analysis of Fontana that helped city officials understand why the city was not receiving from telecommunications carriers the kind of infrastructure investment capital it needed to obtain competitive services.

Based on the results of that feasibility study, Fontana issued a second RFP seeking a proposal to partner with the city in building a community Fiber to the Premise network. Unlike in similar projects, the city did not assume that it would own the network. Rather, its first choice was to embark on a public-private partnership. The RFP further stated that if the option was chosen for the city to own the network, then the city would prefer to be a wholesale rather than retail carrier. The goal being to have multiple private-sector retail carriers offering choice to the community.

This model set the stage for a lively and interesting pre-bid meeting and a very closely fought and hard won RFP process. A final bid award was made to SAIC of San Diego to do a detailed Phase I, including a network design and business plan for a fiber optic network for the city. This business plan will be presented to the city council and will be voted on by the end of January 2005.

We don't know what the outcome of the vote will be. But we do know that whatever happens, we've increased the city of Fontana's visibility to our incumbents—and they know we're serious. Follow our progress at www.FontanaACES.org.

Contributed by Janice McClintock. ●

Meeting the Challenge of High-Energy Physics

How the Ultralight Consortium Is Finding Answers to the Universe's Oldest Questions

THE HIGH-ENERGY PHYSICS COMMUNITY IS CONDUCTING A new round of experiments to probe the fundamental nature of matter and space-time and to understand the composition and early history of the universe. These experiments face unprecedented engineering challenges due to the volume and complexity of their data and the need for collaboration among scientists around the world.

The massive, globally distributed datasets that will be acquired by these experiments are expected to grow to the 100-petabyte level by 2010, and will require data throughputs on the order of gigabits-per-second between sites around the globe. Although grid-based infrastructures developed by collaborations in Europe and the United States have provided massive computing and storage resources, they remain limited by their treatment of the network as an external, passive and largely unmanaged resource.

To overcome this limitation, major high-energy physics centers in the United States have formed the UltraLight consortium. The project, funded by the National Science Foundation, is based on a partnership that includes the California Institute of Technology, University of Florida, Florida International University, University of Michigan, Stanford Linear Accelerator Center, Fermi National Accelerator Laboratory, Brookhaven National Laboratory and CERN (in Geneva, the world's largest particle physics laboratory). Industrial partners recognizing the potential benefits for future network developments and commercial applications have also joined the project. Cisco's Academic Research and Technology Initiatives (ARTI) division and Level(3) are integral to the project—their participation is materialized through concrete technical and strong financial support. Specific networking resources presently being made available to UltraLight are shown in Figure 1. They include the major facilities of LHCNet[1], transcontinental 10 gbps wavelengths from National LambdaRail[2] and UCAID[3], and partnerships with StarLight[4]. Transcontinental and intercontinental wavelengths in our partner projects TransLight[5], Netherlight[6], UKlight[7], AMPATH[8] and CA*Net4[9] will be used for network experiments on a part-time or scheduled basis.

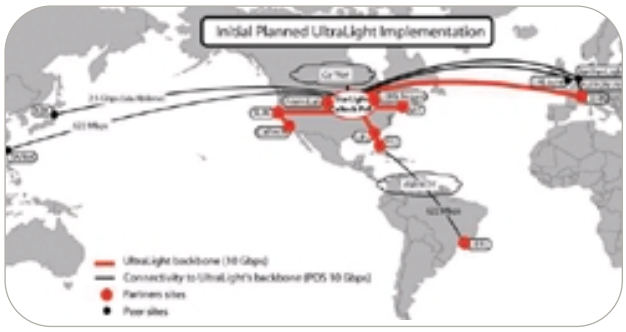


Figure 1: UltraLight Site Diagram

UltraLight will monitor, manage and optimize the use of the network in real-time using a distributed set of intelligent global services. These services will leverage grid middleware, network-aware applications and heuristic optimization algorithms to form an integrated system designed to meet the experiments' needs. The developments will be driven by and will progressively serve the needs for grid-based data analysis and production-processing. The UltraLight hybrid packet- and circuit-switched network infrastructure will employ ultrascale protocols and the dynamic building of optical paths to provide efficient fair-sharing on long-range networks up to 10 gbps. Recently, the UltraLight team used the new FAST TCP[10] algorithm to sustain a single TCP stream of 7.4 gbps over a span of two hours between Pasadena and Geneva—a distance of 11,000 kilometers (approximately 6,836 miles).

The UltraLight application-level services domain will provide interfaces and functionalities for the physics applications to effectively interact with networking, storage and computation resources as described in Figure 2. UltraLight will

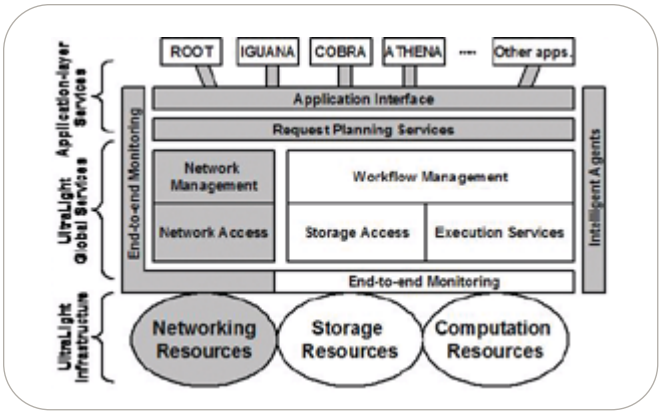


Figure 2: Context of UltraLight work. White regions represent areas which will be leveraged by UltraLight. Shaded regions represent areas that will be developed by UltraLight.

add a completely new dimension to the grid-based systems by interfacing applications to managed-networking services. It will extend the advanced planning and optimization behavior into the networking and data access layers, allowing a whole new class of advanced system behaviors and functionalities.

In addition, UltraLight plans to implement a set of global end-to-end managed services, building on the ongoing and rapidly advancing work on the Monitoring Agents in a Large Integrated Services Architecture system, or MonALISA[11]. The MonALISA system, shown in Figure 3, provides a distributed-service architecture used to collect complex monitoring information and processes it in a distributed-agent framework. The scalability of this agent-based framework is derived from the use of a multithreaded engine to host a variety of loosely coupled, self-describing dynamic services; and from the ability of each service to register itself and to be discovered and used by any other services or clients that require such information. The MonALISA system can be used to monitor and control different network devices, including photonic switches. Gathering the information collected from multiple points allows for the generatation of global views for connectivity and for the ability to spot problems and develop higher-level services for decisions. Mobile agents capable of providing optimized dynamic routing for distributed applications have recently been added to the system.

UltraLight's approach will allow applications and higher-level service layers to be made aware of advanced behaviors, as well as options available within the system, and to provide the required interfaces to grid middleware services. This enables a new class of proactive and reactive applications that can dynamically handle unexpected system behaviors, such as congestion or hardware failures, and allow for dynamic responses to changes in the system setup, such as when new network paths or modes become available. These new functions will enhance global system resilience to malfunction and allow optimization of resource usage, improving overall throughput and enabling effective implementation of policies.

A special and critical class of applications is those to be used for analysis of data from the Large Hadron Collider (LHC), the new particle accelerator being built at CERN. The Grid Analysis Environment (GAE)[12] being developed at Caltech and University of Florida will enable thousands of users to harness the full power of the grid. They'll be able to discover, analyze and collaborate on the petabytes of data generated by the LHC experiments through the use of grid portals based on grid (Web) services designed to hide much of the grid's infrastructure and resource complexity. Components of the GAE will interact with the MonALISA environment and replicate data, schedule jobs and find optimal network connections in an autonomous manner. The result will be a self-organizing grid with no single point of failure, in which thousands of users are able to get fair access to a limited set of distributed resources of the grid in a responsive manner.

continued on page 20

Figure 3: The MonALISA framework provides a distributed monitoring service system. Each MonALISA server acts as a dynamic service system and provides the functionality to be discovered and used by any other services or clients that require such information.

Parks Online Resources for Teachers and Students

Bringing Desert Bounty to a Monitor Near You

SPANNING MORE THAN 600,000 ACRES, ANZA-BORREGO Desert State Park is the largest state park in the contiguous United States. 500 miles of dirt road, 12 wilderness areas and miles of trails provide visitors with an unparalleled opportunity to experience the wonders of the desert.

The park is named after Spanish explorer Juan Bautista de Anza and the Spanish word *borrego*, or bighorn sheep. The park features washes, wildflowers, palm groves, cacti and sweeping vistas. Visitors may see roadrunner, eagles, foxes, mule deer and bighorn sheep, as well as iguanas, chuckwallas and red diamond rattlesnake.

Although the park is only a two-hour drive from San Diego and three hours from Los Angeles, much of it remains unseen by the millions who live within that short drive. The harshness of the environment and lack of paved roads keep visitation relatively low. Large numbers of schoolchildren in the urban areas close to Anza-Borrego have little awareness of the natural and cultural values of their desert neighbor.

The Department of Parks and Recreation's PORTS project (Parks Online Resources for Teachers and Students) aims to change that.

PORTS is a collaborative effort between public schools and California State Parks. By using the California K–12 High-Speed Network (formerly, the Digital California Project) PORTS is able to deliver live presentations to classrooms from parks throughout the state.

The Department of Parks and Recreation offered a powerful demonstration of the potential for its PORTS program during the George Wright Society Conference in San Diego (April 14–18, 2003). During the conference, attended by professional conservationists, participants paid a remote videoconferencing visit to the fossilized oyster beds at Fish Creek in the Anza-Borrego Desert. The conferees discussed the resources and beauty of this very isolated location with Ranger Fred Jee while sitting in a conference room in San Diego nearly 100 miles away.

> The PORTS program allows school children in urban areas and other locales to experience the grandness of state parks, often hundreds of miles from their homes, while addressing academic content standards. The inspiring backdrops of our state parks buttress the lessons of history, science, visual and performing arts, math and English.

Many parks turn away school children because facilities are full and unable to accommodate additional visitation. The Fish Creek online visit demonstrated how PORTS programs can help lessen visitor impact on park resources that are fragile or have limited carrying capacity.

California State Parks was able to undertake the remote interactive presentation using high-speed wireless connectivity provided by the High-Performance Wireless Research and Education Network (HPWREN) operated in conjunction with University of California–San Diego (UCSD) and San Diego State University. HPWREN set up a four-foot antenna on a tripod at Fish Creek, and provided a 45 mbps connection to the HPWREN backbone site on Mount Laguna (thanks to the San Diego County Sheriff's Department). From the Sheriff's facility at Mount Laguna, the wireless link was sent to the Cuyamaca mountains, to Mount Woodson and then to the San Diego Supercomputer Center at UCSD. From there, the video conference was transported via the California K–12 High-Speed Network to the San Diego County Office of Education where it was transferred by a 45 mbps wireless link to the conference hotel in San Diego's Mission Valley.

The PORTS program enables school children in urban areas and other locales to experience the grandness of pristine wilderness—often hundreds of miles from their homes, and offers California's State Parks as inspiring backdrops to the lessons of history, science, visual and performing arts, math and English.

Contributed by Alan Friedman.

Desert Sands Unified School District 101

How to Turn a Connectivity Dream into a One-Gigabit Ethernet Reality

Located in Southern California's Coachella Valley, the Desert Sands Unified School District (DSUSD) serves six desert communities—Bermuda Dunes, Rancho Mirage, Indian Wells, Palm Desert, La Quinta, and Indio—comprising a total of 30 schools and more than 26,000 students. In the early 1990s, when the district served only 20 schools and 19,000 students, several DSUSD schools installed computer networks. As these schools utilized a variety of network operating systems, over time they became difficult to support.

To address this difficulty, a new district-level technology department was formed in 1993 under the direction of technology coordinator Dr. George Araya. "Our initial task," said Dr. Araya, "was to study the different network and computer systems used throughout the district and to propose a new technology plan that would work on a district-wide basis." Part of that plan included a modern learning infrastructure that would enable every classroom and office to access a variety of high-technology applications at high data-transfer speeds.

A Modern Learning Infrastructure

DSUSD's plan hinged on a long-term vision: develop a six-city metropolitan microwave network that would offer students and staff in 20 school sites access to the Internet at speeds of 10 million bits-per-second. The new department also decided to standardize on one platform. Neither decision was very popular.

> From the start, [Desert Sands Unified School District] has relied on innovative and creative ways to economically manage connectivity between sites and obtain Internet service.

Obstacles

A primary objection to the plan was the cost factor of $5 million over five years and a concern about the technology, which Araya admits is an older technology. The decision to use microwave technology was based on the technology department's conviction to avoid paying more for costly T1 lines if it wasn't necessary. "We had thoroughly researched the networking strategies that were available and we were convinced," Araya said, "that despite the high initial investment for microwave technology, it would be more cost-effective in the long run because we would own the microwave; the entire net would be ours." Despite the initial unpopularity of microwave technology, in the end the Desert Sands Board of Education was convinced and supported the proposal.

The decision to standardize on the Windows platform became DSUSD's next hurdle. "Eliminating the Macintosh from the network was not popular," Araya recalled, "because everyone—particularly those in the elementary schools—was familiar with the Apple IIe and the Mac. But there were many reasons why it was important to have only one platform. One of the most important was funding: at that time Apple was much more expensive than clones. Another reason was to alleviate reliance on one company for hardware: most companies that provided competitive pricing supported PC clones. A third important reason was maintenance: we simply didn't have the support staff to maintain both Appletalk and TCP/IP over our network. Today we are very happy that we have only one platform."

Innovation Today

The district's next step is to move the network to high-speed fiber-optical connections that will bring gigabit ethernet online by the end of 2004.

The increased bandwidth will enhance an entire spectrum of applications, enabling access to full-motion video on central servers to classrooms equipped

with Sony network projectors. Increased bandwidth also will open opportunities for videoconferencing, as well as the implementation of an IP-based security system.

For those struggling to meet budgets term to term, the DSUSD plan may seem like an unreachable fantasy. But, drawing directly from the DSUSD experience, Dr. Araya had suggestions on how even those working from the ground up can obtain the dream.

"You have to take the long view and start with a master plan for where you want your entire district to be several years from now. Once you have the plan in place, it is amazing how much easier it is to get support for implementing the individual parts," he said.

Implementing One Gigabit

From the start, DSUSD has relied on innovative and creative ways to economically manage connectivity between sites and obtain Internet service. For example, DSUSD has partnered with some of the most prominent providers of service, equipment and infrastructure to provide an early adoption of gigabit technology to the midsize K–12 environment. We strive to be early adopters so we can reach our goal of providing a platform for gigabit infrastructure to the desktop for every student and teacher network connection. These connections support a high-growth student population and span a diverse socioethnic community.

The gigabit project began when DSUSD realized that their Smithsonian Award-winning (1996) 10 mbps microwave metropolitan-area network would not be sufficient to support its growing student population—a population increasing by approximately three percent a year. By the year 2010, DSUSD expects to be supporting 35,000–40,000 students at 35 sites. Keeping pace with that growth includes building one new school per year through the year 2010, and refurbishing each existing school through that same time period.

DSUSD partnered with Time-Warner Cable to obtain a complete gigabit-fiber infrastructure connecting each of its schools to the district office. All 30 schools are now connected to the gigabit network. In addition, a CENIC node is located within DSUSD's Riverside County Office of Education facility in Indio. Plans are in motion now to connect to this node via underground gigabit fiber.

DSUSD also is implementing a design for a gigabit-capable network to provide gigabit access to desktops well before 2010. The design envisions every wing and classroom outfitted with a minimum of 10-gigabit copper connections. To promote the vision, all new computers are purchased preinstalled with 10/100/1000 network interfaces (NIC).

The gigabit connection to the CENIC node expects to provide integration of the DSUSD gigabit infrastructure to the statewide network before the end of 2004, making DSUSD a proud and early adopter of connection to the gigabit network for K–12.

> By the year 2010, DSUSD expects to be supporting 35,000–40,000 students at 35 sites. Keeping pace with that growth includes building one new school per year through the year 2010, as well as refurbishing each existing school through that same time period.

Getting Support from the Vendors

Another of DSUSD's key initiatives has been to create a consortium of manufacturers interested in making DSUSD a model for other districts. Cisco, Hewlett-Packard, Microsoft and Sony are working with the district to ensure that their products effectively work together and that their results can be replicated as a working whole by others.

"We have naturally developed close working relationships with vendors over the years as the latest technology has been implemented," Dr. Araya said. "The idea was to push this to the next level and get these companies to work together, rather than on just their individual parts of the total solution."

Districts with similiar goals would be wise to use as a template DSUSD's alliances with providers of expertise, equipment, systems and connectivity. Its alliances, as well as its creativity, determination and know-how, make DSUSD a model for districts still longing to realize their vision of a gigabit-to-the-desktop experience via the gigabit statewide network.

Contributed by Dr. George Araya.

(from left to right) Scott Weir, Chuck King, Jacqueline Mercier, DSUSD; Felicia Ferranti, Cisco Systems; George Araya, Teresa Hadler, Ruth Araya, Mike Stunmire, DSUSD

CPEC Revolutionizes Online Professional Development

continued from page 6

Education have received a planning grant for the creation of a professional development program in mathematics for middle school special education teachers to strengthen skills in the delivery of services to special education students. Initial efforts will analyze the needs of these teachers, including needs that stem from the requirement to prepare students for the High School Exit Exam. The goal of the grant is to define an effective mathematics professional development strategy that meets the needs of special education teachers through traditional face-to-face professional development, online collaboration and online resources that can be used "any time, any place" with the assistance of an online facilitator.

The findings generated by these projects illustrate how the California K–12 High-Speed Network bandwidth can be used to enhance teaching and learning for students' benefit.

John Ittelson, professor and director of The IDEA Lab, and his crew from CSU–Monterey Bay, Jeff McCall and Jotham Fischer-Smith, were on hand to record the presentations and promote information sharing. Video clips of the presentations and other information will be posted at http://www.cpec.ca.gov/.

Contributed by Stephanie Couch, director of statewide initiatives, CENIC. ●

The Teaching and Learning Interchange

continued from page 11

resources and online mentor-moderated discussions. Resources and reflection questions promote adapting the new techniques into present teaching.

Examining the practice of accomplished teachers and discussing classroom management, connections to student demographics and resultant differentiated instruction is the most highly requested form of professional development by teachers. The TLI provides it—via anytime, anywhere access to expert math and science teachers across California. Research has shown that the most effective way to retain teachers is to break the isolation of the classroom and provide support from other professionals. The TLI supports California's efforts to retain math and science teachers by offering each one an online mentor with whom they can confer, regardless of location. As the TLI videos are made available on the gigabit network, teachers across the state will be able view National Board-certified and master teachers' practices while conversing with an accomplished teacher in their field—what a gift to California's teachers and students.

For more information on the TLI, visit www.teachinginterchange.org.

Contributed by Pamela Redmond. ●

Meeting the Challenge of High-Energy Physics

continued from page 16

UltraLight will mark the entry into a new era of global real-time information systems, where all three sets of resources —computational, storage and network—are monitored and tracked to provide efficient, policy-based resource usage. By consolidating with other emerging data-intensive grid systems, UltraLight will drive the next generation of grid and monitoring system developments, as well as new modes of collaborative work. UltraLight paves the way for more flexible, efficient data sharing by scientists in many countries and could be a key factor in the next round of physics discoveries awaiting us at the high-energy frontier. Closer to home, it offers profound implications for integrating into our daily lives information sharing and on-demand audiovisual collaboration at a quality previously unimaginable.

Footnotes

1. The LHCNet is the transatlantic 10 Gbps backbone connecting CERN in Geneva to Chicago, Illinois. http://www.datatag.org

2. NLR is an initiative of U.S. research universities and private technology companies to provide a national infrastructure for research and experimentation in networking technologies and applications. http://www.nlr.net/

3. UCAID is a consortium of 206 universities working in partnership with industry and government to develop and deploy advanced network applications and technologies. http://www.internet2.edu

4. StarLight is a high-performance network exchange for many worldwide research and educational wide-area networks.

5. TransLight is a global, experimental networking initiative that supports prototypes of aggressive e-science applications. http://www.startap.net/translight/

6. NetherLight is an advanced optical infrastructure with international connectivity. http://www.surfnet.nl/innovatie/netherlight/

7. UKlight is a national facility to support projects working on developments towards optical networks. http://www.uklight.ac.uk/

8. The mission of AMPATH is to serve as the pathway for research and education networking in the Americas and to be the international exchange point for Latin America and the Caribbean research and education networks. http://www.ampath.fiu.edu/

9. CA*Net4 embodies a true "customer-empowered network" by placing dynamic allocation of network resources in the hands of end users. http://www.canarie.ca/canet4/

10. FAST is a congestion-control algorithm that improves TCP performance in high-speed networks. It's based on a broader theoretical effort toward robust and stable ultra-scale networking. http://netlab.caltech.edu/FAST/index.html

11. MonALISA is an advanced distributed monitoring system. http://www.monalisa.org

12. Grid Analysis Environment. http://pcbunn.cithep.caltech.edu/GAE/GAE.htm

For more information on the UltraLight project, see http://ultralight.caltech.edu.

Contributed by Sylvain Ravot, Harvey Newman, Julian Bunn, Iosif Legrand and Frank an Lingen. ●

Corporation for Education Network Initiatives in California
5757 Plaza Drive, Suite 205, Cypress, CA 90630
714.220.3400 • www.cenic.org • info@cenic.org

CENIC Board Associates

California Community Colleges

Alameda
Allan Hancock
American River
Antelope Valley
Bakersfield
Barstow
Butte
Cabrillo
Cañada
Canyons
Cerritos
Cerro Coso
Chabot
Chaffey
Citrus
Coastline
Columbia
Compton
Contra Costa
Copper Mountain
Cosumnes River
Crafton Hills
Cuesta
Cuyamaca
Cypress
De Anza
Desert
Diablo Valley
East Los Angeles
El Camino
Evergreen Valley
Feather River
Folsom Lake
Foothill
Fresno City
Fullerton
Gavilan
Glendale
Golden West
Grossmont
Hartnell
Imperial Valley
Irvine Valley
Lake Tahoe
Laney
Las Positas
Lassen
Lemoore
Long Beach City
Los Angeles City
Los Angeles Harbor
Los Angeles Mission
Los Angeles Pierce
Los Angeles Southwest
Los Angeles Trade Tech
Los Angeles Valley
Los Medanos
Marin
Mendocino
Merced
Merritt
MiraCosta
Mission
Modesto Junior
Monterey Peninsula
Moorpark
Mt. San Antonio
Mt. San Jacinto
Napa Valley
Ohlone
Orange Coast
Oxnard
Palomar
Palo Verde
Pasadena City
Porterville
Redwoods
Reedley
Rio Hondo
Riverside
Sacramento City
Saddleback
San Bernardino Valley
San Diego City
San Diego Mesa
San Diego Miramar
San Francisco City
San Joaquin Delta
San Jose City
San Mateo
Santa Ana
Santa Barbara City
Santa Monica
Santa Rosa
Santiago Canyon
Sequoias
Shasta
Sierra
Siskiyous
Skyline
Solano
Southwestern
Taft
Ventura
Victor Valley
Vista
West Hills
West Los Angeles
West Valley
Yuba

California Institute of Technology

Jet Propulsion Laboratory

California State University System

California Maritime Academy
California Polytechnic State University, San Luis Obispo
California State Polytechnic University, Pomona
CSU Bakersfield
CSU Channel Islands
CSU Chico
CSU Dominguez Hills
CSU Fresno
CSU Fullerton
CSU Hayward
CSU Long Beach
CSU Los Angeles
CSU Monterey Bay
CSU Northridge
CSU Sacramento
CSU San Bernardino
CSU San Marcos
CSU Stanislaus
Humboldt State University
San Diego State University
San Francisco State University
San Jose State University
Sonoma State University

Stanford University

Stanford Linear Accelerator Center
Stanford Medical Center

University of California System

UC Berkeley
UC Davis
UC Irvine
UC Los Angeles
UC Merced
UC Riverside
UC San Diego
UC San Francisco
UC Santa Barbara
UC Santa Cruz

University of Southern California

Health Sciences Campus
Information Sciences Institute
University Park Campus

CENIC Partners

California K–12 System

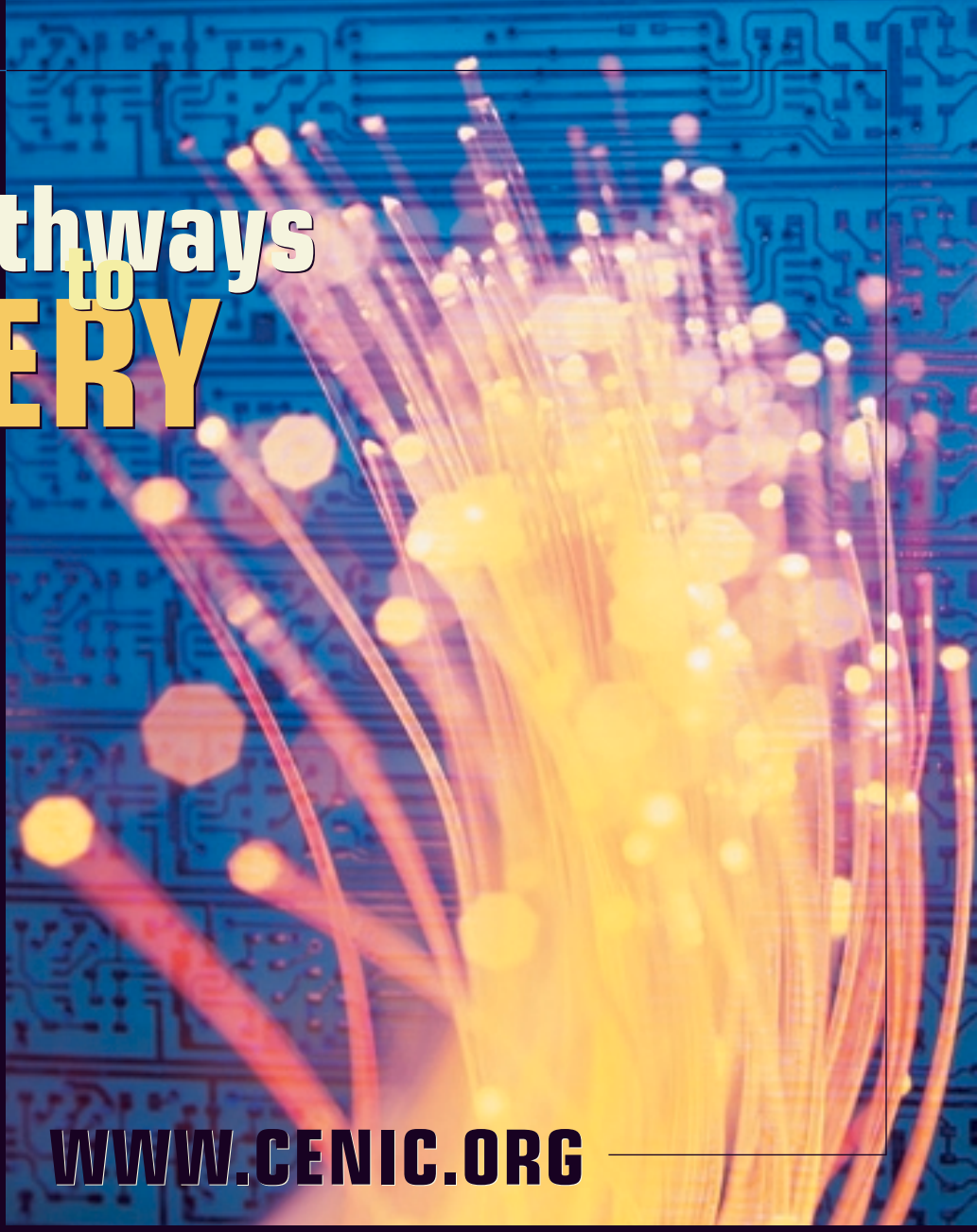
Encompassing 58 counties and 985 districts

CalREN Associates

University and Community College System of Nevada

CENIC 2005

Pathways to DISCOVERY



MARCH 7–9, 2005
RITZ-CARLTON MARINA DEL REY
MARINA DEL REY, CALIFORNIA

Corporation for Education Network Initiatives in California (CENIC) invites you to its ninth annual conference, **Pathways to Discovery**. Quite possibly the most important networking and educational event of the year, CENIC 2005 is your opportunity to connect with California's key high-performance networking professionals—educators, researchers, business people and government representatives—and help advance the vision of tomorrow's Internet. This year's conference offers three days of stimulating tracks, influential speakers and a rich array of collaborative panels amidst the engaging backdrop of Marina del Rey, California.

Reserve your hotel and conference space today.

WWW.CENIC.ORG

Corporation for Education Network Initiatives in California
5757 Plaza Drive, Suite 205
Cypress, CA 90630