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DataBus

"Supporting California's Educational Technology Community"

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Four Streams Become A River: An Update on Video Streaming

Scott Sexsmith, Merced County Office of Education

In the last issue of the DataBus I presented information on Merced County Office of Education's experience with video streaming (the article can be found at http://www.cedpa-k12.org/databus.html, April-May 1999). If you're new to streaming, video streaming is about taking almost any video source, digitally encoding it, and then making it available as a "stream" to a user via the network or Internet. In this article I'd like to update you on our progress in creating reliable and affordable video streaming.

We are currently using Microsoft's NetShow Server 3.0. This is free software from Microsoft that runs on an NT server platform. It's available as a free download (along with documentation and encoding software) at http://www.microsoft.com/ntserver/mediaserv. You'll also find a great source of technical material discussing the features of Microsoft streaming products at http://www.microsoft.com/ntserver/mediaserv/techdetails/default.asp. We use the NetShow Encoding tools to capture the audio/video and forward it to the NetShow streaming server. This allows us to stream video via the network and out onto the Internet. We are streaming real-time our county school run ITFS television station, METV. This station provides educational television to students and staff in Merced, Mariposa, and Madera counties.

One project we were working on at the time of the last article was to migrate our streaming server software and files from our HP NetServer 5/133 LS server (Pentium 133 processor, 24GB of disk space, 128MB of RAM) to our new HP NetServer HP LH3r PII 450 (31 GB of disk, 384MB RAM).

We've since completed the transition and after a few adjustments we're now running smoothly on the new server. This new server should allow many more Unicast connections at any given time. These Unicast connections place a higher load on the system compared to a multicast connection. This is because the server has to handle individual streams for each connection to the server. According to Microsoft's technical papers the new server configuration should now be able to handle several hundred simultaneous low-bandwidth connections. In addition all the NetShow server utilities run much faster, allowing configuration changes much more quickly. For anyone wanting to experiment with the server technol-

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The CEDPA Board of Directors

CEDPA Information

CEDPA is an association of K-12 Technologists. Founded in 1960, the major emphasis of the association's activities are directed towards improving K-12 Technology in public education within the State of California and to prepare its membership to better meet and support the technological needs of Administrative and Instructional Programs.

CEDPA is a California non-profit corporation, as recognized by the Internal Revenue Service.

As cited in CEDPA's bylaws, the purpose of this organization shall be:

(a) To provide information to the California public educational community concerning educational information systems and technologies via dissemination at an annual conference, through quarterly periodicals and special seminars.

(b) To foster the exchange of knowledge of educational information systems and technologies concepts, systems and experiences between local education agencies and other associations both at the state and national level.

(c) To inform the association membership of important information concerning educational information systems and technologies.

(d) To provide recommendations to the State Department of Education, State Legislature, school districts, county offices of education and other public educational organizations concerning educational information systems and technologies.

(e) To develop professional standards for the educational information systems and technologies community within the State of California.

Yearly membership in CEDPA is granted to attendees of the Association's annual conference. Individuals interested in the Association's mailings may request to be added to CEDPA's mailing list by writing to the address below or filling out the interest form at CEDPA's website.

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Electronic editions of the *DataBus* and information about CEDPA are available from CEDPA's website at
http://www.cedpa-k12.org

President's Corner

Terrell Tucker
Panama Buena-Vista Union School District

The last few months have been quite busy for your Board of Directors. We've been kept busy preparing for the annual Conference in Monterey this November. At the same time, a few Board members have been busy redesigning their careers. Three Directors have changed employers recently, with two of them "going back home."

Russ Brawn, Past-President, was selected as the Information Systems Administrator for the CSIS team in Sacramento as the program begins rolling in high gear. Greg Lindner, Director, has returned home to the Elk Grove Unified School District as Director, Information Systems. Warren Williams, SIG Chairperson will be returning to the Grossmont Union High School District as the new Assistant Superintendent, Technology Services. He will begin in the new position on July 1 of this year.

Be sure to familiarize yourself with your Board of Directors. Browse to http://www.cedpa-k12.org/directors.html and get to know the folks that are directing this organization. Drop a note into their "e-mail boxes" to let them know what you think is important and the direction you'd like to see this group take.

Novell News

Joe Rodehaver, Novell, Inc.

Novell Introduces Software That Helps Teachers Manage Internet Resources in the Classroom to Keep Students Safe and Focused...

Novell has announced the release of it's first software application for the education market, Web Lessons, which is an Internet-learning tool that lets school teachers manage the vast resources of the Internet by allowing them to prepare and deliver lessons using specific, selected information on the World Wide Web. In addition, these lessons will keep students safe from harmful or distracting Web sites while focusing them on relevant material chosen by the teacher.

Through a point-and-click Web-based interface, teachers can develop innovative Internet lessons that incorporate specific Web pages or sites while eliminating distractions that interfere with a student's learning by denying access to all Web sites except those chosen by the teacher. Web Lessons is a cross-platform, Java-based application and the only comprehensive curriculum assistant that allows teachers to harness the educational information in the Internet for use in daily lessons.

Web Lessons takes advantage of Novell's industry-leading directory technology, NDS, and its powerful Internet security management suite, BorderManager Enterprise Edition 3. Web Lessons walks teachers through the development of new lessons and also enables them to edit existing lessons. In addition, Web Lessons allows educators around the world to share lessons alreadyprepared.

BorderManager running along side Web Lessons, gives teachers and students fast, secure access to the Internet. Teachers can block access to irrelevant information on the Internet, keeping students focused on the lesson at hand. The ability to give access to only those Internet sites in a specific lesson while denying access to all other sites is unique to Web Lessons. Through NDS,teachers can designate which students have access to what lessons, thus enabling the teacher to easily create a variety of lessons designed for different students.

Any teacher who can use a browser, can easily set up lesson plans with Web Lessons. It contains a wizard-based interface and is tightly integrated into NDS which works transparently to ensurestudents have access to only the lessons intended for them. With an intuitive lesson

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"...Of Mice and Monitors..."

Relocation: Office moves present both opportunities and challenges for IT.

Addison Ching, California State University Office of the Chancellor

The California State University Office of the Chancellor recently consolidated its offices into a new, six-story building in Long Beach, California. The new building was constructed to replace the former CSU headquarters building in Long Beach that was structurally damaged from landfill settlement. The new building was also designed to house the Chancellor's Office (CO) Information Technology, Procurement, and Capital Planning, Design and Construction personnel that were located at the WestEd facility in Los Alamitos. Approximately 500 personnel, 800 computers and 100 printers were affected by the move. Also involved were new telephone numbers, network address assignments, and a brand new wiring plant and cable infrastructure. The challenge was to accomplish the relocation over weekends and without impacting the operation of the Office of the Chancellor.

The physical move was done by professional movers, which meant that all offices had to be boxed up and marked for target destinations ahead of time. You learn very quickly that things that are considered non-critical should be packed first, and those things considered vital should be packed at the last minute. Any variation from this rule results in fruitless searching in already-packed boxes and much wasted time and energy. Furniture was not included in the move; only the contents of desks, files and cabinets were affected. Rather than laboring over the details of the office move, I'll concentrate more on the "behind the scenes" technology support services-related activities that allowed the Office of the Chancellor to be shut down on Friday and resume business, almost as usual, on the following Monday.

The Players

Chancellor's Office Information Technonlogy Services (CITS) teams were largely responsible for the lifeblood of the CO, the technology support services. The Desktop Services team headed by Director Laura Guillory was responsible for all desktop computer and telecommunications equipment, printers, and file servers for backup and departmental data storage. My Information Dissemination and Access (IDA) team had the responsibility of ensuring functionality of the network infrastructure. This included the cable plant, the network infrastructure equipment, and the Windows NT and Unix Internet network servers. The 4CNET CSU Wide Area networking support group designed the network infrastructure, and wiring the cable plant was the responsiblilty of a professional network wiring contractor. Functionality of the Cisco network infrastructure equipment was the responsibility of Pacific Bell Network Integration.

For Propeller-heads Only

A structured cabling design was used throughout the building. Each floor is served by its own Cisco switched hub, and each office and cubicle has a 100Mb. Ethernet home run to the switch. The infrastructure backbone is fiber optic, supporting Gigabit Ethernet, with an ATM connection to 4CNET. Dialup service for our road warriors is supported by a T1 Primary Rate Interface (PRI) line that feeds a Cisco AS5300.

Each office or cubicle is served by a pair of color-coded category-5 cabled jacks: Blue for voice, and Red for data.

The Move Schedule

Notwithstanding the construction project's continually-changing deadlines, the move was scheduled in two phases. The first phase involved a weekend move of the 180+ personnel located at the WestEd facility. This facility is located in the city of Los Alamitos, approximately a half hour away from the Long Beach headquarters building. In addition to the various departments located here, this facility is also the home of all of the Internet service servers for the CO, the Unix data warehouse computers, and the permanent network operations center (NOC) for 4CNET. (The move consolidation did not include the 4CNET group which continues to operate from the Los Alamitos facility.)

The second phase was a weekend move that included the executive, legal, academic, human resource, and business personnel located at the former headquarters building, directly across the street from the new building.

After several schedule modifications, the move dates were finally set for two weekends in April. Sandwiched between move weekends was the annual Toyota Long Beach Grand Prix. When the Grand Prix comes to town,

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CSU Move

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access to the CSU headquarters is quite restricted due to street closures and detours in Long Beach. Not the perfect time to be preparing for a move!

Preceding the first phase office move (and network completion and certification permitting,) the Internet service servers would be relocated and brought online at the new facility to prove out the network functionality. Unfortunately, the amount of time planned for this was, in reality, nowhere near the actual time that was actually available to do this. Instead of weeks to prove out the network, days were the bill of fare. Factors that affected this ran the entire gamut, from installation of the UPS and electrical outlets and completion of the network infrastructure, to installation of server rack equipment, cable trays and final certification of the network.

"What The Heck Is That Doing There?"

Design of the network room was revised more than a dozen times over the course of a year. There was never a definitive understanding of what equipment would be housed there, or what actual dimensions of the UPS and server racks were until very late in the planning stages. "Oh by the way, this has to be located in the Network Room!" began to sound all-too familiar.

A measurement walk-through of the Network Room (now infamously known as Room 326) revealed an alarming sight: A full-size Liebert air conditioning unit occupying the entire back wall of the Network Room. This was not on any of the plans that I reviewed. What the Heck is that doing there? It's sitting in the space that was needed for equipment racks. Back to the drawing board. An already-crowded equipment room was, all of a sudden, even more crowded, and would provide a definite challenge for the physically-challenged and the American Disabilities Act compliance.

Logistic Issues

The requirement of 24x7 Internet Services provide a unique opportunity for creative thought: How can servers that support 24x7 services be moved without interrupting the service?

A variety of servers were housed at WestEd. Due to space limitations, the large Unix Data Warehouse computers would remain at the WestEd facility and be administered remotely. All other servers, including the Internet Service computers for e-mail and WWW support, as well as applications servers and IT development servers would be relocated. A prioritized list was developed that ranked each server by its importance to the CSU mission. The development servers could be moved at any time. Applications servers, as well as most Internet service servers, could be moved before or after normal work hours. This would lessen, but not remove completely, interruption of services. But what about Domain Name System (DNS) service?

The DNS is the key to accessing anything within the calstate.edu domain. It is also what resolves web links to the outside world. Moving the DNS to the new facility would require assigning it a different Internet address. Notification of this change would have to be given to the Internet registration agency. However, the DNS server can't be moved until the change is made. Furthermore, InterNIC might pre-validate the new address before it makes the change. How can one machine be in two places simultaneously?

The solution to this was to place a duplicate DNS support service computer with the new network address in the new facility. This DNS, as an unofficial secondary DNS, would always be current since it replicates the primary DNS. Computers in the new facility would be directed to this DNS for resolution, while the outside world continued to use the DNS located at the WestEd facility. After all relocation was complete, InterNIC could be notified of the new DNS address, and the DNS computer located at the WestEd facility could then be removed from service.

The duplicate DNS was the first machine to be brought up on the new network. In the days following, additional servers were moved to the new facility, according to their move priority, and added to the network. Most of the servers were moved between 6AM and 8AM. during the two-week period preceding the first phase move. The e-mail and web service servers were the last servers to be moved and were relocated to the new facility on the Thursday preceding the first phase move. One milestone was reached!

Move Work Assignments

There were several pre-move operations that were completed prior to the move to ensure operability of the

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CSU Move

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technology in the new facility. In addition to all Internet servers "testing out" the new network, a complete audit of data and telephone jacks was made against the cable plant database. A red Ethernet station cable (to match the red data jack in each office and cubicle) was connected to the "hot" data jack in each office. This made it convenient for the reassembly move teams to reconnect the computers; instead of trying to determine which jack to use (some offices had several) all they needed to do was to plug the computer into the already-connected red cable, wherever it was. The move teams would not be concerned with equipment placement since the equipment would not, in all likelihood, be situated where the office or cubicle occupant wanted it. Instead, the reconnection process would involve only reconnecting equipment, plugging the computer into the network, reconfiguring the TCP/IP network information, establishing a default printer for each workstation, and ensuring network connectivity by launching a browser.

A strict timetable was developed beginning around 3:00 P.M. on Friday before the move. Work teams comprising members of the Desktop Services and IDA staff would visit each workstation, disassemble all peripheral components such as ZIP drives, CoStar label printers, Visioneer PaperPort Scanners, and a host of others, and "bag" all loose components in a plastic bag. It's important to note that all articles to be moved, including computers, monitors, and accessory bag, were prominently tagged for a destination in the new building. In addition, an accessory sticker listing a variety of accessories was placed on each monitor. Items on this sticker would be circled upon disassembly to inform the reassembler what components were attached to the computer and to which ports they were attached.

Computer disassembly was scheduled to be completed by 5:00 P.M. Friday, and the movers would move these items first. Delivery to the new building was scheduled for early Saturday, at which time the reassembly teams (actually, the same people who disassembled the computers) would get assignments from the floor captains and begin reassembling desktop computers.

The first phase move involved two and a half floors and workstation equipment for about 180 emplolyees. This first move would be the benchmark to improve upon when the second phase move was executed two weekends hence. With everything in the move teams' favor, equipment setup would be completed by Saturday evening.

"The Best-laid Plans of Mice and Monitors…"

The only thing you can ever anticipate is Murphy. Mr. (or Ms.?) Murphy certainly didn't want to miss out on this event! My pager went off about 4:30 Friday afternoon, well into the disassembly phase. Did I have a bolt cutter? It seems that in the haste of the Key Police to collect all office keys, nobody remembered to retain the keys that went to the computer tie-down locks. No, I didn't have a bolt cutter. Go across the street to Operations and see if they have one. No, I have some keys that might fit, so I'll drive across town and meet you in a half hour.

Meanwhile, the WestEd building superintendent's assistant had a set of bolt cutters in his trunk. (Now, Mark, what are you doing with *bolt cutters* in your trunk?) The cables were cut, and all tied-down computers were liberated from their move hell and readied for transport before I reached WestEd. Having completed the disassembly by 5:30, everyone left, anticipating the following day. See everybody tomorrow morning at 8:00 A.M.

It's Saturday. I arrived at the new building well before the scheduled 8:00 A.M. start time, only to be greeted by an empty parking lot. 8:00 A.M.? It appears that everyone knew of the rescheduled start time *except me.* It turns out that the reassembly teams were to meet at 9:00 A.M. but I was not informed of the time change. I later found out that it was done because the movers were anticipating a delay and would not be getting the equipment unloaded and delivered to the floors until that time.

The first batch of Macintosh computers didn't arrive at their destination floors until after 10:00 A.M. This resulted in a lot of people standing around waiting for something to do. My team was responsible for the PCs, but the PCs didn't arrive until after lunch. We assisted with Macintosh hookups until our equipment arrived. We also assisted in assigning additional network addresses where office and cubicle occupants neglected to inform anyone that they had multiple computers. Fortunately, we had a supply of 5-port workgroup hubs that could be used to connect multiple computers to the network connection in each office or cubicle.

Most of the equipment was hooked up and function-

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CSU Move

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ing by 4:00 P.M. Saturday. The final hookups and functionality testing were completed by 7:00 P.M., and no major problems were encountered during the phase one move. Overall, the move was very successful, considering the stumbling blocks that were encountered along the way. This, in essence, was the *difficult* move because it was the first, involved cross-town transporting of offices, and was the first large-scale occupancy of the new building. When Monday morning rolled around, it was almost business as usual, with people moving equipment so that it met their requirements. Everything worked!

One Down, and One To Go

The second phase move was better coordinated that the first phase, simply because the first phase move illustrated facets that could be improved upon and because relocation was just across the street. If something was forgotten or needed, just go back to the old building to get it.

While this move involved relocating more offices and equipment, it was completed in the same timeframe as the phase one move. To be sure, additional move teams were deployed, but the disassembly-move-reassembly process was also fine-tuned for efficiency. Nevertheless, Murphy again paid a gratuitous visit in the form of no air conditioning and executive furniture that blocked data port and power access. In spite of that, on Monday morning, again it was almost business as usual.

The move also involved some esoteric equipment that had to be disconnected and reinstalled in the new building. Impact printers that deliver output from our remote MVS facility in Fresno had to be reconnected and reprogrammed for the new network. An IBM remote access controller also had to be relocated along with the T-1 line that connects its two dozen terminals to the State Controller's Office in Sacramento. Video conferencing equipment had to be relocated and reconnected.

We continue to deal with requests for additional telephone lines for personal FAX machines, additional computers, longer cables, and the like. However, the relocation of over 500 employees and their attendant equipment appears to have been a huge success, largely due to the hours of planning, hard work, and team cooperation of CITS personnel. All mission-critical technology was functioning properly in the new facility.

There are those who continue to lament that we shouldn't have moved when we did because the building wasn't ready for occupancy. Yes, we continue to have air conditioning problems, but that's expected in a new building. The window glare does present a challenge for monitor viewing. Elevators sometimes temporarily hold their riders hostage. But the network works fine. Everyone's desktop computer is operational, and everyone can get their e-mail! Hallelujah!

Congratulations to move team members, managers, and all others that made both moves an overwhelming success. And welcome to the new CSU Office of the Chancellor, the headquarters of the California State University, the world's largest University system!

CEDPA Listservs

As a service to K-12 Technologists, CEDPA hosts several e-mail discussion distribution forums (listservs) on current topics of interest. These lists are open to anyone with an interest in the topic area.

Edtech - A discussion forum for educational technology issues.

Erate - A discussion forum for E-Rate, the FCC ruling on Universal Service that provides schools and libraries significant discounts on telecommunications services.

SIG - A discussion forum for K-12 information management issues; also used to assist with the planning and announcement of CEDPA SIG meetings.

Y2K - A discussion forum for Y2K-specific issues, problems, and solutions.

To join a distribution list, send an e-mail message to listserver@cedpa-k12.org. Leave the message subject blank. The message body should contain only two words: the word **subscribe** and the name of the discussion list you wish to join. The rest of the message should remain blank. Do not append your signature line or any other text to the message.

To leave a list, send a message to listserver@cedpa-k12.org as above, except use the words **unsubscribe** and the name of the list you wish to leave.

Novell

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planner, Web Lessons helps teachers organize Internet content and incorporate it into their curriculum.

With the caching technology of BorderManager, Web Lessons helps teachers and students to quickly access information on the Internet. Selected Web pages are stored on a local server and they can be accessed instantly and use less bandwidth than through the World Wide Wait.....

Quality teaching can be achieved by integrating the wealth of resources on the Internet into teacher's curriculum, creating a richer learning environment and enhancing the students' educational experience.

Shipping in May, Novell will be offering several special pricing plans. A promotional price of $495 for a 500 user version of Web Lessons will be available until July 15th directly from Novellor or through any Novell Authorized Reseller. This price will increase to $595 after July 15th, 1999.

Also, any school that has signed an SLA (School Licensing Agreement) can add Web Lessons for only $.50 per student per year and get all upgrades and updates free.

True Global Directory Services Available from Novell

Novell recently announced the release of it's eighth version of the most successful directory system available, NDS, Novell Directory Services. Now with over 70 million users, NDS has evolved into a true global directory and authentication service with a personal digital signature. In its fifth year of delivering directory services, Novell has learned that rather than integrating directories around the world of an individual's PC, it makes more sense to integrate the digital world around the individual. In an era of near-ubiquitous computer access, where users are mobile, IP addresses are always changing, and PC's become generic, the individual is the only common denominator across devices, services, and applications. That's why the individual is the focal point of NDS, and why NDS is much more than just a means of universal authentication.

At its core, NDS is a relationship manager with the ability to manage ALL aspects of your "digital identity." It not only handles multiple platforms, it breaks the physical dependencies of location and device. That means logically integrating the entire network around you. Doing so requires the ability to personalize your network experience on any computer in accordance with your needs, preferences, and authorizations.

The aim of NDS is to map the digital identity of people with that of printers, routers, switches, PC's, mobile phones, and palm tops. Doing so creates a world that is not made up of just a bunch of personal computers with different owners - but rather a truly integrated "personal net." This is the next natural evolution of computing. Texas Instruments recently announced that they'll integrate NDS with digital signal processors. Many others are integrating NDS into their own systems such as NDS for Solaris, NDS for NT, NDS for IBM 390, NDS for AIX, NDS for HP, just to name a few.

The latest version, NDS 8, is such a people-centered directory service, and is so robust that it has been tested with as many as a billion users, which is five times the number of users on the Internet today and countless more than any other directory has even thought about. NDS is tightly knitted into other Novell components such as BorderManager, GroupWise, and ManageWise.

This person-centric capability has been embraced by many manufacturers looking for the best of breed technology. Examples, PeopleSoft has integrated NDS into their HR database application, Oracle has integrated NDS into Oracle 8 for NetWare, Lucent Technologies has agreed to a joint development in bundling and integrating NDS for managing Lucent's high-capacity Cajun P550 gigabit switch, Nortel Networks, Cisco Systems and Bay Networks are working to integrate NDS into their management suites.

What this people-centered directory service offers to the user is to open up the possibilities of a new class of application allowing the user access regardless of where you are or what computer you may be using at that moment. For this type of application, the user would need a common medium, a directory which is built around individuals, that works across platforms, apps, and networks - such a global directory is NDS.

For more information visit http://www.novell.com/weblessons

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Legislative News

Greg Lindner, Elk Grove Unified School District

I attended an Educational Technology Issues meeting at the State Capitol Building on March 31, 1999. I was invited by staff from Assembly Member Lempert's office to represent CEDPA at that meeting. Participants included many lobbyists representing different interest areas (ACSA, Software Publishing Association, Electronics Industry Association, CUE, Software Clearinghouse, CTA, and others) as well as representatives from ETAC, CTAP, and CDE. Also present were staff members from Assembly member Kerry Mazzoni's office and Assembly member Nell Soto's office. Kerry Mazzoni is the chairperson of the Assembly committee on education.

We discussed several issues surrounding technology in education. Each group provided some background about their group and what their current issues were. I represented CEDPA and distributed an information document about CEDPA. This document may be reviewed at CEDPA's website (http://www.cedpa-k12.org/info-document.pdf).

The main discussion centered on several bills that have been introduced, including AB598 introduced by Assembly Members Soto and Lempert. This bill is very similar to the previous Sweeney Bill. It creates the Commission on Technology in Learning and establishes the commission's charter. The commission's charge is to make policy recommendations to the State Board of Education in areas that include statewide planning for education technology. This includes the development of a statewide master plan for the use of education technology. The full text of this bill can be found at http://www.leginfo.ca.gov/pub/bill/asm/ab_0551-0600/ab_598_bill_19990325_amended_asm.html

After much discussion on this issue, I advocated for the inclusion of at least one technical representative from the K12 community who has actually implemented technology in a school district and is familiar with the issues, the pitfalls, the barriers and the rewards. I stressed that it is extremely important that the commission have someone who has "been there and done that," in order to create a check "on reality." The staff said that they felt this was a very good idea and would be open to adding it to the bill.

The current bill lists 14 appointments and the staff is considering increasing that to 17. I will be in touch with the staff and let them know our thoughts on the bill. I think it is a great opportunity to get a CEDPA member on the commission or at least written into the bill.

Another bill that is in the works is AB911 from Mazzoni. That bill's staff member was extremely interested in working with CEDPA in getting our ideas on the bill. Basically it's a bill to provide loans to create exemplary support models. Please review it at http://www.leginfo.ca.gov/pub/bill/asm/ab_0901-0950/ab_911_bill_19990225_introduced.html. The bill states that the CDE would develop standards for implementing networks, computers, and other areas of technology. This would provide a nice opportunity for CEDPA's involvement as an advocate of K12 technologists.

I am interested in your thoughts and opinions about these bills. You can contact me by e-mail at glindner@edcenter.egusd.k12.ca.us.

Breakout Speakers and Exhibitors Still Needed

Breakout speakers and exhibitors are still being sought for the 1999 Fall Conference at the Doubletree Hotel in Monterey.

If you are interested in presenting in one of CEDPA's breakout sessions or if you know of someone who would like to give a breakout session on a topic of interest to K-12 technologists, please get in touch with the speaker chairperson, Oswaldo Galarza (see contact information elsewhere in this issue.) Call for Speaker forms can also be downloaded from CEDPA's website at http://www.cedpa-k12.org/99conference/99call.pdf. This year's breakout session program is quickly filling up but a few vacant sessions still remain to be filled.Thirty-five exhibit booths have already been subscribed for Thursday's vendor show. If you know of a vendor who you feel should be represented at the exhibit, please put them in contact with our vendor exhibit chairperson, Mike Caskey. Exhibitor signup forms are also available at CEDPA's website at http://www.cedpa-k12.org/99exhibitor.pdf. Due to space restrictions at the Monterey Convention Center, only fifty booths are available for this

Adaptive Technology: Optimizing Network Performance

Craig Rodgers, Intel Corporation

Introduced by Intel in 1996, Adaptive Technology is a solution that optimizes product performance for your network environment. The performance optimization is achieved in different ways for different products.

For example, in Intel EtherExpress™ PRO/100 PCI LAN Adapters, Adaptive Technology allows the silicon micro-code to be dynamically updated, thus automatically adjusting to most network operating system environments. The benefit to users is that their adapter is tuned to their specific networking needs, ensuring peak network performance.

Adaptive Technology also offers the advantage of inherent flexibility: Network managers can keep pace with many changes to network operating systems and applications without incurring the expense and trouble of swapping out network adapters.

Intel has applied a similar approach to switching silicon in its family of Express Switches. In this implementation, Adaptive Technology optimizes switch performance by dynamically assigning the optimal switching mode for each port. This provides two similar benefits to the adapter implementation: dynamic adjustment of switch performance based on users' network environments, and protection against future changes to network traffic content and flow.

Optimizing Performance with Adapters

The development of Adaptive Technology marked an industry first and a new level of investment protection for networks. Available for Intel PCI Ethernet Adapters since May 1996, Adaptive Technology increases adapter capabilities and optimizes adapter silicon for specific network operating environments without incurring the cost of typical hardware upgrades. Adaptive Technology optimizes the performance of Intel adapters in two ways:

- Dynamically adjusting adapter performance based on existing network conditions at time of installation; and
- Adapting to new network conditions on an ongoing basis, thus maintaining peak network performance as the computing environment changes.

Companies find this innovative approach appealing because operating systems, PCs and networks tend to change over time. Adaptive Technology lets adapters evolve along with those network changes by means of a simple software upgrade that physically updates the adapter for new capabilities. Because companies no longer need to swap out adapters to stay abreast of ever-changing technologies, they stand to realize a noticeable reduction in the cost of business computing.

With Adaptive Technology, the adapter self-tunes to match the tough performance demands of sophisticated operating systems and applications. This offers performance benefits in the following environments:

- Network operating systems: Microsoft Windows NT® and Novell NetWare®
- Operating systems: Microsoft Windows® 95, Microsoft Windows NT
- Heavy-traffic networks

Adapter Implementation

By enabling silicon-level upgrades, Adaptive Technology clearly differentiates Intel adapters from adapters manufactured by other vendors. Intel's recognized expertise in silicon makes this distinctive approach possible.

Adaptive Technology software downloads go beyond the adapter driver in the software hierarchy to alter the actual silicon microcode on the Ethernet controller.

Adaptive Technology works by modifying the actual microcode that runs on adapter silicon. The implementation for Intel adapters is simple yet elegant: Adaptive Technology employs the known and reliable driver update mechanism to alter the reloadable microcode on Intel 82557 and 82558 Ethernet controllers, which are the foundation of Intel PCI-based adapters. This easy and convenient software update tunes the adapter for maximum throughput and minimum CPU utilization and enables the device to adapt to the nuances of various operating environments.

The adapter silicon is modified when the new software driver with updated microcode is loaded, ensuring no runtime effects. Since Adaptive Technology is a simple software upgrade, it offers another advantage: if necessary, the modifications to microcode can be easily reversed.

(See "Adaptive" on Page 6)

Adaptive

(Continued from Page 5)

To optimize performance in Windows NT, Windows 95 and NetWare environments, an Adaptive Technology-enabled adapter intelligently analyzes the resident NOS, then automatically adjusts performance accordingly.

Adaptive Technology further optimizes performance in heavy-traffic environments through a feature called collision reduction. This powerful feature allows the adapter to intelligently monitor network traffic patterns, then dynamically increase or decrease the spacing between packet transmissions depending on the level of congestion. By continually tuning itself to accommodate fluctuating traffic levels, the adapter minimizes packet collisions and increases overall network performance. The collision reduction feature is ideal for heavily loaded networks, especially environments that experience the increased demands of 32-bit operating systems such as Windows 95, Windows NT and NetWare 4.1, LAN switching, high-performance systems and bandwidth-intensive applications.

Intel issues customized Adaptive Technology software upgrades for Windows and NetWare environments and their companion drivers via its site on the World Wide Web. Companies can license and download them at no cost on the Web at http://www.intel.com/network or http://support.intel.com.

Adapter Performance Benefits

Companies can expect to achieve immediate benefits in increased performance by deploying Adaptive Technology-enabled adapters. For example, tests conducted by Intel indicate that the first Adaptive Technology upgrade can provide the following throughput gains without increasing CPU utilization:

- 3 to 5 percent for NetWare environments
- 5 to 20 percent for Windows NT environments (Figure 2)
- 5 to 15 percent for heavily loaded Fast Ethernet networks

(The actual amount of throughput increase will depend on network loading.)

Optimizing Performance with Switches

Adaptive Technology brings a distinctive silicon advantage to the design of Intel Express Switches. When applied to switches, Adaptive Technology ensures optimal throughput by dynamically assigning the best switching mode of each port based on the level of network traffic. This optimization maximizes throughput, improves network stability, enhances productivity and extends the overall life of a company's networking products. Adaptive Technology optimizes the performance of Intel Express Switches in two ways:

- Adjusting switch performance on a per-port basis according to network traffic conditions
- Adapting to new network conditions on an ongoing basis, thereby preserving a company's investment in switches as traffic content and flow changes

Thus, companies are assured that the switch they purchase today will not become obsolete or less effective in response to changes in network environments that ultimately affect network traffic.

Intel Adaptive Technology can choose from among three switching modes to forward data packets in the most efficient way possible: store-and-forward, fragment-free and cut-through. This flexibility and automatic configuration results in better performance and time savings for a network administrator, helping reduce the cost of business computing.

Adaptive Technology increased throughput by as much as 20 percent in performance tests conducted by Intel.

Switch Implementation

Intel Express Switches with Adaptive Technology automatically select the optimal mode on a per-port basis. This adaptability capitalizes on the advantages of the three forwarding modes, which are described as follows:

Store-and-forward mode buffers data until the entire packet is received and checked for errors. This prevents corrupted packets from propagating throughout the network but increases switching latency.

Fragment-free mode filters out most error packets but doesn't necessarily prevent the propagation of errors throughout the network. It offers faster switching speeds and lower latency than store-and-forward mode.

Cut-through mode does not filter errors; it switches packets at the highest throughput and imposes the least forwarding delay. Intel Express Switches start out using the cut-through mode to achieve the highest performance

(See "Adaptive" on Page 12)

Microsoft School Agreement Overview

Tuan Nguyen, Microsoft Corporation

K-12 Educators Work with Microsoft to Simplify Software

You asked for it. Now we've got it! School Agreement from Microsoft is an annual comprehensive licensing program specially created to address the unique needs of primary and secondary education institutions.

Microsoft spent months working with primary and secondary educators to understand what schools needed in a licensing agreement. The result is a simple, flexible program that helps schools stay current with a broad range of Microsoft's most popular software.

Microsoft School Agreement Products

Microsoft School Agreement includes the most current versions of:

Microsoft Office® Standard & Professional Editions
Microsoft Office® Macintosh® Edition
Microsoft Works Standard
Microsoft Windows Upgrades
Microsoft BackOffice Server Client Access License (CAL)
Microsoft Encarta® Reference Suite & Encarta Online
Microsoft Visual Studio™ Professional Edition
Microsoft Office Starts Here™/Step by Step Interactive by Microsoft Press

Microsoft School Agreement also offers the following add-on Products (same price for all levels):

Microsoft® Project
Microsoft FrontPage®
Microsoft Windows® 98 Starts Here(tm) by Microsoft Press
Microsoft Windows NT® Workstation Starts HereÔ by Microsoft Press
Microsoft Web Publishing Step by Step Interactive by Microsoft Press
Microsoft School Agreement offers the flexibility of licensing a school or a school district. You will need to reach a minimum of 100 eligible machines.

Counting Desktops

Microsoft School Agreement is based on counting the total number of eligible machines in a primary or secondary education institution. In addition, you have the option to include any number of 486 machines or below if you choose to run the software on them. Eligible machines are calculated as follows:

100% of all Pentiums, Power MAC and iMACs +
# of 286, 386 or 486 machines +
# of Apple, UNIX, Windows Terminals =
Total # of machines covered (minimum of 100 machines)

For example, your school has 500 Pentiums, 200 iMACs, 200 386 machines and 200 Windows Terminals and you want to purchase School Agreement. You must include 100% of your 700 eligible machines (Pentiums and iMACs) in your machine count. You can then choose to only include 100 of your 386 machines and 50 of your Windows Terminals. You will therefore calculate the number of eligible as follows:

100% of the Pentiums and iMACS = 700
# of 386s your school needs to cover = 100
# of Windows Terminals your school needs to cover = 50
Total number of machines covered = 850

12-Month Term

Microsoft School Agreement is a subscription that gives you the rights to run the licensed software for a 12-month period, and licenses all upgrades and downgrades of the software throughout the term of the agreement. At the end of the agreement, you may (i) renew the license, (ii) extend the licenses by purchasing perpetual licenses, or (iii) remove the software from your machines.

The Price Is Right

School Agreement program requires you to meet a minimum of 100 machines, then depending on the number of total machines the pricing is tiered. Please contact your Microsoft Authorized Education Reseller or your local Microsoft representative for more details.

NOTE: The information and prices listed are for North American customers only. Worldwide customers interested in Microsoft School Agreement should check with your local Microsoft office.

Tuan Nguyen is K-12 Education Marketing Manager for Microsoft Corporation's Southern California District. He may be reached by telephone at (949) 263-3081 or by e-mail at tuanng@microsoft.com

SIGs: A Return to the Attendee Driven Agenda

Warren Williams, Ramona Unified School District
Scott Sexsmith, Merced County Office of Education

CEDPA has redesigned SIG meetings and returned to its previously successful format. In San Mateo on March 19th, in San Diego on April 8th, and in Merced on May 19th, MIS managers and other IS professionals met to discuss pressing issues. The new format was instituted to increase the attendance at SIGs that had been declining for a few years. For the past three years, CEDPA had asked vendors to co-sponsor SIGs. Vendors did an excellent job of hosting but attendance was still less than expected.

Most MIS managers indicated that they preferred to have wide ranging and open discussions without vendors in attendance. SIGs have historically provided a unique forum for IS professionals to discuss issues that confront them daily. Because members are addressing peers, there is frequently a healthy dialogue with many insights provided to resolve persistent and pressing problems. By maintaining a members only forum, managers can speak openly and can assist each other with strategies that have proven successful in other COEs, districts and schools.

The SIG meetings have always been an integral part of the services that CEDPA hopes to deliver to its membership. The SIGs purpose is to provide:

- An Excellent Opportunity for Networking with IS & Technology Managers
- Success and Problem Stories from the Experience of Others
- The Latest Technology Solutions that Work Based upon Real World Cases
- Discussion of Student and Business Systems
- Discussion of Personnel Issues
- Finding out Vendor Performance Information

The San Mateo SIG was hosted by the San Mateo County Office of Education. Sherry Trade arranged for an excellent meeting room. The setting provided for thoughtful discussion of many topics including Multiple Measures, managing on limited resources, student information systems, CSIS and SACS, terminal server, video over IP, and many more. Feedback from attendees indicated their pleasure with the new format. The twenty plus attendees indicated that they would be back to the next SIG. They also expressed the need to notify more IS managers of the meetings. This will be accomplished by sending SIG notifications to all County Offices for distribution.

The San Diego SIG was hosted by the technology staff. Tina Nerat, Bill Simpson, Jim Mathewson and Donald Stuver led a tour of the Joe Rindone Regional Technology Center. Many leading edge technologies were demonstarted. Most IS managers were interested in the voice, video and data integration hardware and software. In addition, legacy to vendor supplied software, Y2K, Cytrix and thin clients, Office 2000, and other topics were considered.

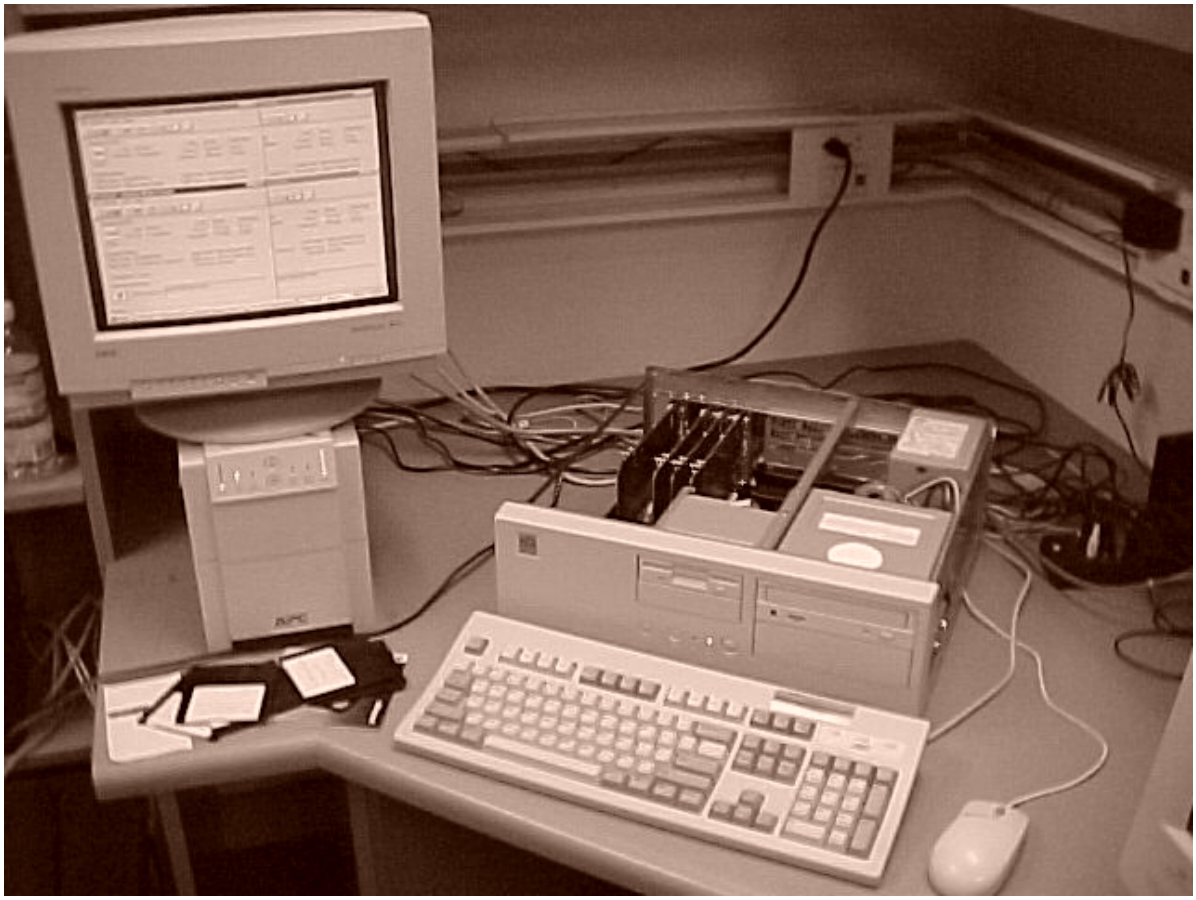
The Merced SIG was held on May 19th. Twenty-two attendees from various districts in the Central Valley including Santa Cruz, Bakersfield, and Stockton, were present. It was a good meeting with plenty of topics. Discussion times had to be limited to 15 minutes per topic in order to cover all topics of interest. CEDPA underwrote the cost of the SIG to determine the interest in holding a Central California SIG meeting. The group was polled regarding this and overwhelmingly indicated that cost was not a factor for these meetings. Travel time was the biggest issue and 10 or 11 had not attended a SIG meeting before.

Scott Sexsmith coordinated the meeting and was a fine facilitator. CEDPA President Terrell Tucker remarked that the meeting went quite well and everyone seemed to find great value in it, and that the idea of a Central Valley meeting was a good one. Attendance was good and discussion was lively – almost too lively at times. According to President Tucker, "It was difficult to cover all the topics, but Scott got us through them and gave demos of his video stuff as well." It was definitely a day well spent.

Future SIGs will be held around the State for convenience. Registration is $25.00 with lunch provided. It is CEDPA's intent to provide a forum that permits MIS managers to network with each other and to assist them with the myriad of issues that they must manage. Please send any suggestions regarding SIGs to wwwilliams@etc.net.

Video

(Continued from Page 1)



ogy, an older Pentium server will work fine. We used the old server for nearly a year before moving.

Another project was to build an encoding workstation that would allow us to encode a video source at multiple rates (up to four) in a single pass. Instead of having separate encoding workstations doing encoding at 56Kbs, 128Kbs, 256Kbs, and 512Kbs we could do it all within one system thus reducing labor, cost and space requirements. Since the NetShow encoders are software encoders (as opposed to hardware based) we're planning on needing dual-processors to handle the four encoding processes that we'll be doing.

This new workstation will house four Winnov Videum AV encoding cards that will run on Windows NT and have built-in audio and video encoders. Having audio and video on one card allows better synchronization and in this case allows multiple encoding cards in one system. The Osprey card we had been using in our single capture systems relied on the system sound card to capture the audio. Because of this we needed an encoding card that had both video and audio capture capabilities.

Major criteria for an adequately powered (and reasonably priced) encoding workstation was that it would have to have dual processor capabilities. We attempted to find a reasonably-priced dual processor system from the major suppliers. Unfortunately, all of these systems were designed to be high-end workstations (with expensive graphics systems, etc.) and were fairly costly. We then developed a plan to assemble our own system using quality hardware components. We ended up building a system based on the Intel L440GX+ motherboard, two Intel PIII 450 CPUs, 128 MB of SDRAM, Seagate 3.2 GB HD, CD-ROM, etc. running Windows NT 4.0. We also purchased four Winnov Videum AV PCI encoding cards ($174 each) for the system. Total price for the entire system with encoding cards was approximately $3,600.

The result of our efforts? The system is now up and encoding all four rates simultaneously. When we first tried the four encoding processes simultaneously, we could only get three of the four cards to begin to encode. With the three encoding rates running on the system

(See "Video" on Page 15)

Video

(Continued from Page 14)

(512Kbs, 256Kbs, and 128Kbs) the processor utilization was at about 95%-98%. RAM utilization was around 67%. After contacting Winnov technical support, we followed their advice and upgraded the encoding software to the new Windows Technologies Beta 4.0 released in April. After the upgrade we were successful in getting all four cards to encode. With all cards running the processor utilization was a full 100%. RAM utilization continued around 67%. (As a note, if you are going to do this don't forget to download from Intel the SIMD Extensions Driver that will be needed for NT to take full advantage of the Pentium III processors.)

It appears that we have pushed the current system to its processing limits. If we attempt to run any other service on the system, an audio encoding process on one of the cards will stop. The next step will be to test performance with PIII 500s. However we are very pleased with the ability to encode four streams simultaneously. We can now clear off a large portion of our encoding work area, and replace the three existing encoding systems with a single system. One of the biggest differences we see is that in observing the final output video stream, the new Winnov cards do a superior job in audio/video synchronization than the old Osprey cards.

What's next? As I mentioned above, Microsoft announced in April the release of Windows Media Technologies 4.0 Beta. This completes the transition from the NetShow "brand" to Windows Media. A most interesting feature in the new release is Microsoft's Intelligent Streaming. According to Microsoft, "New multibit-rate encoding enables developers to encode multiple data rate streams into a single streaming media file, so users click once and always receive the highest-quality video, regardless of the speed of their network connection."

What does this mean for us? It means we can encode a stream at multiple bit rates and an end-user can "click" on a single link and receive the optimum bit stream for their type of connection. If the connection degrades or improves, the stream rate should adjust accordingly.

We'll begin testing the new Windows Media Technologies 4.0 later this month. We'll try it on both our server and encoding workstations to evaluate the new features. Until then we'll continue to refine our current encoding and streaming processes.

You can find Merced County Office of Education's video-streaming site on the web at http://www.merced.k12.ca.us/metv.html. I can be reached via e-mail at ssexsmith@mcoe.merced.k12.ca.us. I'd also like to thank Vern Alvarado, MCOE Network Engineer, for his work on this project.

Vern Alvarado, MCOE Network Engineer

Speaker's Chair News

Oswaldo Galarza
ABC Unified School District

I am delighted to inform you that Carlene Ellis, Corporate Vice President for Intel, will be our main speaker on Wednesday at the Monterey conference. Carlene joined Intel in 1980 as a Manager of Planning and Control, Corporate Information Services. In 1983 she was promoted to Director of Sales and Marketing Administration. She become a Director of Corporate Information Systems in 1985, was named Vice President of Corporate Information Systems in 1987, and promoted to corporate office two years later. From 1988 to 1990 she was Vice President of Finance and Administration, from 1990 to 1992 Vice Present of Human Resources, and in 1993 become Vice President of Information Technology. Carlene was appointed Director and Vice President of Education for Intel in January, 1999.

As the former CIO of Intel, and current Vice President of Education, Carlene Ellis has a particularly relevant technology vision for education in general and CEDPA in particular. In her keynote, Carlene will discuss where Intel foresees technology heading for education and how schools (large and small) should develop their IT strategies. She will also discuss how Intel is using its resources to help provide advanced technology to schools, school districts, teachers and students. Intel's technology in networking, video, management software and silicon deliver the best in class solutions to the education market. Intel's goal is to enable schools to teach students better and to help prepare our students for the Technology age that is a part of our lives.

Breakout Sessions: The CEDPA membership's response to the breakout sessions has been excellent. Your CEDPA board has selected a number of great sessions for the November conference. Thank you for your interest and participation. Continue to submit your forms and ideas as we continue to pursue a conference that will have the greatest benefit for our members.

CEDPA's 39th Annual Conference
November 17-19, 1999
DoubleTree Hotel
Monterey, California

Vendor Show–1999

Mike Caskey
Stanislaus County Office of Education

Preparations for the 1999 CEDPA Vendor Show are continuing. We have sold 35 booths as of 5/15/99, and have commitments for several more. Due to the layout of the Monterey Convention Center, there will be no Kiosk displays this year.

Monterey is the site of one or our most successful conferences. It is also a site with a limited capacity for booths and we have commitments for about 60% of the total space available for vendor spots.

If there is a vendor that you would like for me to contact, please let me know. I not only have, but will respond to both voice mail and e-mail. You can reach me at mcaskey@stan-co.k12.ca.us or at (209) 525-5095. I appreciate your tips and suggestions.

The CEDPA vendor show puts you in contact with companies that are familiar with, and work well in the education environment. These companies support CEDPA and, in turn, deserve our support as we provide technology to our districts and county offices, and go about the business of "Switching Millennia".

Job Opportunity

PROGRAMMING MANAGER

San Joaquin County Office Of Education, Department of Information Technology has an opening for a Programming Manager. This position requires a minimum of 5 years programming experience, three years supervising programmers, excellent project management and technical skills. Knowledge of Macintosh, Windows98/NT, relational databases, object-orient programming, and payroll/financial systems are a plus. Excellent benefit package including medical, dental, vision, retirement, educational stipend & other. Five weeks a year vacation. Salary $70k. Application available from Personnel Office JOB HOTLINE (209) 468-4981. Send application, resume, letter of interest and 3 references to Personnel PO Box 213030 Stockton CA 95213-9030. Application review will begin June 18, 1999. Position open until filled. EEO/AAE

ABC Unified School District

16700 Norwalk Boulevard, Cerritos, CA 90703 (562) 926-5566

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OPEN TO ALL QUALIFIED APPLICANTS

POSTING DATE: May 20, 1999 **FILE APPLICATION:** June 11, 1999
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ESSENTIAL DUTIES AND RESPONSIBILITIES: Assists in the collection and analysis of information for projected computer applications for the purpose of scheduling, monitoring and prioritizing projects.Analyzes problem or deficiencies in District computer related systems for the purpose of recommending solutions or improvements to systems.Coordinates departmental activities for program development, application software and operating systems upgrades, LAN installation and telecommunication upgrades for the purpose of ensuring activity outcomes and that project deadlines are met.Designs and analyzes District computer systems for the purpose of ensuring systems integration. (Mainframe, Mid Range, Network) Develops, modifies, tests and debugs computer programs for the purpose of ensuring that program execution conforms to design criteria and specifications. Provides technical assistance to District personnel and Information Systems staff for the purpose of determining project scopes, requirements and costs for the purpose of establishing department priorities.Produces and revises programming and documentation standards for the purpose of maintaining computer systems.Provides programs specifications and operational instructions for new programs for the purpose of evaluating computer operations. Prepares reports and/or presentations for the purpose of documenting and conveying information regarding District computer and communications systems. Trains Information Systems and other District personnel in the operation of District computer systems and programs for the purpose of supporting them in the completion of their work. **Other Job Functions:** Assists other personnel as may be required for the purpose of supporting them in the completion of their work activities. Attends various meetings (e.g. district, site, etc.) for the purpose of communicating and/or gathering information. **QUALIFICATION REQUIREMENTS**: **Education and Experience Required**: Bachelors degree in computer science, business administration or related field, or equivalent experience and two years of course work or certificate program in computer science field. **Experience Required**: Minimum five years prior job related experience within specialized field with increasing levels of responsibility. **Skills, Knowledge and/or Abilities Required**: **Skills**: Ability to perform multiple highly complex specialized technical tasks (i.e. integration of a variety of computer operating systems; mainframe, mid range & network environment). Other specific skills required are to operate computer equipment, plan and manage projects, prepare and maintain accurate records, utilize pertinent software applications (i.e.Word/WordPerfect, Excel, Access, Netscape, CC:Mail, Powerpoint, Internet) communicate with persons of varied cultural and educational backgrounds. **Knowledge**: Ability to read technical information, create and/or compose documents (i.e. program documentation, hardware manuals), ability to perform basic math including fractions, percents and ratios and to analyze situations to define issues and draw conclusions (i.e. program and Network design). **Abilities**: The complexity of the job requires significant flexibility with people and equipment; ability to exercise discretion, independent action and/or judgment in working with people and equipment; independently analyze issues, and create a plan for each a solution. The job requires responsibilities for resources and oversite of people including leading, guiding and/or coordinating. **SIGNIFICANT WORKING CONDITIONS INCLUDE:** an environment subject to noise from equipment operation and interruptions. Significant physical abilities include sit for prolonged periods, the capability for occasional stooping, and kneeling, frequent reaching/handling/fingering and/or feeling, near and/or far vision, depth perception, visual accommodations, color vision and/or field of vision, and talking/hearing conversations. **Licenses, Certifications, Bonding, and/or Testing Required**: Criminal Justice Fingerprint Clearance, Valid Driver's License and evidence of insurability.

SELECTION PROCEDURE: The selection process may consist of any or all of the following: training and experience evaluation, written examination, performance test, technical oral interview and general qualifications appraisal interview.

DISABLED? If you have a verifiable disability please inform Human Resources prior to the examination so that any possible accommodations can be made within the testing process.

AN ELIGIBILITY LIST WILL BE IN EFFECT 6 TO 12 MONTHS OR UNTIL FEWER THAN 3 CANDIDATES REMAIN ON THE LIST.

Adaptive

(Continued from Page 6)

possible. If the error levels on any given port reach a certain threshold, the switching silicon automatically changes that port's switching mode to the best (and safest) forwarding mode, depending on the type of error. This sensing process is repeated independently for each port, making performance on the entire switch truly optimal — without requiring human intervention (Figure 3).

To accomplish this optimization, the switching silicon uses a combination of per-port Remote Monitoring (RMON) management counters and fast internal state machines to determine the amount and type of errors, in real time, at each port. This information allows the switch's Adaptive Technology capability to achieve the best balance of performance and data integrity at each port, without affecting the overall switch forwarding rate and performance.

Conclusion: Optimizing Performance While Protecting Your Investment

Intel is committed to delivering technologies that help companies build and maintain faster, simpler networks. Intel continues to lead the way in this initiative by exercising its silicon expertise to come up with a long-term strategy for optimizing performance, easily and without the costs of hardware upgrades.

Adaptive Technology adds a new level of investment protection to networking. Adaptive Technology-enabled adapters let companies take advantage of the latest Intel advancements in silicon design and performance technology — minus the drawback of high support and service costs. Adaptive Technology-enabled switches prolong their value to companies by automatically adjusting to ever-changing network conditions.

Craig Rodgers is a Corporate Account Manager for Intel Corporation. Craig may be reached by telephone at (909) 597-2216 or by e-mail at craig.rodgers@intel.com.

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