

A STRATEGY PAPER FROM

CENTER FOR
DIGITAL
EDUCATION

Digital Curriculum and the Wireless Challenge

Are school networks ready for next-generation learning?



Digital Curriculum and the Wireless Challenge

Are school networks ready for next-generation learning?

A revolution is occurring in our nation's schools, and it's all about the role of technology and the shift from paper and textbooks to digital content. Smartphones, laptops, tablets, e-readers, social media and interactive whiteboards are infiltrating classrooms and changing the way learning happens. Technology makes school fun for kids and inspires collaboration, creativity and self-directed learning. Apple's iPad textbook announcement in early 2012 will undoubtedly encourage a new level of innovation, with follow-on offerings from other high-tech companies and publishers.

In many school districts, this revolution is more of an evolution — but digital teaching is where our future is headed; how you plan to get there could make all the difference in the results for your faculty and students. The right strategy incorporates not only adopting the optimal content providers and hardware platforms for your student population, but devising an A to Z approach for the underlying technology infrastructure.

This paper will discuss how this digital shift at K-12 schools and community colleges will impact IT decisions, particularly as it relates to wireless networks. Wireless technology is quickly evolving to better meet the needs of schools from a cost, functionality and management perspective. Importantly, the right wireless strategy helps schools successfully deliver on the promise of digital education.

How prepared are schools to make the digital shift?

While the content is here, many schools aren't quite ready technologically. School districts and colleges are adapting to the digital curriculum shift slowly, through a blended approach of digital and traditional teaching and a phased approach to technology integration. Schools will need to choose their technology strategy carefully — one that is budget friendly, that they can grow with and easily support.

Wireless technology is a critical component of the evolving IT infrastructure in schools. Students and teachers are increasingly mobile, taking lessons

or projects outside the four walls of the traditional classroom. As schools begin to encourage students to bring in personal devices from home, IT needs to support them with connectivity, despite varying hardware platforms. Additionally, since many schools have limited budgets for new technology purchases, laptops on carts will continue to be a popular way to enable students to access digital content. Those laptops require quick and reliable mobile access to the Internet, as they travel between students and classrooms.

Beyond portability, wireless has quickly become the emerging networking standard because it is easier to deploy and support than cabled, hard-wired networks. According to the FCC, in 2010, 80 percent of schools surveyed had wireless access in at least one of their buildings.¹ A recent market survey found that 70 percent of respondents reported wireless local area networks (WLANs) as the top network investment for their institutions.²

Despite the growing acceptance of robust wireless networks as a priority in education, certain challenges persist:

1. Poor performance: School networks too often fail teachers' and students' expectations. Twenty-one percent of teachers report that they often encounter difficulties, including skipping, pausing or constant buffering when streaming video online, while another 54 percent encounter these difficulties from time to time, according to a 2010 survey by PBS and Grunwald Associates LLC.³ Between 37 percent and 40 percent of schools and districts report that their networks are not fast enough to meet objectives, according to the FCC.⁴ Many schools have deployed consumer-grade wireless equipment, which is buckling under the pressure of the rapid expanse of users and devices. A lack of adequate bandwidth in many schools also plays a role.

2. Unable to scale quickly with demand: Districts may not realize that despite their growing access to excellent digital content and devices, the networking infrastructure needs to evolve as well. If a wireless infrastructure

cannot adequately ramp up with users and intelligently route traffic to maintain performance, the network will slow to a crawl or even crash as demand spikes.

3. Too complex: Another common problem is that many wireless networks are too complicated for teachers to use. Teachers are not network administrators, yet they are often in the position of troubleshooting connectivity issues when a student can't get onto the network. With laptops, smartphones and tablets in the classroom, teachers have to serve as de facto IT support — a role for which many teachers are unprepared. If students are using their own devices, teachers may also be troubleshooting many different operating systems and platforms.

4. No easy controls: Beyond these distractions, students themselves are easily tempted to surf the Web or check email when they are supposed to be working on lessons or projects. Teachers can't catch all of these behaviors, and efforts to do so detract from teaching time.

5. Struggles to incorporate rich media: Standard wireless usage such as searching topics on the Internet and incorporating blogs and social media into a lesson are the traditional uses of computers in schools. But teachers and students also want to view and share video and multimedia applications. At home, students regularly play interactive math and spelling games on tablets and smartphones. They seek the same experiences at school, since mobile apps offer a fun, instant-feedback method of learning.

Teachers at Pender County Schools in Burgaw, N. C., post recordings of students reciting poetry to YouTube, where student peers can critique the performances. Other schools are finding success incorporating video game elements into educational programs. These learning methods are novel and engaging, yet school infrastructures aren't typically built for this kind of high-bandwidth traffic. Without business-class technology and network management tools, such activities can quickly bring a network to its knees or



worse — disrupt a standardized testing session.

These challenges beg the question: What is the ideal wireless infrastructure for schools, and is it affordable?

Defining the "new wireless" infrastructure

Not all wireless technologies are created equal. The free WiFi network in the local coffee shop isn't necessarily equipped to manage hundreds of users logging on at once, streaming video and serving up interactive websites at high speeds. Older or consumer-grade technologies fail because they are too slow and can't scale well, or they are too expensive to manage and troubleshoot.

Schools need wireless technology that is foolproof for technologists and teachers alike to use, with appropriate features for the classroom, strong security and centralized reporting to measure ROI. The technology should also be affordable for budget-strapped schools and should scale across aging buildings and campuses. Given the rise in 1:1 computing initiatives — some of which are funded through grants — it's possible that in a few years, most K-12 students will have a dedicated computer at school.

To meet the demand of technology growth in our nation's schools, vendors are making enterprise-class capabilities more affordable, reliable and manageable for schools, districts and colleges.

The vision in progress:

1. The cloud: Everyone's talking about cloud computing, and for good reason. Outsourcers, networking providers and software companies offer affordable technology hosted in their own data centers and delivered over the Internet. The cloud option limits capital expenses — since you don't need to purchase hardware — and can incorporate strong security and management capabilities. It's also faster to get up and running with cloud-based networking. School districts now have more choices in cloud computing. There is no one-size-fits-all solution. You can choose to place part or all of your IT infrastructure in the cloud, depending upon your unique requirements, budget and existing technology. Schools and districts can choose from public or shared-server clouds or private clouds that store your data on more secure, dedicated servers. To decrease the complexity of managing the wireless infrastructure, many schools are looking seriously at cloud-based solutions.

2. Speed: The latest wireless networking systems can transmit data six to eight times faster than previous iterations, resulting in near-wired performance. These wireless LANs are based on an industry standard — IEEE 802.11n — which eliminates the risk of near-term obsolescence and addresses interoperability issues between end-user devices and access points (APs). Networks running on 802.11n also better support streaming media and other Web 2.0 applications and cost about the same as the older 802.11g technology. The U.S. Government's E-rate program offers discounts of up to 90 percent on networking equipment and services for eligible schools wishing to upgrade.

3. Scalability: High-speed 802.11n products can accommodate higher throughput, which means that networks can support the steady growth in laptops, netbooks, smartphones and tablets. Union School District, an elementary and middle school district in San Jose, Calif., needed to find a better solution for its wired network. As school faculty and staff began to install their own access points for

mobile devices, users were regularly experiencing slow-downs. The district required an updated infrastructure that could support nine locations and many users simultaneously at high speeds. After deploying a new wireless 802.11n network, the district was able to deliver multimedia instruction without issues or delays. Today, the wireless network can handle more than 30 computers and devices concurrently.

4. Cost and complexity: Some vendors provide cloud-enabled, distributed WiFi and routing solutions to deliver needed functionality and performance, without the cost and complexity of a controller-based solution. These systems enable APs to communicate with each other, eliminating the need for expensive controllers. The management system for these APs can be deployed on premise or in the cloud. Such architectures enable administrators to simplify control of wireless devices such as smartphones in the classroom or throughout the campus. Distributing functions such as network intelligence, data forwarding and provisioning to the AP level means that APs can simply be added or subtracted, while the network automatically adjusts to the change. If an AP should fail or be decommissioned, the others around it will adjust accordingly and direct traffic across to another AP nearby. By placing the intelligence and management at the AP level, risk is reduced since a controller can be a single point of failure that brings down the entire network.

5. Simpler, centralized management: With many teachers taking on larger classrooms and district IT directors acquiring more responsibility with the same staff, manageability is as critical as performance. A centralized management system for your wireless network offers real-time topology, performance and device information in one dashboard. This makes it easier to conduct capacity planning, troubleshoot problems and push out security policies and configurations to all APs at once over the air.

Cloud-based management cuts costs and doesn't impact network connectivity should the management tool

get disconnected. There are many benefits to this architecture; from a pricing perspective, for example, the only components you need are the APs and either the one-time cost of a management system or an annual management cloud service fee. Add-on applications can ease the monitoring and tracking of wireless client use in schools and give teachers a real-time view of students' connection status as well as the websites students are viewing. It's the control that schools need, but without the hassle.

Real stories of change

Despite all the latest and greatest technologies available today, schools, districts and colleges must consider what they can afford to do now and what must wait until later. Most often, they need to make concessions regardless of the proven benefits that new technologies can deliver to students and teachers. This was the case with Framingham Public School District, in Framingham, Mass., which took a creative approach to incorporating more technology with constricted funds.

Framingham Public School District: A Creative Approach to Digital Education

Framingham Public Schools includes 13 schools that serve more than 8,000 students from preschool through 12th grade. "We needed to upgrade our network infrastructure, but our budget was tight," says Adam Seldow, the district's director of technology. "Just running new cabling through our buildings would have been cost prohibitive. And there's no way we could have afforded to purchase new notebooks for all of our teachers at once."

Instead of attempting to provide computers to as many teachers as they could, the district adopted a policy in which students and teachers could bring their own laptops and devices into the school. Now, the challenge was supporting them and delivering fast, affordable connectivity. Seldow determined that wireless networking was the best choice because it was cheaper and more flexible than cable. Yet he ran into challenges finding the right solution; he wanted to minimize the components he would need to buy



and support and he wanted to avoid purchasing a controller that would limit the number of access points.

Framingham ultimately deployed a new class of wireless infrastructure that combines an enterprise-class access point with a suite of "cooperative control" protocols and functions. The new network delivers all the benefits associated with controller-based wireless LANs — but without the additional burden and cost of hardware controllers or an overlay network. Now, the intelligence is embedded within the APs instead of the controller, which minimizes risk.

The new network was up and running quickly. Within five days, Seldow had the district's 440,000-square-foot high school fully connected. From the first day that the network went live, 140 of 200 high school teachers connected with their laptops, while many students also used the more secure, content-filtered wireless LAN for Internet access. Teachers now use their smartphones to take class attendance, and faculty can use their phones and devices from any location on school premises to look up student information. The district is working hard to make more teacher and student applications available for wireless access. Seldow also plans to use the wireless network to help support the district's new voice over IP telephony initiative.



Best of all, the network is not expensive to manage and consistently performs to expectations. "We don't have to do much to manage it, and we routinely get wireless connection speeds of up to 115 to 120 Mbps," Seldow says.

Allegheny County Public Schools: Securely Advancing Digital Curriculum

Allegheny Public School District, in Cumberland, Md., was also intrigued by the concept of supporting a bring your own device (BYOD) infrastructure. Not only is this more affordable, since it eliminates the need to buy computers for everyone, it's what teachers and students often prefer.

"We are providing the ability for students and staff to bring their own personal WiFi devices — whether it's a laptop, iPad or smartphone — into the classroom," says Jeff Blank, supervisor of networking at Allegheny County Public Schools. "The superintendent wanted students to be using the same devices in learning as they do in everyday life, and he wanted that experience to be seamless."

To make this vision a reality, the district knew it needed to upgrade from its existing 802.11a/b/g WLAN to a faster 802.11n network. The new network needed to support simultaneous access by many devices, while still delivering a consistent application experience. The district

"Each AP can act as a firewall and that was very attractive because it lets us separate personal devices from school devices. That saves us quite a bit of money because Network Access Control solutions are very expensive. Having that functionality integrated into the AP amounted to huge cost savings."

*-Jeff Blank, Supervisor of Networking
Allegheny County Public Schools*

was also concerned about security, anticipating all of the new traffic from unmanaged devices.

Choosing a new wireless networking vendor was no small decision, since the district includes 24 schools, 9,000 students and 700 staff members. The wrong choice would impact a large population of existing and potential users.

The decision to move away from its controller-based WLAN infrastructure was based largely on economics, since it was much cheaper to eliminate that hardware. Blank was also motivated by simpler security, to address the concerns of personal and school devices existing on the same network.

"Each AP can act as a firewall and that was very attractive because it lets us separate personal devices from school devices," he says. "That saved us quite a bit of money because Network Access Control solutions are very expensive. Having that functionality integrated into the AP amounted to huge cost savings."

In addition, with security being incorporated into the APs on the edge of the network versus the controller in the center, there is less risk of viruses traveling across the network and wreaking havoc on individual devices. "It's like having a traffic cop at every corner," Blank says.

Since the network became operational, the district has rapidly increased the number of computers and devices it

supports — the latest count is 4,000 computers and 2,000 laptops that travel between classrooms on carts. While Blank is unsure of the number of devices on the network, he knows that the network’s central managing system can closely monitor WiFi network activity and conditions.

Blank and other managers at the district are excited about the possibilities that the new wireless network is bringing to students and teachers. “We want to eventually give them the same application support on their personal devices as they have on school devices,” says Blank. “When they graduate from high school, we want them to go on to college, and then into the workforce, prepared.”

Wireless networking and digital curriculum: key takeaways

Transitioning to advanced wireless technologies that are best-suited for your district’s digital learning objectives will not be an overnight transformation. School officials will need to establish policies and norms for security, access and usage and balance digital with traditional instruction. Cultural differences may prevent some schools from progressing as quickly as others, and available funding will invariably impact decisions across the board. IT directors and administrators should keep these top concerns and opportunities in mind as they plan for the digital teaching shift:

- Consumer-grade wireless equipment is prevalent in many schools, but these networks are buckling under the pressure of more users and devices.
- Many wireless networks are still too complex for teachers to manage in the classroom, and don’t allow for adequate control over student access and Web use.
- Supporting rich media and high-bandwidth files such as video may require upgrading the infrastructure to ensure adequate user experiences.



- Wireless networking is becoming commonplace in schools, with 802.11n as the gold standard for speed and performance.
- A new wireless infrastructure for schools, incorporating enterprise-class features such as built-in security, the 802.11n protocol, centralized management and scalability, is increasingly available and affordable.
- Controller-less wireless networks provide easy to manage enterprise-grade WiFi without the additional hardware expense of a controller.
- A centralized management system for your wireless network offers real-time topology, performance and device information in one dashboard, easing troubleshooting and policy management.
- Cloud-based WLANs gives schools the ability to avoid capital expenses for a portion of their wireless network, while still providing enterprise-class management features, security and configuration control.

Endnotes

1. http://transition.fcc.gov/010511_Eratereport.pdf
2. <http://www.enterprisestrategygroup.com/2010/02/esg-research-brief-2010-networking-spending-trends/>
3. http://www.pbs.org/about/media/about/cms_page_media/182/PBS-Grunwald-2011e.pdf
4. http://transition.fcc.gov/010511_Eratereport.pdf



Aerohive[™]

NETWORKS

Aerohive Networks reduces the cost and complexity of today's networks with cloud-enabled Wi-Fi and routing solutions for medium and large enterprise headquarters, branch offices and teleworkers. Aerohive's award-winning cooperative control Wi-Fi architecture, public or private cloud-enabled network management, routing and VPN solutions eliminate costly controllers and single points of failure. This gives its customers mission critical reliability with granular security and policy enforcement and the ability to start small and expand without limitations.

For more information about enhancing learning and boosting productivity with an easy-to-use wireless solution that provides integrated classroom control, visit www.aerohive.com.

CENTER FOR DIGITAL EDUCATION

The Center for Digital Education is a national research and advisory institute specializing in K-12 and higher education technology trends, policy and funding. Along with its research services, CDE issues white papers and conducts the annual Digital School Districts and Digital Community Colleges surveys and award programs as well as hosting events across the K-12 and higher education arena. CDE also supports the Converge media platform comprised of the quarterly themed Converge Special Reports, Converge Online, and custom publishing services.

www.centerdigitaled.com