



# Graduating to High-Speed Cabling

By Carol Everett Oliver and Arlene Franchini



When you think of coal mining, cotton fields, catfish, southern farms and riverboats, the states of Kentucky and Tennessee may come to mind. But, you don't usually equate these areas to high-speed, high-bandwidth cabling. Recently, through government grants, elementary and high school students in certain low-income areas of Kentucky and Tennessee are getting the advantages of the most advanced voice, video and data networking systems. Everything from wireless backbones to the latest ratified Category 6 connectivity to the desks are allowing students in these areas to become proficient in the newest technologies and educational computer programs.

Behind every technologically advanced school district are efficient school committees who have the savvy necessary to obtain high-tech tools for their students. Take for example, John Dalton, superintendent of the Wayne County School District, KY, who has dedicated his career to the advancements of his students. For eleven years, he was the technology coordinator for the district before becoming superintendent seven years ago. "Through the Kentucky Education Reform Act, the Kentucky Educational Technology System (KETS) was formed in 1993 to focus on putting technology in the classrooms and to standardize a cabling system for all schools in the state," he notes. "All students in the public school districts across the U.S. should have equal access to

technology no matter what the income level is of that town. Fortunately the government compensates for the lower income areas through the FCC's Universal Service Fund combined with state grants," he notes.

Today, many of the schools in these areas are being recabled with Category 5e or Category 6 to each classroom, library and media center. "Hopefully this will put our students on an equal playing field with the rest of the country," adds Dalton. "When you're cabling schools that have been around since as far back as the 1930s, you want to be assured that your cabling system will be warranted to last at least ten years or until they get a new facility," states Dennis Gomer, president of Computer Consulting & Network Design, Inc. (Benton, KY), who is instrumental in designing and specifying systems for these schools. "Therefore when I design an infrastructure for a school system, I want to build in the best cable and connectivity to last," he adds.

Together Gomer and John B. Allen, president of Application Services, Inc. (Campbellsville, KY) an installation firm, have assisted many school districts in Kentucky and Tennessee in applying for the "E-Rate" government funding. Upon receiving these funds, Gomer and Allen have designed and cabled new schools and re-cabled existing schools to provide high-speed Internet access through a sen-



**CeilingCable:** The Berk-Tek LANmark-2000 data cabling runs above the ceiling to the student and teacher desks at Cooper-Whiteside Elementary School (Padukah, KY).



**Racks:** The MC in the Cooper-Whiteside Elementary School (Padukah, KY) included the Ortronics Mighty Mo II cable management racks that house the Category 6 connectivity, fiber distribution enclosures, coax patch panels and all the electronics for voice, data and video. The cable then goes up the conduits into the ceiling and is horizontally distributed.

sible structured cabling system. The students and teachers have become well connected and are now appreciating the many benefits of Internet access, as well as advanced educational software tools.

### E-Rate: More than Just a Free Lunch

The Schools and Libraries Corporation is a newly formed not-for-profit organization established by the Federal Communications Commission to administer the Schools and Libraries Universal Service, popularly known as "E-Rate." E-Rate was created as part of the FCC's Telecommunications Act of 1996 to ensure that all eligible schools and libraries in the United States have affordable access to modern telecommunications and information services.

All kindergarten through 12th grade schools (public and private) and public libraries qualify for the program and receive discounts according to their level of economic disadvantage. This is determined by the percentage of students eligible for the national school lunch program, which is submitted annually. The Fund was created to make telecommunications services affordable for every school

and library. A school or library will receive discounts of 20 to 90 percent on telecommunications services, internal connections, and Internet access. Discounts are applied to the full price, and the school or library will pay for the remainder, after the discounts are applied. Although the Fund will not pay for desktop computers, learning software, or teacher/librarian training, schools and libraries can use the funds they save on telecommunications infrastructure to support these elements of a comprehensive technology plan. The Fund is capped at \$2.25 billion annually. Funding is provided by the telecommunications industry, following the long-established tradition for assuring affordable access to telephone service for all.

"We have tried to standardize the components of the cabling infrastructure to make it easier for the schools to determine the percentages allotted for hardware as well as installation costs," notes Gomer. "With systems warranted by the manufacturer and certified contractors for up to 25 years, a standardized structured cabling system for the LAN within the school districts made it much more conducive than just installing a couple of modems and computers," states Allen. "Since each school is laid out differently, the pathways may be different, but the system can be standardized," he adds.

With new schools, it is easy to design a cabling system before construction. However, Gomer and Allen have designed many layouts depending on the space available within the existing facilities as well. This includes utilizing existing classroom or library space for the termination equipment, or even installing it between the ceiling and the roofs.

### Wireless LAN in Wayne's World

The Wayne County School District

(Monticello, KY) has one of the most intricate communication systems installed. Through government funding and subsequently with a creative design, they were able to install a wireless backbone to allow gigabit to the desktop through high-speed copper cabling. Currently 100 Mbps is running to the desktops with an in-building fiber optic backbone installed at 1 Gbps. Wayne County's campus includes three elementary schools, one middle school, a vocational technical school, and one high school. The campus is located on 20 acres. The RF signal, through antennas placed on each building, provides remote communications between each facility. All the buildings are then cabled with coax from the antenna to the access point, then connected through (UTP) copper cabling to the Telecomm closets and patched through Ortronics 48-port Category 5e patch panels with Berk-Tek's LANmark-350 Category 5e and at the high school patched 48-port Category 6 patch panels through LANmark-1000 Category 6 for data and video.

The pathways were determined by the available space. "We used one-inch conduits between the trays and the individual drop locations for horizontal runs. Because we could have as many as 300 cables running through the trays, we used trapeze hooks for the beam attachments to better stabilize the tray," explained Allen. "Cable management is important because we want to prevent any cable sagging, which could lead to degradation of the signals," he adds.

When the high school was recabled through renovations and a new addition, the design included Ortronics patch panels, patch cords, workstation outlets, cable management racks and panels in addition to replacing the old Category 5 with Berk-Tek's LANmark-1000 for the highest speed available.

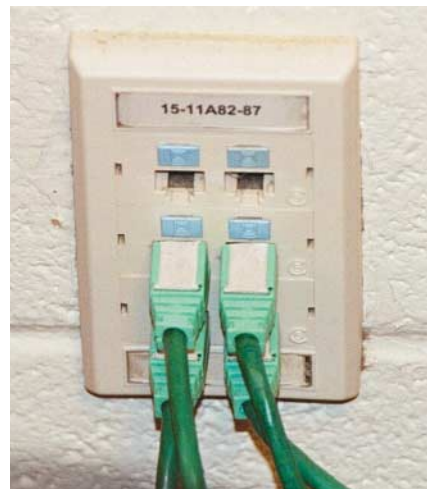
Through Berk-Tek/Ortronics alliance, this design provided NetClearGT2, an above the standards end-to-end high-performance and capacity cabling solution consisting of a fiber optic backbone and Category 6 horizontal copper cabling to the workstation outlets to assure greater performance, bandwidth and throughput.

"Our old system was a 10 megabit system which quickly became slow and outdated," notes Superintendent Dalton. "This new wireless network operates at 11 Mbps backbone, and with the new cabling we are capable of one gigabit to the classrooms at the high school. I'm hopeful that we are set, at least in the high school, for 8-10 years," he adds.

### Standardized Layouts

Most of the schools were provided with a standardized set of Ortronics connectivity products. All the Berk-Tek fiber optic backbone cabling between closets is terminated in the MC and ICs to Ortronics ORMMAC fiber distribution cabinets. From there, it is patched over Berk-Tek's LANmark-350 Category 5e, LANmark-1000 Category 6, or LANmark-2000 enhanced Category 6 through Ortronics Clarity6 48-port patch panels and then either through Category 5e, or even Category 6 for the horizontal runs. The Mighty Mo II racks are bolted to the floor and grounded. The conduits for horizontal distribution are placed vertically on top of the racks and then distributed in trays above the ceilings and down to the individual workstation outlets.

"Where it was viable, we would design and implement an above the standards Category 6 system for the ultimate in bandwidth, speed and future proofing," states Gomer. This was true at not only the Wayne County High School, but Allen also retrofitted a NetClearGT3 channel



StudentOutlet: Ortronics Series II workstation outlets contain 6 data ports for computers in the classroom at the Bell Elementary School (Wayne County, KY)

solution, at the Cooper-Whiteside Elementary School (Paducah, Kentucky) and at East End Elementary (Humboldt, TN), as well as the new Muhlenberg North Middle School (Greenville, KY).

The number of connections determined the number of Mighty Mo II racks per closet. Basically, there were two racks in the MC and one in each IC. In each classroom, there are six computer network connections - one for the teacher, five computers for the students and one printer connection.

Each workstation outlet was similar in design. Ortronics Series II(r) outlets or Clarity6 TracJack(r) outlets were utilized because of their modularity to fit into any design or opening. Series II faceplates were installed at all the Wayne County buildings. "For strength and durability in classroom environments, we installed stainless steel faceplates and Clarity6 TracJacks, where possible," states Allen. "For the Cooper-Whiteside Elementary School, we also installed the stainless steel Clarity6 TracJack outlets that could easily snap into existing Wiremold's G4000 raceway, which was put in place in 1992 for side-by-side power and communica-

tions cabling,” he adds.

The outlets were configured similarly throughout most of the schools. The port outlets were color-coordinated according to the application. Blue denoted data, red was for voice, green for receiving video and yellow for transmitting video. For the student computer outlets, six blue ports were designated for five computers and one printer and located on one common

faceplate. The jacks at the teachers’ desks included one data (blue); one voice (red) and one transmit video for a camera (yellow).

There were also video connections through enhanced Category 6 cables in each classroom and library. With enhanced Category 6 in video applications, higher frequencies and longer distances can be realized, and 120 channels of video can be transmitted versus 70 over Category 5e. Separate video outlets were placed higher on the wall in many rooms to allow for monitor hookups. Receiver video connections at the television locations use the green icon.

The numbering system was also standardized so that they could easily match the port in the closet to the outlet. The first number denoted the classroom number/location; the next series indicated the cabling closet location, the rack number, and the panel number (where there were more than one patch panel) and the last digits indicated the individual port numbers.

### Unique Configurations

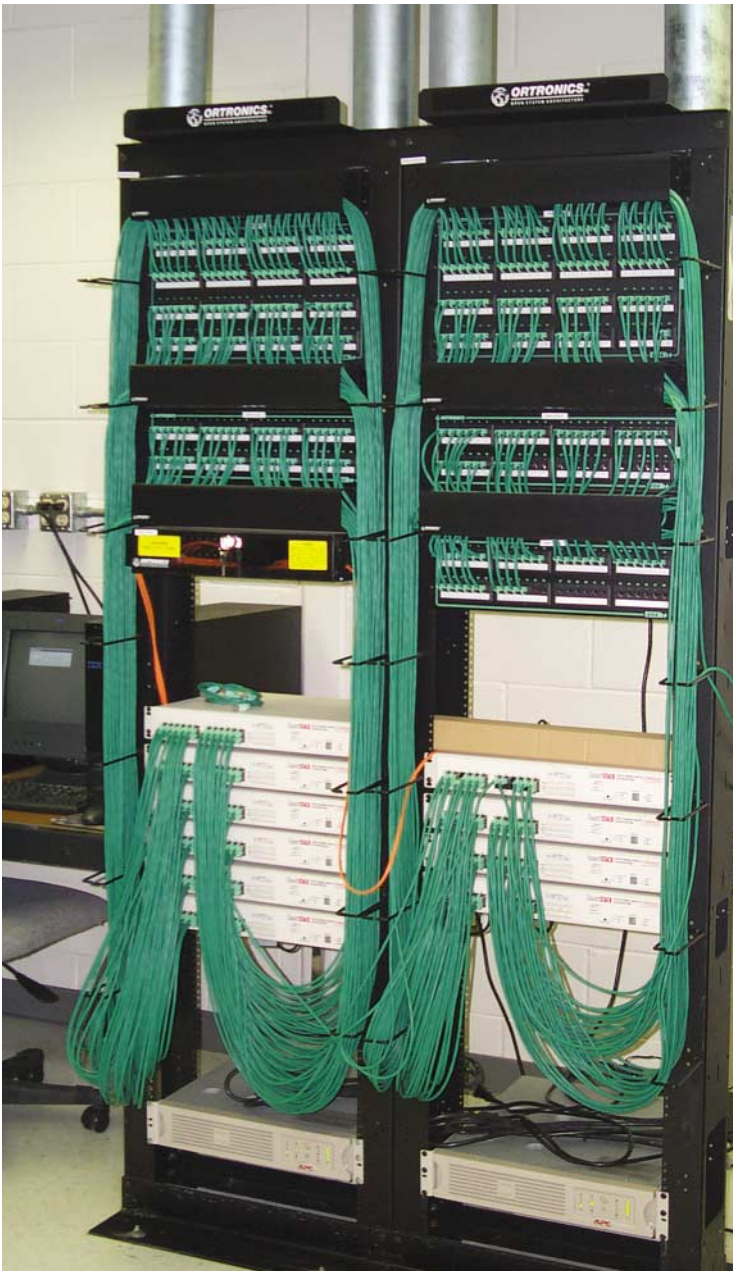
“Even though the cable and rack layouts and product mix were standardized, we were faced with individual challenges at each school posed by different installed areas for the termination equipment, particularly those retrofitted in the older schools,” notes Gomer. The most unique design was at Muhlenberg North

Middle School. “We were building a new school while utilizing the existing facility,” states Larry Bender, Technology Director for the Muhlenberg County School District. “We had to keep the old system running, while we were building the new. Because of this we have redundant coax and enhanced Category 6 for our video system.”

The new HVAC and communications equipment was installed on a concrete mezzanine that ran the length of the building between the ceilings and roof. There was enough height to put in the equipment racks above the HVAC systems on the concrete mezzanine and then run plenum cables down to the classrooms and other workstation outlets. This worked out well as it is out of sight and protected from any access other than the telecommunications or maintenance people. Because of the length of the mezzanine, there is one MC and two ICs located there.

When retrofitting the cable at the Cooper-Whiteside Elementary School, they recently pulled out their Category 5, which had been placed in 1992, and installed an enhanced Category 6 horizontal solution, thanks to E-rate funding. The MC was placed in an existing auditorium/gym behind the stage. The IC was located in a separate closet in the library that had been recently added. A separate video MC is in the A/V room off the library. “This was a challenge. As in most areas, there wasn’t any conduit installed, so we had to pull out the Cat 5e in the raceway and replace it with Cat 6,” states Allen.

“We wanted the Category 6 because it gave us a chance to leapfrog technology and get the highest rated system with available funding,” states Jeff Nelson, Technology Director for Paducah (KY) Independent School District.



IC: The Ortronics Mighty Mo II cable management racks in the IC at the Wayne County High School cross-connects for video from the Category 6 patch panels to the video equipment.

East End Elementary in Humboldt, TN, was built in the 1960s but was also able to have Category 6 installed. "We are going to be building a new wing for this school and we are excited to have the latest and greatest technology available for our students," comments Garnett "Butch" Twyman, Superintendent of Schools. "Pulling cable in this school was a challenge for Application Services since the roof is preform and precast full of steel. The installers had to be careful cutting through the steel for the integrity of the ceiling," he adds. "We had six drops to every classroom, although there are only three or four computers now in each. We hope to add more later," adds Albert Simmons, director of Technology for the district who was instrumental in getting the funding approved for this school, which is the first in their district to get high-speed

Internet access. "We hope that the four other schools in this district will soon follow suit."

### Cat 6, not Cat-fish

"The catch-phrase seems to be 'The more you give, the more they want' for both students and teachers when it comes to technology," states Twyman. "The teachers are very excited about training, to learn how to integrate technology and computer teaching in the classroom," he adds.

In many classrooms, teacher and students are already researching over the Internet, as well as utilizing educational software, such as for book reports, that are listed in a national library listing system. "The computers have revolutionized the way the staff and students learn," comments Linda Jones, Director of Public Relations for the Wayne County Schools. "For

example, attendance figures, statistical information and staff data has been streamlined through the Software Technology program, which schools use across the state," she notes.

"In the future, we hope to work with colleges and let our high school students work towards college credits," notes Twyman. The new Cat 6-based cabling infrastructure and leading edge technology now gives these students resources to better prepare for their future endeavors. **CBM**

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