

WIRELESS NETWORKING IN SCHOOLS

What Leading Edge Districts
Have Learned

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BACKGROUND

Wireless networks are no longer the new kid in school. With some 88 percent of all school districts reporting the presence of wireless at their campuses, according to a 2009 CDW-G survey, wireless has moved way beyond the adoption tipping point in K-12. Having traversed the standard three- to six-year implementation and depreciation curve, early adopter districts have already entered their second major round of technology deployments. These leading-edge districts are learning that the latest generation of best-of-breed wireless products offers major benefits in several areas:

- Greater network performance and scalability
- Broader use in more functional areas, including security and safety
- Easier deployment and management

GREATER NETWORK PERFORMANCE AND SCALABILITY

Oftentimes, districts have grown their wireless network deployments haphazardly. They'll test the technology for a specific purpose—to address a new one-to-one program in a particular grade level or to accommodate a shift from computer labs to laptop carts—by acquiring a bunch of access points and setting them up as pilot initiatives. Seeing the impact on learning and school operations, other functional areas will begin requesting wireless access too.

Suddenly, IT faces a mushrooming population of access points, which creates network chaos. The problems with lack of control are fourfold. First, the more users tapping into a wireless network that's ill-designed, the greater the hit to performance and the more likely that the network won't sustain a growing level of traffic;

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network operations slow down and essential applications won't deliver. Second, without the right kind of wireless equipment, IT administrators don't get the visibility into network activities required to monitor and manage traffic patterns and events and deliver on service guarantees. Third, installing the wrong kind of gear for a given environment can introduce conflicts among wireless components, which, in turn, results in unreliability; packets get dropped, and access points lock up. Fourth, the cost goes up; maintenance and support calls suck up time that IT people could be dedicating to other work. The result: Users stop relying on the network to function when they need it.

That's some of what happened at the Burlington Area School District in Southeast Wisconsin. For its first wireless network in the 2003 and 2004 school year the district used Apple's AirPort gear, which came free with an extensive Macintosh laptop purchase. "The problem we were having was that the access points would lock up," recalls Technology Director Scott Christensen. "We just had wireless everywhere. To fix problems, you'd have to log into each individual access point. It was becoming a full-time job to run around and unplug them. We had them all put up in the ceiling so you couldn't see them, and my techs would have to climb up a ladder to reach them to reset them."

The IT group researched the problem with Apple tech support, which finally concluded that the district would need an enterprise-class solution, which the AirPort was never intended to be.

"I don't want to bash on Apple," Christensen says. "It was just a matter of having 15 or 20 [access points] in one school conflicting with each other. Plus there was no centralized management. The radio part of it was just a radio."

That started Christensen's team looking in the fall of 2007 for an alternative company to provide replacement gear for their wireless projects. The district compiled a vendor shortlist with solutions from three different companies: Cisco, HP, and AT&T.

Cisco was eliminated, Christensen says, "because after we got the initial pricing, there was no way I could afford it. Cisco was on and off the table very quickly." He eliminated AT&T because he "wasn't impressed at all." HP was the finalist. The company, which already provided most of the networking hardware used at the district, brought in some wireless gear for testing, and the equipment worked as promised.

"We were pretty set to go with HP," Christensen says. Then a local consultant he worked with called to say he had another company the district should consider: Trapeze Networks." "He told me, 'They sell wireless stuff. It's the best I've ever seen. The management is solid. The software is great.'"

The consultant brought a Trapeze company rep into the office, and within half an hour Christensen knew he had another alternative. Pricing was comparable—if not less—to HP. And he was impressed by Trapeze's Ringmaster software, which provides a graphical view into the wireless network operations.

"I didn't sign a contract that day, but I had a really good feeling," Christensen recalls. He followed up on references provided by the rep, which included a national healthcare company and a major university. "They raved about [Trapeze]," he says. "The support was good. The service was good."

So the Burlington district used a local channel partner to do its first Trapeze deployment in its high school. Similar to the Apple AirPort approach, the access points were put up in the ceiling. "My guys worked with the company we hired," explains Christensen. "We had left enough cabling in the ceiling, where if we needed to move an AP 10 feet either direction, we could. There's only been a couple to move. Coverage is really fantastic—even going through floors. We're really happy with that."

After that initial installation, Christensen sent two tech members to get certified on Trapeze Networks technology. "Now they're certified installers," he says. "And we've done all of our own deployments since then."

The next implementation went into a middle school that was formerly a high school, which, Christensen says, "just kept getting added onto and built out. Even there, the coverage has been really great."

Currently, three schools—the high school and both middle schools—as well as the district offices have 802.11 b/g Wi-Fi all using Trapeze access points. Next up will be two elementary schools running 802.11n Wi-Fi. Once that installation is completed in early 2010, the district will have wall-to-wall wireless in all of its facilities in town. The IT group initially talked about upgrading the high school network to the 802.11n standard and shifting the equipment being used

there to the other schools, but the performance of the b/g Trapeze network hasn't been an issue, so they dropped the idea.

"I've never been disappointed with the speed of the wireless when I've been at the high school," Christensen states. "I don't have people calling me: 'This is unusable.' That's never happened. I take my laptop everywhere at the high school, and I've never sat there saying, 'Oh, this is too slow.'"

BROADER USE IN MORE FUNCTIONAL AREAS

Wireless networks have frequently been introduced for the simple but valuable purposes of enabling anywhere-anytime Internet browsing and easier file access. Wireless has also become essential in district one-to-one scenarios and to maximize the benefits of broader adoption of laptops for student and teacher use. Now that network performance and scalability can be assured with deployment of the right products, technologists at leading districts have discovered the value of expanding usage of the wireless network for other functional operations in their schools, such as school security and safety.

According to the CDW-G survey, two thirds of K-12 districts have reported break-ins, unauthorized people in school buildings, and vandalism. To address physical security concerns, many schools are currently taking advantage of a number of special funding programs and grants to implement new IP-based video surveillance, access control, and voice-over-IP solutions. In each case, the device that provides the security—camera, badge or keycard reader, or phone—may need to be placed in areas outside of classrooms and offices where the wired Ethernet cabling infrastructure doesn't currently exist. Running wires in those locations isn't always a simple matter. That type of implementation may require tearing through walls and ceilings and ripping up carpet. If a wireless network already exists in the same or adjoining rooms, there's no need to deploy additional access points to accommodate the addition of new devices. Whatever the component might be, it simply shows up as simply another node on the wireless network.

Deploying security features on the wireless network can save both staff time and deployment hassle. But it also offers another advantage when the school has been equipped with the appropriate wireless gear: reduced maintenance. A wireless network encompasses fewer "moving pieces" since there are fewer physical connections.

New users of wireless networks have discovered that their implementations tend to be more secure than their wired networks. To test that, all it requires is to take a laptop computer into a typical school setting and use an RJ45 cable to plug the machine into an Ethernet outlet. Frequently, that user will find himself or herself on the network with access to all kinds of non-public resources. In a well designed wireless network, access control doesn't depend on keeping Ethernet wall jacks blocked off (a near-impossibility when unauthorized network access is as likely to come from internal users—bright and curious students—as from external hackers).

Wired Equivalent Privacy (WEP) protocol and Wi-Fi Protected Access (WPA) and WPA2, while not the ultimate solution for banks or defense efforts that require the highest levels of encryption, have proven quite serviceable and incredibly safe for school district-type network traffic.

But more important, wireless also enables a new form of security that's particularly relevant to school environments: location awareness. This refers to the use of technology to manage valuable physical assets, whether those are laptops, classroom projectors, or science equipment. Through radio frequency tagging and GPS-savvy firmware or software, the IT administrator can track down an errant laptop cart or missing projector. In newer applications, a digital fingerprint can be made of equipment in a specific area. When something's been moved, the application can detect that event and gather data to alert security personnel.

Location awareness can also be applied to people. If a user is identified as being outside of a building or proscribed wireless area based on GPS coordinates, network access can be denied.

The expansion of wireless at the Wisconsin district has gone hand in hand with the growth of the laptop cart program in the district. "In some buildings we don't have space for computer labs. So we've been putting in laptop carts for the kids," Christensen explains. Plus, "Probably 90 percent of our teaching staff have a laptop for their own use."

Each of the two middle schools, one for fifth and sixth grades and the other for seventh and eighth grades, has six or seven carts, with about 30 computers on a cart. "When you're talking a school of 500 kids and that many laptops, even then, the network has been working great," he says. "A teacher checks out a cart, brings it to the classroom, and the laptops just pick up the wireless that's in the building."

The district has Promethean interactive whiteboards deployed throughout its schools. The teachers are able to take their laptops home and create lessons on them. "Then they can turn around and plug the laptop directly into the board and use those together. Those projects have gone hand in hand with wireless availability," says Christensen. "Now they're sharing the whole world on a big screen with video. It's really enhanced the teaching that we're able to put forth by having that product in place. Teachers are using wireless up on their boards to do interactive games, activities, and field trips. You name it."

Burlington doesn't limit its wireless network usage to laptop computers. Principals, teachers, and staff are also allowed to get online with devices that have Wi-Fi capabilities built in, such as smart phones. For example, the wireless network has enabled physical ed teachers to bring in their iPod Touches, which they use to do assessments in the gym or out on the fields for whatever skills are being taught. "They log into the gradebook application and enter their data," he says. No more keeping paper notes out on the field and then returning to the office to enter that data into an application.

Administrators armed with iPhones and iPod Touches are getting onto the network to access Skyward, the district's student information system. New mobile programs are coming out that enable observations to be collected on mobile devices during classroom walkthroughs for the purposes of teacher assessment. Environments that offer Wi-Fi enable those devices to upload the data immediately to a program where it can be aggregated, analyzed, graphed, and reported.

Encouraging the presence of those smart phones on campus is becoming an increasingly common way to ensure student safety. Teachers and resource officers can quickly relay emergency information via Enhanced 911 or E911, which routes a call to the most appropriate public safety agency based on the caller's location at the time of the call.

What Christensen isn't working on yet is allowing students to bring in their own wireless devices, but that's only because he doesn't consider it necessary yet.

In the course of preparing the most recent state-mandated technology plan, he did a survey among students at every level. According to the results, 82 percent thought they had sufficient access to technology at school. "I've always really tried hard to provide enough technology in the schools so the kids don't have to bring their own computers. That's been my goal since I started

doing this job 10 years ago," he says. "I know that as time goes on, they'll want more and more access to things. So I really thought that would be a lower number. I was pretty happy because that's a big discussion. It's one of those things where you open up a whole new level of potential problems."

That said, he's going to continue monitoring requirements. "It could be coming down the road. With budget constraints maybe that'll be something we start to do. We could have kids bring their stuff, and they could be off on their own [virtual LAN] segmented away from the rest of our network so they couldn't try to hack into servers."

EASIER DEPLOYMENT AND MANAGEMENT

The IT organization in school districts often tends to be small and located in a centralized data center in the district offices. Traditionally, when problems with the wireless network surface at a school, it usually requires an IT person going on-site to do the troubleshooting, which often means taking them off of other important districts projects.

Choosing the right wireless network management tools can dramatically minimize the amount of time and hassle it takes to maintain the network and address problems as they arise. RingMaster, an application available as software or an appliance from Trapeze Networks, bundles all the functions necessary for planning, configuring, deploying, monitoring, and optimizing a wireless network, all from a central console.

As Burlington's Christensen reports, "I didn't go to school to be a network administrator. I was an educator. So if somebody calls and says they're having trouble and I'm the one who answers the phone, using RingMaster I can look at half a dozen things. It lets me do some basic troubleshooting from my office."

Choosing the proper type of access point for a given environment is important too. For example, Trapeze's Mobility Point (MP) 432 Indoor Wireless AP is appropriate for low-density deployments requiring maximum coverage whereas the company's MP-82 is designed for high-density deployments that emphasize throughput capacity over coverage.

Using RingMaster the district can import floor plan files to create a 3D model of the building it wants to network. The RingMaster software will automatically determine how many access

points need to be installed in any part of a building, taking into account radio frequency obstacles. It also automates channel assignment and power level settings.

It's not unheard of in school deployments for best-of-breed access points to accommodate between 25 and 30 devices, depending on application usage. Rather than having problems with signal overlap and "bleed" among those access points, that bandwidth overage can be shared. A wireless controller, such as Trapeze's MX-8 Mobility Exchange, which supports up to 12 access points, handles the coordination and management. Should a group of users in one classroom require additional throughput, the controller can direct underused access points from across the hall to deliver the required bandwidth.

"Guest" management is also essential in schools. At the Burlington district substitute teachers or presenters gain access to wireless through a full guest network set-up managed through a simple application that works with the district's Remote Authentication Dial In User Service (RADIUS) server, "an old G4 tower," as Christensen describes. That server does authentication of devices -- laptops, iPhones, and others -- by MAC address. "We have those all entered into this server," Christensen explains. "In order to get onto the network, the authentication path is set to go through that RADIUS server. If you're there, you're in."

Trapeze sells an advanced access control application, SmartPass, that gives the administrator granular control over client access, not just for guests but for other groups of users. For example, SmartPass could be used to specify no Internet access temporarily in a classroom where a group of students is doing computerized testing.

Nowadays wireless service is no longer limited to interiors of buildings. At Burlington's high school, the IT team has set up a Trapeze Mesh/Bridging module that extends the reach of the Wi-Fi network from the cafeteria to the press box at the football field. No trenching for cable-laying necessary. The primary reason to set that up was to be able to monitor for storms so that the school would know if it needed to evacuate the field or the fans. Previously, the high school had a person located in the press box talking on a cell phone to somebody located in the cafeteria who was monitoring weather conditions on a weather website through a computer located there. A side benefit to the bridge link is that journalists covering games can file their stories without having to leave the premises to get an Internet connection.

THE UNINTENDED CONSEQUENCES OF WIRELESS

Wi-Fi on K-12 campuses is "one hundred percent worth it," Christensen concludes. "Putting wireless in your schools brings you more things than you think it's going to. I always have these conversations with friends and we talk about unintended consequences. With wireless, the unintended consequences are all good things."

It especially makes sense to move to wireless or expand wireless at schools that are expanding laptop use or going through one-to-one programs. "If you're going to laptops, you've got to have wireless," he insists. "Otherwise, what's the point?"

The principals at his schools agree. "I sat down and sold it to the principals. I decided this was important so I moved things around in the budget and they've certainly put in what they could in order to make it happen. I've never had one come back and say, 'Scott, that was really dumb.' I think everybody has been incredibly happy with how it's turned out.

Christensen, a former elementary teacher himself, says he never quite bought into the idea of dropping everything in class to head to the computer lab. Now, he points out, teachers don't have to. "What a lot of teachers will do is divide the kids up to focus on different things. You'll go by a classroom and there will be three or four kids working together on a project on a laptop, getting out on the Internet, doing research. It meets their needs so much better."

But the advantages of wireless in the schools don't stop with what the students can do. There are a multitude of benefits for the teachers as well. "You go to meetings and all the teachers have their laptops," Christensen observes. "They're able to bring things to show each other. The district put its gradebook online with family access. And now teachers can be anywhere in the building with that. Wireless on campus has just made the flow of information and communication that much better and easier."

ABOUT US

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