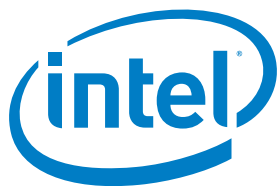


# edIT: It's Time to Change the Story

Building the Education Infrastructure





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# Empires of the Future: Empowering Tomorrow's Leaders

Sir Winston Churchill delivered a speech in September of 1943 at Harvard University during which he said, “The empires of the future are the empires of the mind.” No doubt, in the midst of World War II, his audience understood the concept of military and industrial empire building and what it took to be successful. It is equally important for us to understand what it takes to build those empires of the mind because today’s global competition for power and wealth has become a competition of human knowledge, particularly in the realm of scientific and technological progress.

While nations position themselves to compete, individual students are bringing a new generation’s interest in collaboration and cooperation to their educational activities. Supported by an explosion of social networking tools, students prefer to work together, explore together and learn together in a manner unlike any other time.

This rise of global competition in a knowledge-based economy and student preference for collaboration demands an educational transformation that supports the development of 21st-century skills.

Experience shows that those skills are best taught in eLearning environments that include the effective integration of information communication technology (ICT). As we look to the future, the Software and Information Industry Association’s Vision K-20 initiative for education calls upon institutions to use technology and eLearning to increase student engagement and achievement; provide equity and access to new learning opportunities; document and track student performance; empower collaborative learning communities; maximize teaching and administrative effectiveness; and build proficiencies in 21st-century skills.

This is an ambitious agenda to be sure, but one worth pursuing. As we continue to look to the future, we must not lose sight of the realities of the data-driven educational environment, complete with high-stakes accountability measures and the requirement for educators to quickly identify and address individual student needs. Early detection and analysis of student needs and the ability to implement the appropriate corrective action is a fundamental component to improve student learning outcomes. This kind of just-in-time response depends on teachers’ and administrators’ access to the totality of a student’s record. By using data from administrative and instructional systems to understand relationships among decisions, allocation of resources and student achievement, educators are able to appropriately apply resources when and where they will be most effective.

Teachers are worrying about students. At the same time, administrators, state officials and the public are worrying about teachers and school effectiveness. A 21st-century school infrastructure creates the opportunity for increased transparency, accountability, efficacy and efficiency. By putting the appropriate infrastructure in place, schools are able to bring down the walls that have historically divided administrative, operational, disciplinary and generational fiefdoms within educational institutions.

The benefits that come from bringing down those walls can be significant in terms of organizational improvement and financial savings. Technology acquisition is often successfully funded through innovative restructuring and reallocation of existing resources. Replacing labor-intensive, expensive and error-prone manual systems with proven information technology capabilities can help create savings within existing budgets, which can be used to further invest in the ICT infrastructure; thus, enabling continued innovation improvement of robust learning environments without increased funding.

As we look to the future and the kind of empires of the mind we want to create in our schools, districts, communities, states and nation, we must remember the choices we make should be based on the best evidence and expertise available. The experience Intel has gained while working with educators around the world demonstrates that the creation of data and information-rich learning communities — which train students to identify common problems, share ideas and strategies and develop and deploy real-world solutions — are indeed the foundation of a new world of learning.

*Eileen Lento*

*Intel Strategist: Government and Education*

# It's Time to Change the Story: Building Education Infrastructure

*We are convinced that technology is transforming and will continue to transform the way teachers and students learn. This involves much more than merely changing paper worksheets to computer ones or providing advanced calculus to rural students through distance learning. Technology will change the nature of the learning process from a passive endeavor to an active one as students, young and old, access information and work with others from around the world.<sup>1</sup>*

*- Deanna H. Durrett, Regional Policy Information Center Director, 1994*

In the early 1990s, there were few who stated the promise of technology so emphatically. Conversations and decisions about technology were passed on to the computer guy, gal or geek, who occupied a corner of the data processing center or a desk in the server room. This person, isolated from the business of education, was in charge of keeping the e-mail running (for the few schools that had e-mail), rebooting computers in the school's computer lab and buying the software necessary to keep the “darned” things running. Increasingly, though, information technology plays a central role in the lives of students, in managing schools and school districts and, most importantly, in educating. Technology is critical to education today. Students expect it; teachers need it; principals and administrators depend on it.

If you are skeptical about the importance of technology in education, consider the students. Forty-five percent of teenagers and 90 percent of college students have a cell phone. Most college students do not install landline telephones in their dorm rooms. Eighty-six percent of kids are gamers.<sup>2</sup> World of Warcraft, an online Internet game, boasts more than 8 million players worldwide.<sup>3</sup>

Teaching these hyper-connected, hyper-communicating, mobile, multitasking kids requires a different approach from the 20th-century “sage on the stage” approach to schooling. Schools must integrate technology into the learning environment, speaking and teaching in the language the students use. Add to this the cost savings, efficiencies and service improvements that can be gained through automated systems, and the case for technology becomes more compelling.

To reach students in ways they understand, teach students using the power of mobile multimedia pedagogy and manage education organizations in ways that yield significant efficiencies, schools are compelled to build a robust technology infrastructure. IT infrastructure is a critical part of school build-out, as critical as the buildings, classrooms and furniture.

This book, compiled by the Center for Digital Education and underwritten by Intel Corporation, will explain technology infrastructure in terms education administrators and teachers understand, making the case for infrastructure as an imperative in education.

The following chapters showcase examples from across the country about what has been achieved using technology and provide high-level strategies for building an infrastructure in your school or district. Each chapter includes examples from various sized schools and school districts. It concludes with case stories of schools that have accomplished amazing results by combining imagination, vision and technology.

### Infrastructure

A general definition of infrastructure is, "An underlying base or foundation especially for an organization or system."

In the technology world, this underlying foundation includes:

- the transmission media, including the cabling, telephone lines, cable television lines and antennas (for wireless transmission);
- the devices to control these transmission paths, such as routers and repeaters;
- the software used to manage the communications sent over these lines; and
- the servers that host the software.

Infrastructure is fourth on the "Top-Ten IT Issues 2008" list issued by EDUCAUSE, a nonprofit organization whose mission is to advance higher education and to promote the use of technology in education and that has one of the largest conferences on education every year.<sup>4</sup>

# The Imperative

*Through technology in schools, a new approach of “networked education” must be implemented to “go beyond bandwidth, addressing fundamental issues such as equitable access and closing the achievement gap.”*

Students are growing up in a world that is vastly different from the world most of their teachers grew up in. The Millennials have the distinction of being the first generation that has not known life without a mobile phone. And the phones they know are equal parts phone, camera, media player and computer. With them in hand, students are entrenching new habits and creating the future at the edges as old-school educational institutions struggle to understand how to make corresponding changes at the center.

Communication and social interactions are no longer limited by time and space; in fact, they are now location independent. This shift is at the heart of the way students interact with each other. This generation of students thinks, works and acts differently, forming relationships through a new language of text messaging and social networks, such as Facebook and MySpace.

This fundamental shift is not a stage students will outgrow once they enter the working world. Rather, it represents a shift that is all-inclusive — from relationships to commerce to the work that will need to be done in this century.

Vinton Cerf, often touted as the inventor of the Internet, drives this point home. He said that online collaboration and role-playing sites are used more for entertainment than anything else but will play a more important role in the future.

“I expect to see substantial increase in collaborative use of computing and communication in virtual environments,” Cerf said. “Today we have Second Life and World of Warcraft. I don’t see why these can’t become a materially useful basis for carrying out business, education and scientific research. Think about scientific experiments where you have shared instruments online that you interact with on the Web.

“Imagine a virtual lab, where kids interact with a virtual instrument, but having a real instrument somewhere else respond. You can imagine kids being invited into lab, interacting, having real instruments produce real results for them to use.”

By 2035, Cerf said that the world population is predicted to be about 8.12 billion, with Asian countries representing an ever-increasing portion of the population.

“We will be competing with India, China and Europe,” he said, “and they will be bigger than us. Our GDP at that time may be only half of the Asian GDP. This isn’t something we can solve. ... We need to rely on being really smart on how we use our resources.”<sup>5</sup>

The generations with the primary responsibility of managing these challenges will need the skills necessary to be innovative in an increasingly global world.

## The 21st-Century Student

A quick review of the habits of the Millennial generation reinforces the idea that the shifts in communicating and socializing will have a significant impact on the world. Myspace and Facebook, created by Millennials, have transformed socializing for those under 25 years old. Facebook, a strange land to those who formed their social skills before the days of instant information access, reflects the Millennials' times, their preferences and their view of the world<sup>6</sup> — anywhere from 75 to 90 percent of college students have an account.<sup>7</sup> Social networks are changing how youth interact with each other and how they interact with their world.

Texas Rep. Mark Strama tells the story of using high school interns in his recent re-election campaign. One intern job was to walk the neighborhoods, knock on doors and ask people to support their candidate by displaying a sign in the front yard. It was the middle of a Texas summer, and the young interns were not excited about days spent outside in the heat. Instead, they devised a plan to create a Facebook account for the campaign. They reached out to anyone with an account who lived in Strama's district and asked if they could be friends. Creating the electronic equivalent of signs in the front yard, they asked their new friends to put a statement of support on the page, link back to Strama's campaign site and pass the word to other friends. Within a week, the campaign's Facebook profile had more than 5,000 new friends.<sup>8</sup>

Sen. Barack Obama's presidential campaign dwarfs these numbers, with 761,910 Facebook supporters in April 2008, which is more than double what it had been a year earlier.<sup>9</sup>

The "Horizon Report" states that the growing use of Web 2.0 and social networking is gradually but inexorably changing the practice of scholarship.<sup>10</sup>

A new, first-of-its-kind study from the University of Minnesota confirms this statement. Christine Greenhow, a learning technologies researcher in the university's College of Education and Human Development and principal investigator of the study, said, "What we found was that students using social networking sites are actually practicing the kinds of 21st-century skills we want them to develop to be successful today."

Greenhow said that the study's results, while proving that social networking sites offer more than just social fulfillment or professional networking, also have implications for educators, who now have a vast opportunity to support what students are learning on Web sites.<sup>11</sup>

## Skills for a New World

An initiative by the National Governors' Association (NGA) titled "Innovation" emphasizes the need to approach education in a fresh way. There is a gap between what students are trained for and the skills they will need to resolve the challenges of the future.

The skills framework developed by the Partnership for 21st Century Skills is well known;<sup>12</sup> however, there is still a significant gap between what students need to know and what they are learning. A national survey on how well America is preparing its young people for the workforce found an overwhelming 80 percent of voters say that the kind of skills students need to learn to be prepared for jobs is different from what they needed 20 years ago. Yet a majority of Americans say that schools need to do a better job of keeping up with changing educational needs.<sup>13</sup>

The NGA Innovation initiative cites a more startling statistic: 1.1 million Americans drop out of high school every year. That's one person every 29 seconds, 6,000 people every day.<sup>14</sup>

A report by the Education Commission of the States asserts that a new approach is needed. Educational institutions need to make a fundamental shift to personalize and customize the education process and participate in a collaborative community of students and educators. Through technology in schools, a new approach of "networked education" must be implemented to "go beyond bandwidth, addressing fundamental issues such as equitable access and closing the achievement gap." Through this approach, every school across the nation "can share the same tools and resources, regardless of a school's size or geographic location. Every student can access advanced courses, regardless of whether he or she is planning to enter the workforce directly after high school or plans to pursue higher education." According to the report, this new approach can "help enable 21st-century outcomes for all students by making education personalized, equitable, relevant and cost-effective."<sup>15</sup>

### Facing Challenges

The challenges of connecting with students in ways that are relevant to the world and teaching skills that are critical in today's world are running head-on into some realities of the 21st century:

- a shortage of teachers;
- the aging of the other infrastructure – schools' physical buildings and facilities; and
- increasing concerns about the environment.

# Connected Teaching

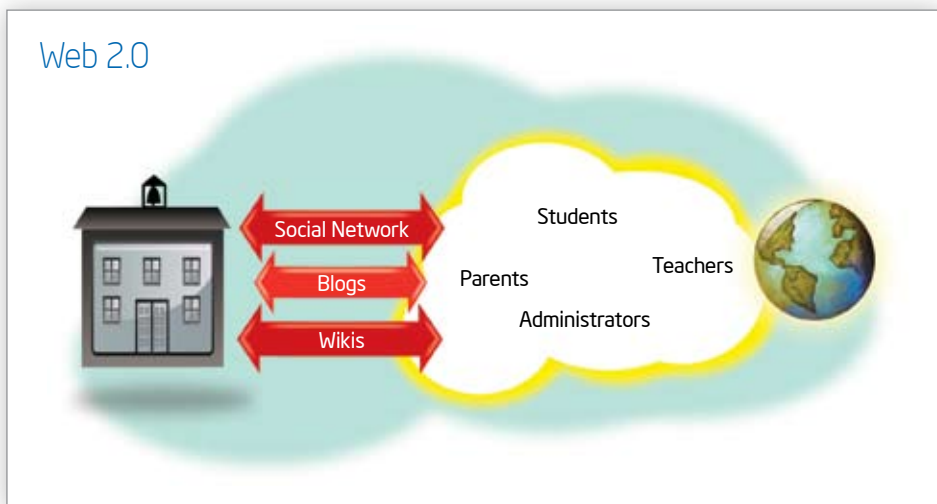
Computers — and technology in general — are moving into the classroom. Teachers have the ability to access and present material, provide individualized and self-paced learning for students and perform ongoing student assessment.

Podcasting, online gaming, wikis and simulations are among the new technologies that help teachers connect to the world, and in turn, connect to students.

Seventh-grade students at Longfellow Middle School in La Crosse, Wis., are writing, editing and splicing podcasts, hoping to reach large audiences. A podcast is a digital recording that can be downloaded from the Internet. Language arts teacher Jeanne Halderson created the “Coulee Kids” podcast with only a few computers. The program has become popular with students who sometimes use their lunchtime to work on their podcasts.<sup>16</sup>

Teachers are introducing these resources to children as young as 5 years old. Maria Knee, a kindergarten teacher at Deerfield Community School in Deerfield, N.H., has been using a class blog for three years. The students post blog entries, which helps track their computer literacy throughout the year — most of the kindergartners have never used a computer before.

“That is so powerful because they know someone is paying attention to them,” Knee said. “They’re looking for comments from the world because they know that they have the power to talk to people around the world. That’s their future. In industry, people have to know how to talk to people from around the world.”



Of emerging technologies, online gaming is one of the most frequently used by students.<sup>17</sup> North Carolina public schools tested the popular Quest Atlantis game, a 3-D virtual environment where students must complete both educational and entertaining “quests” or tasks. The program received high marks, with teachers reporting differences in student achievement, particularly those with poor performance records.<sup>18</sup>



Some of the most exciting new technologies to enter the classroom are video conferencing and virtual fieldtrips, which can transport students to a different world — or, in some cases, to a different time.

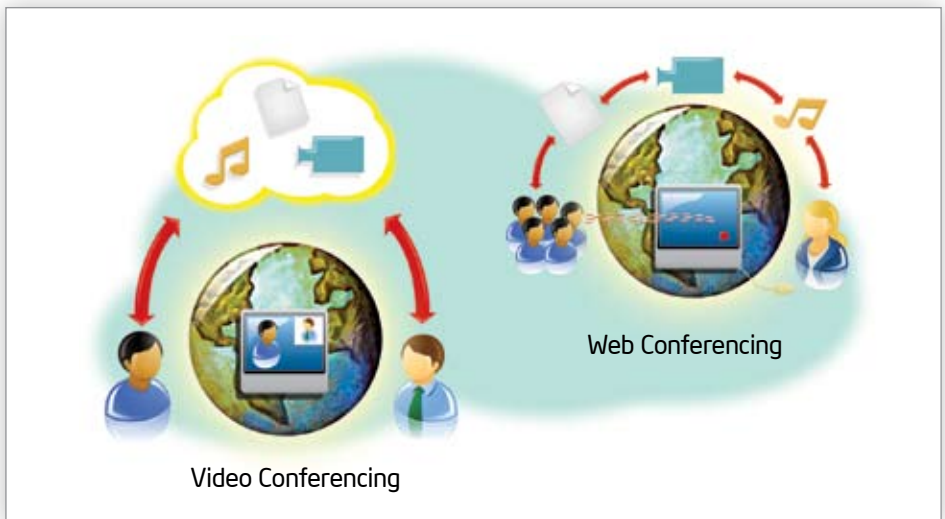
## Live from the Antarctic

Many are familiar with the famous line from *Saturday Night Live*, “Live from New York, it’s Saturday night!” In the early days of the show, thousands of faithful viewers would wait for Chevy Chase to fall and announce the lines that would transport them to New York and the specific brand of humor that came to be known as *Saturday Night Live*. Those who wanted to see that week’s stunt had to tune in at a specific time, on a specific station. Either you tuned in or you missed out.

Schools now have a way to transport students to New York’s Metropolitan Museum of Art, San Francisco’s Museum of Modern Art, a NASA explorer station under the Antarctic and California’s most remote parks.

Through the use of video conferencing, students can experience a range of activities never before possible. And, unlike the weekly television show, these visits can be scheduled around classroom needs.

California's state parks are accessible to students through video conferencing. California's parks system, the nation's largest state park organization, houses some of the most diverse natural resources in the United States. Kids who live too far away to travel for fieldtrips can experience these vast resources. Park rangers give guided tours and answer questions in interactive sessions.



## Doing More With Less

While virtual fieldtrips and video conferencing can create unique learning opportunities, not all schools have the funds to make these a reality. But schools can still create a rich and exciting learning environment by integrating technology that has been around for a while. The savings are two-fold: Older technologies generally come with a lower price tag and the learning curve is faster for teachers that have had more experience with the programs and machines.

A projector, connected to a computer or by itself, gives teachers a way to bring a remote concept to life and make it relevant to the kids in the classroom. Add to this an interactive whiteboard, and the benefits can be huge. These devices facilitate team learning, improve student involvement in the lessons, increase conceptual understanding and provide individualized learning.

Katy Independent School District in Katy, Texas, is working to put a projection system in each classroom in the district.

“The teachers love this,” said Lenny Schad, CIO of the school district. “They use it for just about everything.”

Projection systems also received a warm welcome among teachers at the Poway Unified School District. The district is located in northern San Diego County, Calif., and encompasses an area of 100 square miles of suburban San Diego, through the rural city of Poway.

“The teachers started using the projection systems as soon as they were installed,” said Robert Gravina, the district’s CTO. “We hadn’t even started the training yet.”

#### FAST FACTS:

- Mineola Union Free School District, a small district in Nassau County, N.Y., with five elementary schools, one middle school and one high school, installed a video-on-demand system to expand its learning environment.
- Clark County School District in Clark County, Nev., installed an automated library system that is tied to online resources and can be accessed by any computer in the district. Instantly, all schools have access to research and education resources within the district.

## Connecting to Parents

Connected teaching isn’t only about connecting teachers and students to the world. It’s also about connecting them to those a little closer to home. Parents can have the most influence on a child’s progress in school and getting information to them is critical. Study after study highlights the importance of parental involvement in a student’s success. In fact, it is the single most important factor.

Parents of students in Maria Knee’s kindergarten class at Deerfield Community School can follow classroom activities through the class blog, which acts as an online bulletin board. Knee posts several times per week, including pictures of class projects and examples of student work in her blog entries.

At San Antonio’s Northside Independent School District in Texas, parents can track their child’s grades, attendance records and test scores through a Web portal called Parent Connection. The interactive system can send e-mails to parents when certain triggers are activated. For example, if grades drop below a pre-set level established by the parents or if a child is absent.

Parent Connection, which offers services in English and Spanish, also displays links to articles that inform parents on trends, such as social networking Web sites and health-related issues or that give tips on academic success.

## Case Stories

### Winchester Public Schools

Winchester, Mass.

3,800 students

Instead of practicing French language skills with English-speaking peers, the administrators at Winchester Public Schools in Massachusetts had a better idea. They collaborated with students from a French school to assist English students with their language skills — and in turn, students from Winchester assisted the French pupils with their English.

“They were mentoring each other,” said Annamaria Pisari Schrimpf, director of education technology for the district. “They would share written work back and forth in their different languages.”

Although this communication was done through e-mail, Schrimpf said she plans to incorporate video conferencing. This way, students will be able to see what their language pen pals look like.

Schrimpf said the school is also trying to incorporate more Web 2.0 tools in the classroom. She developed an online course for teachers to learn about iGoogle, podcasting, wikis and blogs.

“I’d like to see them get in the hands of our students during the school day,” she said. “I think they’re at a disadvantage when they come into school without the resources.”

### Fort Wayne Community Schools

Fort Wayne, Ind.

31,600 students

Franke Park Elementary, a small neighborhood school in Fort Wayne, Ind., was a NASA explorer school in 2006. Through video conferencing, third-grade students travelled with NASA scientists to the Antarctic, below the ocean, to collect meteorites. These 9- and 10-year-olds questioned engineers and scientists about the experiments, how much money they made and what it was like working for NASA. This was an awe-inspiring experience — most of the kids had never left Indiana.

“We love video conferencing,” said Pamela Ghaffarian, the teacher largely responsible for Franke Park’s selection as a NASA Explorer School. “[The students have] talked with scientists and engineers around the nation. They talk to kids in other schools about what it’s like in other parts of the nation. They’ve been with a team racing in the Iditarod.”

Students also experienced the challenges of building and piloting a remote vehicle similar to the Mars land rover. As part of a grant, students at Franke Park received a LEGO rover construction kit. They constructed the rover from more than 800 LEGO pieces and programmed it to be piloted remotely. After a test run, they shipped the rover to a sister school in Chicago, Ill., where they can pilot the robot and monitor its progress through the video conference link.

## Montgomery County Public Schools

Rockville, Md.

137,745 students

A story that started with one Maryland teacher ended up involving 100 students from six different countries — all through Web 2.0 tools. George Mayo, an eighth-grade English teacher from Silver Spring International Middle School is using resources such as blogs and wikis to demonstrate the way student work can be a resource to the world.

“Students regularly received comments from other teachers and students across the country and sometimes from abroad,” he said. “It’s incredibly motivating for students to know that they are writing for a real audience. It’s also better for students when they receive feedback on their writing from other people besides the teacher.”

His mission began with the Exploding Walls project, taking assignments created by his students and sharing them with a large audience. The English students posted information on a blog and wiki called Many Voices for Darfur, which increased awareness about the tragic situation in the African region to classrooms all over the nation. Mayo’s class used video conferencing to recruit other teachers to join the Darfur blog.

Mayo’s students also wrote a collaborative story using Twitter, a micro-blogging service. Micro-blogging allows bloggers to write short text updates and publish them. One student would write a short blurb, and then another student — sometimes from the other side of the world — would add the next part of the story. After more than 100 posts, the end result was a story that chronicled the journey of a mermaid.

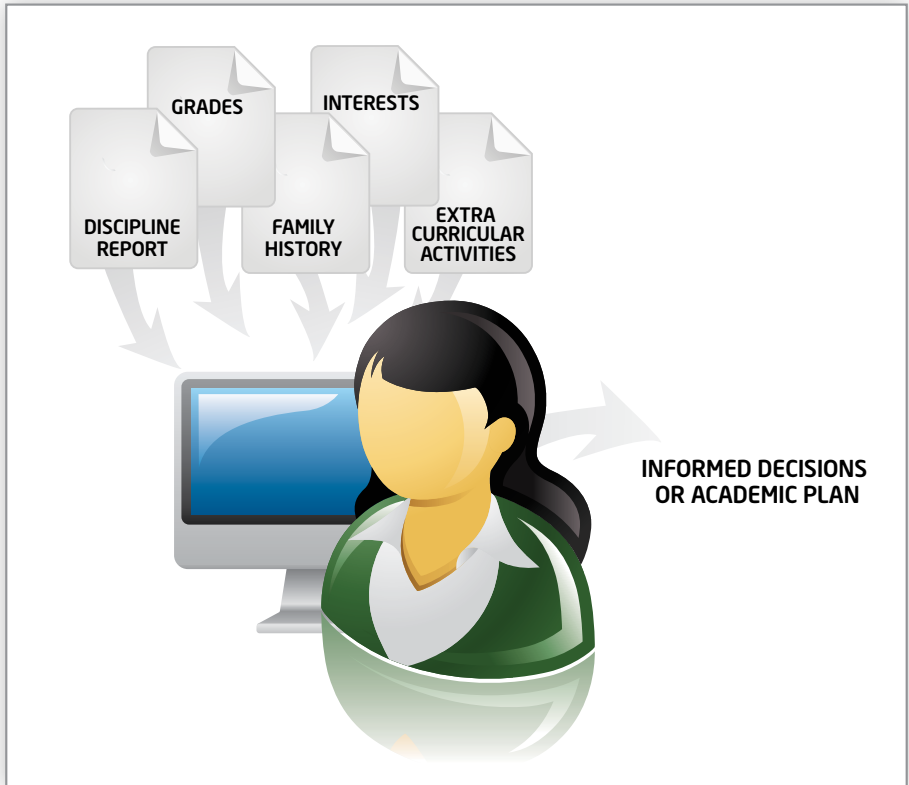
“Web 2.0 gives students an instant audience for their work,” Mayo said. “When they know a particular assignment or project is going on the Web, they put more thought into what they are doing.”

# Managing in a Whole New Way

With new technology comes the need to consolidate resources and increase efficiency. The short shelf life of new equipment requires school leadership to create innovative policies that will cut costs while generating sustainable programs and applications for students, teachers and parents. Effective management can mean the way districts organize data such as transportation systems, communication lines and student information.

## Culture of Data: High-Stakes Accountability and Data-Driven Decision-Making

The No Child Left Behind Act took effect in 2002, and with it came high-stakes accountability — higher than schools had ever known. Schools were, and continue to be, responsible for ensuring students meet predetermined levels in learning, measured by standardized testing in certain grades. Inability to meet these standards can result in loss of federal funding.



With these high stakes, school administrators and teachers must find ways to collect and analyze student data to make informed choices, identify problems and correct them *before* end-of-the-year testing.

Prior to having such requirements, teachers gauged students' learning progress intuitively, without taking into consideration other factors that may affect a student's academic performance

Jim Hirsch, the associate superintendent for academic and technology services at Plano Independent School District (PISD) in Plano, Texas, said that simply reporting test scores wasn't doing teachers or students justice.

"We needed to be able to take a look at the scores and model those scores in such a way that gave a more complete picture that predicted a student's typical learning ability versus the projected curve that students need to get to if they're going to meet a standard at a certain grade level," Hirsch said.

Three years ago, PISD implemented a platform that contained a variety of indicators about each student in the district. Teachers can access data about each student in the class — language abilities, special needs, financial status, cognitive abilities and assessment test results. By itself, this information is still raw data — numbers and statistics — but the tool PISD uses displays data in an analytic model, highlighting students' growth and trouble areas.

"You can look at the history of what their [student] performance has been on state tests, the adaptive achievement test and the ability test," Hirsch said. "Have they been

### Course Management Systems

Course management systems can be used for long-distance and online education or as a sidekick to brick-and-mortar classrooms. These Web-based applications facilitate student-instructor communications — whether administrative or academic, in many ways.

Alexandria City Public Schools (ACPS) in Virginia started using a solution by Blackboard Inc. in order to maximize the benefits of its one-to-one laptop project — the initiative provided devices for all ninth- to 12-graders. The solution not only eased student-teacher interactions, but it also encouraged peer-to-peer communications at all levels. In addition to tracking students' scores and performing other common tasks, teachers began exchanging ideas on how to create efficient multimedia-based lesson plans. Students used the discussion board feature to collaborate on projects and participate actively in class conversations.

## Student Information Systems

Student information systems provide capabilities for entering student test and other assessment scores, building student schedules, tracking attendance and managing many other student-related data needs in a school, college or university. These systems are also known as student information management systems (SIMS, SIM), student records systems (SRS) or student management systems (SMS).

These systems vary in size, scope and capability, from packages that are implemented in relatively small organizations to enterprise-wide solutions that aim to cover most aspects of running large multi-campus organizations. Many systems can be scaled to different levels of activity and can be configured by their home institutions to meet local needs.

on a positive trajectory? Are they staying right on the expected path? Are they starting to move below their expected path? Is there an issue we need to be aware of?”

By viewing data from an analytic model, teachers focus on an individual student’s trouble area and see exactly where the student started struggling. The data not only assists the teachers, but it helps the school district see which teachers excel with certain types of learners.

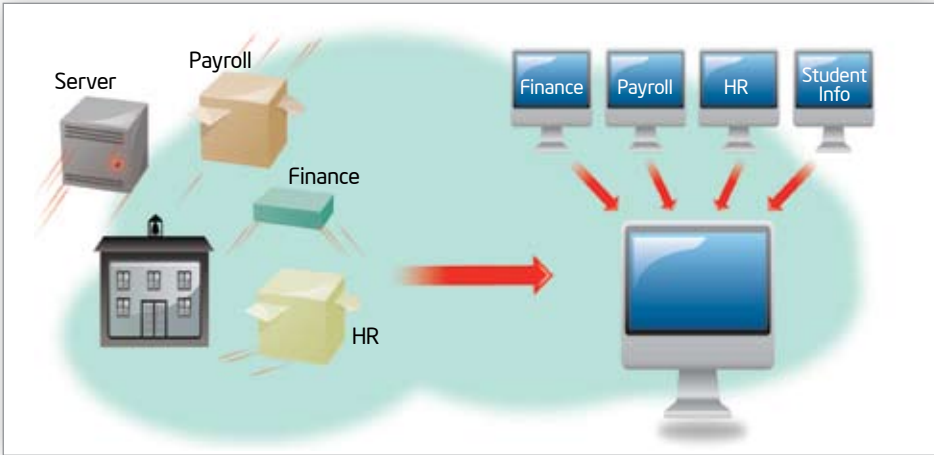
Hirsch said that the data portal helps match students and teachers in order to maximize the learning experience. By examining students with certain indicators who are succeeding in the classroom, other students with the same indicators can be matched with that teacher.

“With the right learning experience in a classroom, these students are much more successful than if they’re struggling within the learning environment itself,” Hirsch said. “We’re more interested in that individual student’s growth curve.”

By using raw data and turning the information into a model teachers can use, PISD has been able to conduct data-driven decision-making for the district’s 53,000 students — all with different backgrounds and learning abilities.

## Human Resource Management Systems

While students are their main priority, schools would not be able to run efficiently were it not for faculty and administrators. And to make sure these individuals are taken care of, a human resources management system that organizes employee data is also necessary.



Scott Price, the director of technology at Glendale Unified School District (GUSD) in Glendale, Calif., said one of the biggest problems with school districts is that the systems they use are disparate. Departments will design customized spreadsheets for keeping data because they don't know how to use the proprietary software.

“You want something that you can extract easily — do on-the-fly queries and something that is intuitive so that if you have users that aren't used to working with an HR system, they can learn quickly,” Price said. “So they can patch data together for different projects.”

These are the tools that support a school district's human capital. The more attention schools pay to these systems, the stronger their workforce. Human resource management systems ensure employees' needs are taken care of by providing timely pay-checks, offering flexible work hours and benefits programs and showing employees' training development. Additionally, it stores private information such as employee address, background and length of employment.

GUSD moved to the county's system four years ago, which means the district uses the county's online software instead of its own proprietary system. Before this, GUSD had used the same proprietary software for 20 years — writing over it again and again with the programming language COBOL. Price said the decision to switch was mostly financial — using the county system saves the district more than \$200,000 annually.

For GUSD, the county software has been the most cost-effective way to store employee data. However, school districts can also look to home-grown tools and business models — whatever it takes to keep human capital healthy.

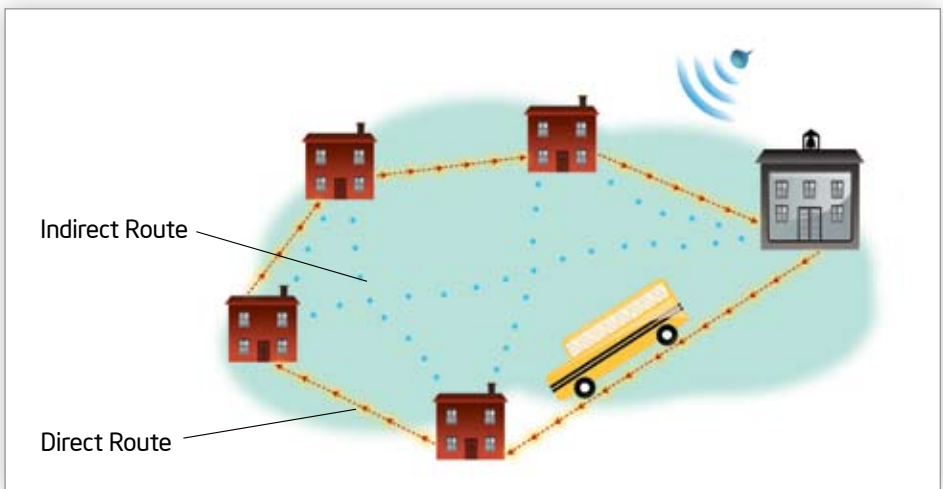
## Getting on the Bus

Almost every district in the nation has school buses. From New York City’s fleet of about 10,000 public and private buses to the small and mid-sized fleets that most districts manage, buses and transportation are important issues for schools. Tight budgets — particularly with increasing fuel costs — and concern over the impact of vehicle emissions on students’ health and the environment are compelling districts to run their fleets as efficiently as possible. Transportation systems not only help schools run fleets efficiently, they can also provide instant answers to one of the most common questions in days leading up to the start of school: “Where does my kid catch the bus?”

Katy ISD implemented a bus routing and parent information system because the schools and the district were inundated each year with calls regarding transportation. The district implemented a bus management system that plans the routes, making more efficient use of the bus fleet, and also includes a Web-based component. Parents can look up their kids’ bus routes, stops and pick-up times.

Clay County School District in Green Cove Springs, Fla., had similar reasons for installing an online component to their bus routing system.

“Parents can now go online to get their bus routing information instead of trying to get through on busy phone lines,” said Bob Veres, the district’s transportation director. “The system helps the district better communicate with parents and saves the district office from the deluge of phone calls that hit at the beginning of each year.”



## Keeping Kids Safe

Schools must have emergency plans — and the communication systems necessary to support those plans. School, district and public safety officials must be notified when an emergency occurs. Parents must be informed regularly and accurately. Clark County School District chose to do this through a converged communication system (see p. 32 for a discussion on converged communication). When a 9-1-1 call is made, the call comes to the district police with the building and room number where the call was placed.

Emergency notifications can also be sent automatically to the parents, as principals have the ability to issue these notifications from any phone, including a cell phone.

“In the spring of 2008, we had a power outage,” said Dr. Phil Brody, CTO of Clark County School District in Las Vegas, Nev. “The school needed to be evacuated; at the same time, the principal needed to notify all parents. While heading out the door, the principal used her cell phone to send notification to 2,700 parents in about 30 seconds.”

If a parent has multiple students in a district, the system will bundle the calls so the parent gets one notification.



## Teaching Teachers

Teachers are an integral part of the foundation for building 21st-century skills. But before teachers can instruct their students, they have to know how to use the technological skills themselves. How to get teachers professional development — with their notorious lack of extra time and districts' lack of money — has been an ongoing conundrum. With technology advancing at a dizzying pace, this is an even greater problem. School administrators must equip teachers with the tools they need to educate students for the 21st century.

One way for teachers to receive professional development sans travel is online. Educators across the nation have caught about to the idea of podcasts as a way to collaborate about best practices. The Teachers' Podcast, developed and produced by Dr. Kathy King and Mark Gura, has 3.5 million listeners. Recent podcasts have discussed mini laptops making their way onto the market for elementary students, such as the Intel Classmate PC and use of the Nintendo Wii in the classroom.<sup>19</sup>

Teachers Teaching Teachers is another online resource for educators. A part of the Worldbridges Network — a community focused on homegrown webcasting — Teachers Teaching Teachers gives participants online chat capabilities while the session is recording for answers to questions and the opportunity for additional collaboration.<sup>20</sup>

Another online teacher training initiative is the Florida Online Reading Professional Development (FOR-PD), which offers teachers free courses on how to help students become proficient readers. Course participants learn how to apply scientifically based reading research through instructional strategies. The FOR-PD course offers teachers and administrators an abundant amount of rich and relevant resources on reading and classroom implementation.<sup>21</sup>

From 2005 to 2007, Florida's fourth grade reading and math scores improved — rising above the national average score of 220 and 239, respectively. And eighth grade reading scores also increased in this period, making it one of six states that saw an increase in this time frame.

By using a mixture of online development tools, schools can accomplish several goals: cutting cost by using free resources; enhancing teacher abilities by providing them with cutting-edge materials; and improving student achievement with the guidance of trained teachers. It's a cycle that benefits everyone.

## Case Stories

### Denair Unified School District

Denair, Calif.

2,200 students

Although it may be small, Denair Unified School District (DUSD) is taking precautions to keep its 2,200 students safe. The district implemented a call system that allows administrators to send a message to staff, parents and anyone off campus in the case of an emergency.

“Anyone in the district can program in a message and that will go out to every parent and every cell phone of every teacher,” said Kelley Day, a board member for DUSD and a program manager for the California Resource Network.

Day said that a principal at one of the district’s schools used the call system during a shooting in a nearby neighborhood. The principal immediately sent a message to his staff to alert them about the circumstance, and the students were placed on lockdown until the situation was resolved.

### Central Valley School District

Spokane, Wash.

12,000 students

The Central Valley School District (CVSD) located near Spokane, Wash., saved thousands of dollars after implementing an automated bus routing system. For decades, the Central Valley Transportation Department generated school routes using paper maps, pushpins, plastic transparencies and colored pens. Addresses for every Central Valley student had to be located on a paper map and marked by hand. Transportation professionals manually developed routes by grouping students and marking pick-up points. Today, the district uses a GIS-based routing system and a bus manager database to quickly develop more than 200 routes.

“In the past, all of our routers had to look at a map and try to figure out the best routes,” said Debra Holmes, transportation supervisor of CVSD.

What once involved combing through map books and a virtual busload of information — or worse, manual field data collection — is now just a few mouse clicks away. In the past, if parents called and wanted to know the distance between their house and the nearest bus stop, a transportation official would often have to jump into a car, drive to the area and manually calculate the distance. This was a time-consuming process. Now, that process is automated and streamlined. A parent can type in an ad-

dress and get a map with the closest bus stop marked. With the click of a button, the distance pops up on a screen.

The district has been able to save one week in the time it takes to develop the routes. It eliminated half a dozen routes and has saved the school more than \$125,000.

## Waterford School District

Waterford, Mich.

12,000 students

Keeping track of 12,000 students has become a breeze for Waterford School District in Waterford, Mich. For the past year, it has used Microsoft Office's SharePoint to store student data and enhance teacher collaboration. When teachers log onto their classroom computer, student data is at their fingertips — attendance, grade books, state test results, individual curriculum benchmarks, formative assessments, ethnicity, socioeconomic status and special education requirements, just to name a few.

“It's an incredibly powerful tool,” said Michael Batten, assistant superintendent of Instruction and Accountability. “The more data our teachers have, the more precise we can become in our decisions about what programs to support. And we can allocate our resources to our needs because we have a much clearer vision of what we need.”

Batten and Superintendent Robert Neu said the data platform has increased teacher collaborations. If students in one classroom are excelling in an area where students in another classroom are struggling, teachers are able to exchange curriculum information with one another.

“If we're going to meet all children's needs, then we've got to have the data to drill down and learn their learning styles with real-time data,” Neu said. “We're asking teachers to work in collaborative teams.”

Although the data is helping teachers assess their students, it's also assisting the district in determining where teachers need to improve. Neu said that they will never use the data on a teacher's evaluation form, but teachers will be asked to present a plan for improving in areas they are lacking.

“We have to allow our teachers time to meet the kids where they are,” Neu said. “And not just focus on the assessment and not live only by the data point.”

By creating a warehouse for the students' data, the district offers teachers a forum to assess student progress and use this information for professional development.

## State of Oregon

552,194 students

Recognizing the importance of making accurate, relevant data available to decision-makers and teachers, Oregon is building a statewide data system that will help promote a culture of data-driven decisions. Oregon is working to consolidate student data from disparate systems across the state into a common system. The Oregon Legislature wanted to reduce the reporting burden on schools and districts.

“We were assessing school performance, measuring schools around the state, but we didn’t have standard ways of tracking and reporting performance,” said Baron Rodriguez, technology and information systems director for Oregon’s Department of Education.

The data-driven decision model will create the data structures to support teachers and education leaders and develop a methodology to measure and report on individual student growth.

The overall program is comprised of four components:

- The **Oregon DATA Project**, a three-year, \$4.7 million initiative, funded through federal education money, is a statewide initiative designed to improve student achievement through the use of data.
- **Teaching-Learning Connection (TLC)** provides training on Oregon’s Data-Driven Decision-Making model, focusing on teaching educators how to collect, analyze and use appropriate data.
- The **KIDS Project**, an \$8.3 million project, funded by the Oregon Legislature, will integrate student information systems from across the state into a common data warehouse. The goal is to provide the Oregon Department of Education and district stakeholders with a single, accurate and authoritative student data structure for the entire state, enabling data sharing between districts and the state. The project is on track for implementation in fall 2009.
- The **Longitudinal Growth Model**, a \$1.8 million initiative included in the Governor’s Recommended Budget for the 2007-2009 biennium, is developing a process that allows the state department of education, schools and districts to track the learning progress and growth of individual students over time. The goal is to provide a multi-dimensional view of student achievement.

# Building the Foundation

The previous chapters discussed the “why” and the “what” of technology in schools. This chapter covers the “how” — as in, how to build, fund and manage a technology infrastructure — and why the stuff that nobody sees matters.

Technology infrastructure is the necessary foundation that allows schools to connect students to an amazing array of teaching resources available through the Internet, with experiences such as exploring the universe with NASA scientists and visiting California’s redwoods. It helps connect parents to their children’s teaching experience through homework lines, access to grades and other progress reports and communication with the school and teachers. It connects teachers to professional development opportunities and supports them with materials, tools and online communities. Finally, infrastructure is the foundation that helps district administrators run a more efficient operation.

Technology infrastructure, by its nature, is also easy to take for granted. Like roads, bridges, ports, the electrical grid and public buildings (including, notably, schools), digital infrastructures are an assumed part of the landscape. Taken together, these infrastructures — made of steel, concrete and silicon — are the foundation on which communities and the country rely. Regrettably, much of that infrastructure is a half-century old — and it gains public attention only when it fails or falters. Even the Internet, the nexus of so much innovation during its first incarnation, is four decades old.

The genius of infrastructure is that, when well designed and built, it does what it is intended to do — and for longer. But even the best built infrastructures have their limits as they labor under unanticipated and often unprecedented loads, and for much longer than their creators would have imagined. By one estimate, renewal of the nation’s infrastructures would cost \$1.5 trillion.<sup>22</sup> The need for that level of public investment was underscored by a presidential candidate in his acceptance speech when he concluded, “We need to catch up with history.”<sup>23</sup>

What is true of the nation is also true of school districts and even of individual school buildings. They have come a long way in the last decade, when classroom technology was limited to chalk boards, overhead projectors and an occasional telephone. Indeed, through concerted effort of the public, private and nonprofit sectors over the last decade, most of the nation’s schools enjoy broadband Internet access, almost ubiquitous PC penetration to classrooms and a critical mass of 1:1 laptop to student ratios. All of that, as praiseworthy as it is, is still closer to the beginning of school modernization than the end.

Building on these advances requires recognition that digital technologies are the new platforms for educating. Putting the long view aside, the near future requires that technology infrastructures be sufficiently nimble and robust to meet today's needs and tomorrow's expectations. And to be clear, the infrastructure will be tried from all sides. Administrators need the capacity to support data-driven decision systems that track staffing, student attendance, school bus fleet management, food supply and safety; teachers are turning classrooms into online learning environments and neither they nor their students will tolerate the latency of slow-speed connectivity or processing; and students (who, importantly, are native to the Internet) are creating new communities of interest, discovering new learnings and making new uses of commodity technologies. All of this will take place — and is taking place — at once. Rationing will not do. The success of all these endeavors has a single point of failure: infrastructure. It must be good enough, strong enough and big enough to get the job done today and tomorrow.

Behind the curtain, it is about what technologists informally refer to as speeds and feeds, bits and bytes. But for educational users regardless of role (administrators, teachers, students and their parents), it is ultimately about the experience: Is it rich? Is it rewarding? It is relevant? In the end, infrastructure delivers on the promise of a better educational experience.

## Infrastructure

When computer professionals begin talking servers, router and switches, the meaning and purposes are often lost to those on the outside. While the language — and, too often, the ensuing explanation to a request for translation — may not be straightforward, the concepts are.

### *Servers*

A server is a specialized computer on a network that provides a service to client computers by sharing its resources within the network. A server can be as simple as a singularly purposed system that is set up to share files with another computer, or it can be a powerful set of machines specially configured to run complex systems, such as an organization's communication platform. No matter what the configuration, the key concept is that a server provides a centralized set of resources that can be shared in a cost-effective manner.

### *Routers, hubs and switches*

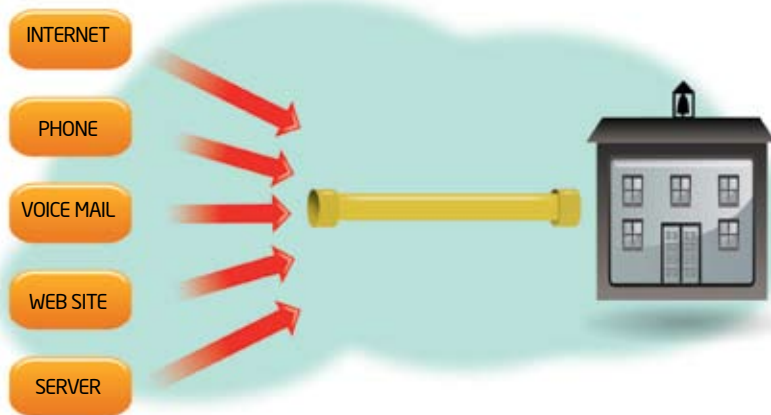
Routers, hubs and switches are perhaps the least discussed part of an IT system. If it were not for the lights flashing on the front of them, no one would notice that they were there. Their purpose is to provide an effective “traffic system” for the data that is passed among the computer systems. Essentially, these components direct the information traffic in the most efficient manner. This direction is important to provide the highest-speed connection with the most reliability. At a simple level, hubs connect computers within a classroom or building; switches connect between classrooms or buildings; and routers connect campuses or schools to the Internet.

### *Network speed*

Network speed is generally measured in “megabits per second” (Mbps). That is, how many millions of bits per second are carried between computers and systems. Within a school, newer wired networks are generally 100Mbps (100 million bits per second) and can even be 1Gbps (1 gigabit per second). Older networks are often 10Mbps. Wireless networks often operate between 1Mbps and 54Mbps.

Network speed is most important when considering the connection of your school to the Internet. As students often do simultaneous work in labs or classrooms that involves the Internet, that speed slows and a bottleneck can occur. The second place of consideration is wireless networks. Wireless access points are perhaps the least understood piece of equipment, and their speed can be affected by quality of equipment, building materials and number of users.

Finally, a critical element to discuss with your IT professional to maximize your network speed is the division of your network into small sections connected by switches and routers. These not only provide the best speed, but also optimize reliability and management of potential issues.



## Converged Networks

*Converged network: A single network with the capacity to carry a combination of data, voice and video traffic.*

### According to EDUCAUSE:

The challenge of maintaining and enhancing campus infrastructures has become more acute due to a number of factors: more complex environments that are subject to intrusions and security breaches; more demanding technology users and higher expectations for always-on service; new pressures on sustainability and the environment; and budgets that are never quite sufficient to cover priority investments.<sup>24</sup>

Converged networks offer a way for universities and community colleges to address complexity, security and budget pressures.

Converged networks provide the ability for:

- multimedia instruction;
- distance learning;
- improved network security;
- cost control;
- wired and wireless connectivity as well as voice, video and data on the same network with the same security protections; and
- the ability to connect dorm rooms, support centers, business operations and other campus facilities.

## Building IT

In any technology project, there is a basic continuum of “build it” or “buy it.” At one extreme is the in-house solution — complete the project using in-house staff only. At the other extreme is the outsourced solution — outsource the entire project to a service provider. The service provider may be a vendor, a consortium or a public entity, such as a university or a local government.



The implementation strategy depends on the organization’s ability to take on the project, funding and timeline.

Before undertaking the creation of a technology infrastructure, it is critical to assess the organization’s ability. If the organization has a strong, experienced technical staff with experience implementing networks, most of the work can be done internally. If the staff has little experience with infrastructure and networks, or has never attempted such an implementation, vendor support for the planning and implementation is worth the investment.

Decision-makers should regularly ask themselves, “What business are we in?” The answer to that question should guide their decisions about where they want to expend resources (human and financial) and how much and which types of risk they want to assume. If their answer is that they are in the business of educating children then they should keep IT as simple and straightforward as possible, looking for others who can create or provide what they need. They should only take on the things they must have that cannot be better or more cheaply provided by others.

Most organizations find themselves somewhere on the continuum, rather than at either end. Lenny Schad at Katy ISD included staff development as part of his technology plan. He began the infrastructure implementation with a heavy reliance on consultant expertise. As the project progressed, he trained internal staff in the technical areas that he knew the district would need on an ongoing basis. While the initial mix was about 60–40 consultant support, the district is working toward a support model that is almost exclusively internal staff, with consultants used only for specialized areas.

Clark County in Las Vegas, Nev., used primarily internal staff for its infrastructure project, augmenting, with consultants in cases where either the district couldn't pay a competitive salary for an expert or the skills were only needed for a short period.

Smaller districts may want to look at a consortium model, where multiple districts band together to lease or build one system, then all contribute funding for operations and maintenance.

## Finding Funding

Even in the best of times, funding school technology can be challenging. In tough economic conditions, finding support and money for technology initiatives can seem daunting. However, there are some practical, imaginative ways to fund school technology projects — even with tight budgets.

One study suggests that one of the most important factors in funding technology projects isn't related to the economy at all. Instead, it's visionary leadership. The report "Digital Leadership Divide" finds that "schools that are committed to deepening the impact of technology are finding ways to raise or repurpose funds to maintain or increase their level of support for technology, even in difficult budgeting cycles."<sup>25</sup> The report also states that leadership is needed in a variety of places and at multiple levels. In districts where technology budgets are increasing, school leaders report that a variety of stakeholders, including school boards, teachers, the community and parents are heavily involved in decision-making.<sup>26</sup>

In addition to leadership, technology funding requires imagination. Few schools rely on a single source of money to build and maintain their infrastructure, instead using a combination of funding sources. Empire High School in Tucson, Ariz., decided not to purchase textbooks when it opened in 2005. Instead, the money was used to build a technology infrastructure and pay for software and online subscriptions to educational resources.

Below are some more common building blocks of successfully funded programs.

### *Bonds*

Bonds help solve the problem of producing a large initial investment for building an infrastructure from scratch. They can be especially effective in growing districts where there are ongoing capital improvements. Clark County, Katy IDS and Poway Unified School District funded their initial infrastructure projects with bonds.

A word of caution: While bonds are useful for the initial investment, ongoing operations and support funding needs to be included in the out-years if an infrastructure is to be reliable and maintained.

### *Leasing*

Some districts turn to leasing as a way to fund technology. The advantage with leasing is that technology becomes a regular component of the district's budget. This allows for a built-in technology upgrade program, ensuring equipment is never obsolete. Robert Gravina, CIO of Poway Unified School District, decided to use leasing for servers and computers. He had two reasons for this decision.

"Leasing allowed us to get the project going without a huge upfront cost for equipment," he said. "It also gave us a built-in upgrade plan."

The district refreshes its desktops every five years and its servers more frequently. Gravina also said that this is how most businesses approach it.

### *Grants*

In addition to the usual suspects — federal grants and E-Rate funding — grants can come from some unexpected sources. Franke Park Elementary was able to create a LEGO duplicate of NASA's Mars Rover using a grant from LEGO. Students built, programmed and learned to operate the rover, all through the grant.

### *Community Partnerships*

This is where the opportunities become interesting. Schools and districts have formed a wide range of partnerships, providing teachers and administrators with opportunities that wouldn't otherwise be possible.

- Fort Wayne brought high-speed connectivity to every school in the city by partnering with Verizon. Verizon brought fiber to the city as part of a build-out. The mayor at that time, Richard Graham, and school district leaders ensured that this build-out included all schools. In addition, the city of Fort Wayne — through its implementation of Lean Six Sigma — helped to make the project so efficient that Verizon went beyond its initial plans to bring fiber to 60,000 homes and businesses, instead including more than 100,000 homes.

- Poway Unified School District created an innovation fund.

“We have a lot of innovative teachers, but I didn’t have any way of funding innovative technology projects,” Gravina said. “Vendors that sell computers to the district need to provide 1 percent of the money back to the district. This money goes into a grant fund — with a total of about \$40,000 to \$50,000 a year — that is provided as seed money to teachers for innovative technology instruction projects.”

- Don Pedro Albizu Campos Public School 161, in New York City, N.Y., uses multiple partnerships to achieve its goals. The school boasts more than 40 partnerships, actively seeking partners that can strengthen the math, science and language arts curriculums. The Suzuki Program helps facilitate music instruction; a music program, partially funded by the Ford Foundation, helps parents and children connect math and music skills. School staff members participate in a professional development program with KPMG, a global accounting firm that donated 320 hours of professional training on software applications such as Word, Excel, PowerPoint and Microsoft Publisher.

A word of caution on partnerships: Donated equipment and services can be a valuable resource to schools. However, CIOs in districts across the nation caution against accepting used computers. Donated computers may at first appear to relieve budget pressures; however, this practice can lead to a complex hybrid desktop environment. Supporting this type of environment is difficult, often leading to poor reliability and performance.

Application streaming is a way districts can save money and other valuable resources. Application streaming is a form of on-demand software distribution that allows parts of a program to be “streamed” to a computer over a network connection as needed. The result is reduced network congestion and server load, universal application access across networks and ensured version consistency and updating. Cleveland Municipal School District, in Cleveland, Ohio, one of the 50 largest K-12 school districts in the United States, chose application streaming to address the challenge of constantly installing and upgrading existing applications on the district’s 12,000 desktop computers. Now, students have “self-serve” access to Windows-compatible applications. IT costs and resources are also freed for critical education projects.

## Case Stories

### Redondo Beach Unified School District

Redondo Beach, Calif.

7,640 students

For Los Angeles County’s Redondo Beach Unified School District (USD), consolidating servers didn’t just simplify its workload — it helped the district cut costs. By switching to Intel processors, Redondo Beach USD was able to add applications without the need for an additional server.

“In the past, we might have purchased one to two new servers per year to support new applications,” said Derek Kinsey, the district’s chief information and instructional technology officer. “Now we can simply create new virtual servers without any new costs.”

Kinsey said that prior to consolidating servers, Redondo Beach USD used more than 20 servers for applications such as educational classroom games and data management. The single server allowed the district to hire fewer IT staff members, investing the savings in innovative services.

“Traditionally, a server failure might take several days to repair and require two or three technicians,” said Lance Yu, a district systems engineer. “Now a single technician can simply migrate a virtual machine from one physical server to another in a few minutes. We save time, resources and money.”

### Evansville Vanderburgh School Corporation

Vanderburgh County, Ind.

22,350 students

As far back as 1998, Michael Russ, director of technology for the Evansville Vanderburgh School Corporation, knew where education technology was headed.

“People want multimedia resources,” said Russ in an April 1998 interview. “Even kindergarteners are using high-end multimedia programs.”<sup>27</sup>

Russ had the foresight to recognize that high-speed Internet access would be cutting edge: The school corporation boasts more than 41 sites connected by fiber on a 1Gbps wide area network (WAN). And schools are running at least 100Mbps Ethernet.

Russ is in the process of making all of the buildings wireless and is upgrading links from 1 to 10Gbps. He is also preparing a converged network of voice, data and video. Although the school corporation is still using its WAN, Russ is requesting information from vendors for the schools' next step.

## Clark County School District

Clark County, Nev.

308,785 students

When Dr. Phil Brody began working on Clark County School District's infrastructure five years ago, technology was seen more as a hindrance than anything else. The network wasn't reliable and e-mail crashed so often that teachers quit using it.

"When I first got here," Brody said, "it took six weeks to repair a computer."

He knew if teachers were going to integrate technology in the classroom, they needed an infrastructure that was so reliable no one thought about it anymore.

"From day one, we were thinking about how the backbone can help provide instruction," he said.

The district decided to go with an infrastructure large enough to meet whatever education needs arose and implemented a 1Gbps network five years ago. The high-bandwidth network allowed the district to undertake large projects simultaneously. Over the years, the district has been able to implement learning and administration systems and tools. The connectivity and the reliability helped the teachers feel that this is an always-available resource. Today, Clark County's 30,000 phones run on the network. The district has a Web-based library system that provides high-quality library resources to all schools, wiping out any funding equity issues.

The implementation began with a pilot project of seven schools. At that time, a lot of the things we take for granted now were cutting edge. Brody wanted to use these schools to create champions and provided them with the best tools and technology available. As the schools began talking about their successes, support for the project grew.

"Don't focus on the technology," Brody said. "Focus on what you can do with it in place. And don't get cheap on it. When it comes to the infrastructure, build it upfront, and build it right. It will cost more and take longer, both in money and in opportunity, if you try to go piece by piece. We spent a lot of time on it, but we did it once."

# If We Build IT:

## Examples of Incredible Achievements

The previous chapters highlighted the importance of integrating technology into classrooms to provide tomorrow's workforce with 21st-century skills and the need to manage data to meet high-stakes accountability and reduce costs. They discussed the choices schools must make when developing infrastructure — whether to buy it or build it — and the advantages and disadvantages to both. Finally, the complicated and often misunderstood components of back-end systems were simplified, providing understanding for why a strong foundation is imperative for a future of learning.

Throughout the book, concepts were followed by examples of schools that enhanced technological learning and created efficiency. School districts with as few as 1,500 students to as many as 300,000 students were represented. These examples not only provide inspiration and momentum for schools looking to do the same thing, but also present the opportunity for a dialogue about the intricacies of making everything run smoothly.

Below, even more examples are provided. These schools are some of the best of the best. They have excelled in multiple areas, some having overcome great odds to get there.

### Redefining the Future – Don Pedro Albizu Campos Public School 161 Elementary School

- Don Pedro is one of the more than 1,400 schools that comprise the New York City Department of Education.
- Ninety-eight percent of the students qualify for federal free lunch; more than 80 percent of the students are from Latino families and nearly half of the students are second-language learners.

Don Pedro Albizu Campos Public School 161 serves one of the nation's most economically disadvantaged areas in Harlem, N.Y. In 1999, it was on the verge of closing after it was placed on New York's version of school probation — "Schools Under Registration Review." The school was suffering from poor academic performance and poor fiscal and facility management. Now, it is a national showcase of excellence.

Often, school success stories involve a 'technology champion' and Don Pedro is no exception. After Principal Barbara Brown was hired, she began making drastic changes. She hired a new management team and implemented curriculum that charted a new path, enabled by technology. Through visionary leadership, parent involvement and more than 40 imaginative partnerships, the school provides programs that would not otherwise be available:

- Don Pedro fosters and strengthens parents' connection to their kids' education by training parents as volunteer aides and classroom readers and offering evening general equivalency diploma (GED) classes and computer training for family members;
- A parent/student music program, the Suzuki Program, helps facilitate music instruction;
- Another music program, partially funded by the Ford Foundation, helps parents and children connect math and music skills;
- The school has a music lab, including hardware and more than 20 keyboards, provided by the video-music television station, VH1;
- The Lorraine Monroe Institute, a New York-based nonprofit, provides staff and administrative professional development support;
- The school's staff members receive professional training through a partnership with the accounting and technology consulting firm, KPMG.

Peter Kornicker, CIO of Don Pedro, said schools need to integrate technology into every aspect of school life if they want to connect with kids.

“We have to talk in a language that the kids understand,” he said. “Technology is that language.”

Kornicker said about 75 percent of the students have access to the Internet, even in the school's economically distressed neighborhood.

Don Pedro uses electronic whiteboards and 3-D displays to bring concepts to life. The school has plasma screens in the halls and scrolls pictures of students and school activities throughout the day. Technology is used to help the school's large population of English as a Second Language (ESL) learners improve their language skills. Students not only hear, but also see concepts illustrated. Technology is used for special education students to provide individualized, focused learning.

## Building the Future – Poway Unified School District

Poway Unified School District covers 100-square miles from suburban San Diego to the rural city of Poway. It includes 23 elementary schools, six middle schools, four comprehensive high schools and one continuation high school. Five years ago, the district's technology infrastructure was so unreliable that teachers did not use e-mail. Desktop computers would break and remain unusable for weeks. Teachers were left without the basic tools needed to communicate reliably, let alone begin integrating new technology into their classrooms.

The district's CIO, Robert Gravina, set out a bold plan — to build a technology infrastructure that would support the district not only in the present, but for years to come.

“We didn't want the network to be the limitation,” Gravina said. “If a teacher has an idea, we wanted to be able to support it.”

The network was funded through a variety of imaginative approaches, such as bonds and leasing space on campus to cell phone providers. It installed a high-speed fiber optic network that connected the schools and the district offices. As need grows, the network bandwidth can be increased to keep up with the demand. The robust, rock-solid network (Gravina boasts a 98 percent availability for the district's network), allows teachers to integrate technology into instruction and enables administrators to perform their jobs.

“Technology is required now for our teachers and our staff to do their jobs,” Gravina said.

### Achieving Excellence

- The district has installed a multimedia package in every classroom, including a Docu-Cam unit, interactive boards, projector and computer. The system was created so all components are in place and easy to use.
- Teachers have access to real-time achievement data for every student. They can also analyze the data and compare student achievement to state and federal standards. Using this information, teachers can modify their instruction plans to address deficiencies.
- The district has had homework and assignments online for nearly 12 years. They are implementing a system that will connect information and allow students, parents and teachers online access. When it's implemented, parents and students will be able to access the same data as teachers. Parents will be able to go to one place to access attendance, school performance and other important data about their children.

## Beginning at the Beginning – Kindergarten a New Way at Deerfield Elementary

*“I’m not doing anything different in my classroom that I haven’t done for years and years and years — we’re just doing it in a new way.”*

*“That’s their future. That’s now. In industry, people have to know how to talk to people from around the world. And so that’s what I want my kids to be doing.”*

– Maria Knee, kindergarten teacher at Deerfield Elementary School

Located in the small town of Deerfield, 15 miles from Madison, Wis., the Deerfield Community School District enrolls approximately 730 students in three schools — one elementary, one middle and one high school. Maria Knee, a kindergarten teacher in the elementary school, is an example of what one inspired teacher can accomplish.

Several years ago, Knee had a special education student whose parents wanted information about what was going on in class so they could have conversations with their child. However, the work of manually recording classroom activities could be overwhelming. Faced with this dilemma, Knee discovered technology had the perfect solution.

“It was like, POOF!” Knee said. “I’m going to start a classroom blog because it’s an online journal of what we do in the classroom, and I can post pictures.”

Motivated by one student’s needs, Knee adopted a new way of running her class. She blogs with her students so they can collaborate with each other and people outside the class.

“It’s like the bulletin board of past years and generations,” Knee said, “but now it’s the bulletin board of the 21st century — something that parents can access 24/7 and see what’s going on.”

The tools allow her to melt the walls and bring parents into the classroom. She posts whatever work the kids are doing — building blocks, drawing and writing. When they were studying the life cycles of butterflies, she took pictures, and the kids decided as a class what to write in the blog. Many of the kids have digital cameras, and they contribute their pictures to the blog as well.

“The students actually have an authentic audience and a real purpose for talking about their work and reflecting on what they do,” she said.

Knee received permission from parents for the students to participate. She instructs the kindergartners in online safety and monitors what they write. Each kid has a personal blog within Knee's blog. The kids can add to their blog, and Knee will make grammar, spelling and punctuation corrections underneath the posting.

The class also reads other classroom blogs. One in particular is from Australia — 2M Gems. The Australian students were celebrating Pancake Day and Knee's kids thought this was exciting because they were soon learning to make maple syrup. Knee's students made a voice thread, videos and pictures to show the Brisbane kids how to make their syrup.

Knee even uses the popular online play area, Webkinz, to educate her students, particularly because she feels it is a safe environment on the Web. The program allows students to care for a virtual pet — that comes in stuffed animal form — requiring them to purchase things for it with virtual money.

Knee stressed the educational value of the online tools she uses to teach.

“We do it because it's real work,” she said. “This isn't something that's just catchy and fun. My kids really feel they're helping other people learn things they wouldn't be able to learn otherwise. And we're learning from other people. It's such genuine work. We have a real audience. And I'm not doing anything different in my classroom that I haven't done for years and years and years — we're just doing it in a new way.”

Through an infrastructure as simple as an Internet connection and free online software, Knee is setting a foundation of using online communities and collaboration to accomplish work.

“That's their future,” she said. “That's now. In industry, people have to know how to talk to people from around the world. And so that's what I want my kids to be doing.”



## Endnotes

- 1 From the director's note, published in the policy paper, "Toward a Technology Infrastructure for Education: Policy Perspectives I," 1994.  
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- 2 Walsh, David; Gentile, Douglas; Walsh, Erin; Bennett, Nat, "11th Annual MediaWise Video Game Report Card," National Institute on Media and the Family, November 2006.
- 3 Blizzard Entertainment boasts that World of Warcraft has more than 2 million players in North America, more than 1.5 million players in Europe and more than 3.5 million players in China. [http://www.monstersandcritics.com/gaming/pc/news/article\\_1242325.php/World\\_of\\_Warcraft\\_passes\\_the\\_8\\_million\\_player\\_mark](http://www.monstersandcritics.com/gaming/pc/news/article_1242325.php/World_of_Warcraft_passes_the_8_million_player_mark)  
<http://www.answers.com/topic/infrastructure?cat=biz-fin>
- 4 The organization's magazine, *EDUCAUSE Review*, explains that infrastructure has been a top-ten issue for several years. In 2008 it jumped from seventh to fourth. "Top-Ten IT Issues, 2008," Debra H. Allison, Peter B. DeBlois, and the 2008 EDUCAUSE Current Issues Committee, *EDUCAUSE Review*, vol. 43, no. 3 (May/June 2008): 36–61, <http://connect.educause.edu/Library/EDUCAUSE+Review/TopTenITIssues2008/46605>
- 5 From Vinton Cerf's presentation and the Conference on California's Future, May 16, 2008.
- 6 Mark Zuckerberg, a Harvard graduate, is considered the founder of Facebook. It launched Feb. 5, 2004, while Zuckerberg was still in school. Originally available exclusively to Harvard students, the popular networking site was opened to anyone over 13 years old in 2005. It is estimated that the site is now worth about \$1 billion. ("The Tangled History of Facebook," John Markoff, *International Herald Tribune*, Aug. 31, 2007, <http://www.iht.com/articles/2007/08/31/business/facebook.php>; "Facebook: The Complete Biography, Aug. 25, 2006, Sid Yadav, <http://mashable.com/2006/08/25/facebook-profile>).
- 7 "Obama's 'Youth Mojo' Sparks Student Activism, Fueling Campaign," (Bloomberg.com, Heidi Przybyla <http://www.bloomberg.com/apps/news?pid=20601070&refer=home&sid=aJ4wSyFVOGx8>, May 7, 2007) cites 75 percent. In his biography, Yadav claims this number is closer to 90 percent.
- 8 As told by Texas Representative Mark Strama, GTC Southwest, Jan. 30, 2008.
- 9 The candidate's official Facebook page listed 325,000 supporters in May 2007. "Obama's 'Youth Mojo' Sparks Student Activism, Fueling Campaign," (Bloomberg.com, Heidi Przybyla <http://www.bloomberg.com/apps/news?pid=20601070&refer=home&sid=aJ4wSyFVOGx8>, May 7, 2007)
- 10 "Horizon Report." <http://www.nmc.org/horizon/>
- 11 [http://www.eurekaalert.org/pub\\_releases/2008-06/uom-uom062008.php](http://www.eurekaalert.org/pub_releases/2008-06/uom-uom062008.php)

- 12 The organization holds that, in addition to core content areas, such as language arts, mathematics, science and geography, students must also be taught interdisciplinary themes. Students must be taught global awareness and financial, civic and health literacies. Key skill areas (creativity and innovation, communication and collaboration, research and information fluency and critical thinking, problem solving and decision making) must be woven into core subject matter. The Partnership lists English (reading or language arts), world languages, arts, mathematics, economics, science, geography, history and government and civics as the core competencies. More on the framework can be found at [http://www.21stcenturyskills.org/index.php?option=com\\_content&task=view&cid=254&Itemid=119](http://www.21stcenturyskills.org/index.php?option=com_content&task=view&cid=254&Itemid=119).
- 13 From a national poll conducted by Public Opinion Strategies and Peter D. Hart Research Associates on behalf of the Partnership for 21st Century Skills. <http://www.21stcenturyskills.org/>
- 14 “Americans Talk Innovation: An analysis for America’s Governors,” prepared by Dr. Frank Luntz for the National Governors Association, February 2007 <http://www.nga.org/Files/pdf/0702TALKINNOVATIONREPORT.PDF>
- 15 *Networked for Learning: Enabling 21st Century Student Success* <http://www.ecs.org/html/Document.asp?chouseid=7067>
- 16 “Podcasting Craze Comes to K-12 Schools” <http://weebhoyseducationdiscussion.blogspot.com/2008/02/podcasting-craze-comes-to-k-12-schools.html>
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- 18 “Report notes gains by students using program developed by IU School of Education professor,” July 23, 2008 [http://site.educ.indiana.edu/news\\_detail/tabid/10308/Default.aspx?xmid=164](http://site.educ.indiana.edu/news_detail/tabid/10308/Default.aspx?xmid=164)
- 19 <http://www.teacherspodcast.org>
- 20 *Converge* magazine, 2007/2008 Special Issue, page 15. <http://www.convergemag.com>
- 21 <http://forpd.ucf.edu/index.html>
- 22 Working documents by Gopal Ghanna, Minnesota State CIO, in preparing to assume the presidency of the National Association of State Chief Information Officers (NASCIO), August 2008.
- 23 Sen. John McCain specifically called out information technology as one aspect of the economy where the country needed to do better, Sept. 4, 2008
- 24 “Top-Ten IT Issues, 2008” <http://connect.educause.edu/Library/EDUCAUSE+Review/TopTenITIssues2008/46605>
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- 26 “Digital Leadership Divide,” [http://www.cosn.org/resources/grunwald/positive\\_attitudes.cfm](http://www.cosn.org/resources/grunwald/positive_attitudes.cfm)
- 27 “Pinch me, I must be dreaming of unlimited bandwidth,” *Communication News*, April 1998, [http://findarticles.com/p/articles/mi\\_m0CMN/is\\_/ai\\_20496416](http://findarticles.com/p/articles/mi_m0CMN/is_/ai_20496416)







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