White Paper

MERU NETWORKS

voice. Data. wireless. *Become one.*

Enabling the Wireless School
Challenges & Benefits of Wireless LANs in K-12

Table of Contents

The Growing Demand for Wireless in K-12

Many K-12 schools are seeking new technological solutions that help optimize learning and collaboration among their students, faculty and administrative staff. Following on the success of Wireless LANs (WLANs or Wi-Fi) in higher education, an increasing number of K-12 schools are also integrating wireless and mobile technologies to better meet instructional demands and provide more users with on-line resources. From connecting to the Internet and e-mail, to delivering online homework assignments, to providing collaboration tools in classrooms, Wi-Fi access enables all stakeholders in the school system to benefit.

- **District Office and Administration Can Streamline Procedures**: Classroom applications can track each student's progress to facilitate reporting; provide up-to-date student information on hand-held computers; respond to emergency situations and handle disciplinary incidents, security enforcement and parent communications.
- **IT Department Can Optimize Performance and Cost Savings**: Wi-Fi can accommodate rapid expansion, which is particularly important for schools using mobile classrooms that can make wiring very challenging. WLANs are also more economical than traditional wired connections, especially where wired connections would be prohibitively difficult—for example, schools that have no space for computer labs, or that anticipate future renovations that would require re-wiring in classrooms.
- **Teachers Can Be More Proactive and Accessible**: Wireless networks increase interaction between teacher and students; complement classroom instructions with on-line applications including digital whiteboards and on-line testing; real-time access to administrative resources and design curricula that better meets individual learning styles.
- **Students Can Learn More Efficiently**: Wi-Fi provides the opportunity for more free-flowing collaboration among peers, with teachers and digital resources and the Internet.

While higher education deployments focus broadly on delivering high-performance, pervasive wireless coverage across large campus environments, K-12 schools—with tighter budgets and limited IT resources—tend to deploy wireless to support specific mobility applications such as mobile carts, wireless IP telephony, video surveillance, mobile classrooms, etc. In order to support these and other emerging wireless applications (e.g., educational videos, location tracking, cafeteria point-of-sales systems, etc.), schools need a wireless infrastructure that can deliver reliable performance in dynamic, high-density environments.

The Hidden Challenges of Wireless

With the broad availability and relatively low price points of WLAN products, however, it has become all too easy to deploy a WLAN without adequate understanding of the technology's limitations that could

ultimately lead to degraded levels of service, security, and usability. Specifically, WLANs for K-12 institutions must effectively address the following unique requirements:

Requirement 1: Rapid Login & Reliable Connectivity in Crowded User Environments

Wireless in the classroom is designed to support connected learning, communications between teachers and students, and peer-to-peer collaboration. For these "I just want it to work" users, wireless must be able to deliver immediate and reliable access to on-line resources and the Internet. Specifically, quick "log-in" (e.g., authentication), is required because classes typically run for less than an hour, rendering useless any technology that significantly cuts into valuable instruction time.

In most schools, however, Wi-Fi supports computer labs, mobile computer carts, and digital media centers—environments in which multiple users need simultaneous access to the network. Providing immediate and reliable connectivity in such environments is challenging due to over-the-air collisions that are left unchecked in a traditional Wi-Fi environment. These collisions result in increasingly significant delays as more and more users try to login to networked resources. Moreover, throwing additional access points (APs) at the problem on only makes the problem worse by decreasing the transmit distance between the clients on the same channel (i.e., effectively increasing the interference in a given area). The problem can not be solved unless the network, rather than individual clients, control access to the wireless medium.

Requirement 2: Simple and Cost-effective Installation

Deployment is one of the biggest hurdles to successfully adopting Wi-Fi in schools. First of all, K-12 schools generally lack the necessary IT staff to deploy and manage WLANs. In addition, large K-12 wireless networks must be deployed during school vacations or during the narrow window of time between the start of the fiscal year and the beginning of the school year, placing enormous pressure on the already-limited IT staff. Finally, K-12 schools IT staff must often deal with unique building designs that involve multiple enclosed classrooms, long hallways and remote and temporary buildings.

Traditional WLAN solutions require complex site surveys, channel planning, and on-going RF tuning. To complicate matters, WLAN deployments are typically phased in over time, necessitating on going changes to the network design. The wireless deployment may also be modified as more users are added, or new applications are deployed. These changes to the WLAN design are extremely complicated to plan, with potential ripple effects on the existing deployment, due to the limited number of non-overlapping (i.e., usable) channels.

In particularly crowded areas, moreover, access points (APs) are placed closer together to take advantage of higher data rates, increasing the speed at which clients transmit data. However, careful planning to avoid adjacent APs having the same channel will only increases channel interference and network congestion.

Requirement 3: Network Grows with the Needs of the School for Maximum Investment Protection
Unlike corporate organizations, which may replace technology every 18-24 months, K-12 capital budgets do not permit such short infrastructure refresh cycles. This makes it exceptionally difficult to keep up with emerging capabilities and rapid standards evolution of Wi-Fi technology, ranging from faster radios to new client devices to ever-changing security approaches. In addition, since the "right" wireless applications are not obvious at the time of deployment, the original network design is guaranteed to require future modification. Advanced applications such as voice and video, for example, will require both more bandwidth as well as seamless mobility.

Changes to the wireless LAN design to support these emerging requirements are extremely complicated to plan, with potential ripple effects on the existing deployment, due to the limited number of non-overlapping channels available. Often times, schools are forced to migrate to a newer and more expensive technology in order to keep up with the increasing usage and changing requirements. For these reasons, a school's wireless strategy must take into consideration, not just the initial installation and hardware costs but also investment protection that allows for a more gradual migration to future standards and capabilities.

A Smarter Wireless LAN for K-12 Schools

As schools become increasingly dependent on connected learning, wireless will continue to play a growing role in the delivery and administration of K-12 education. However, deploying a high-quality wireless network that supports the technical and business requirements of K-12 institutions is not as simple as it seems. In fact, early adopters of wireless in both higher education and K-12 have learned the hard way that most WLAN systems were designed primarily to deliver basic data applications (e.g., Internet access and email) to few users rather than bandwidth-intensive multimedia applications in crowded classroom settings.

A new smarter wireless LAN architecture addresses the emerging requirements of advanced applications, user behavior, and educational IT requirements by combining centralized security and management with system-wide air traffic coordination and control. How does this translate to benefits for K-12 users and IT administrators?

- No RF expertise required to deploy and manage
- Seamless handoffs across access points (APs) for transparent mobility
- Guaranteed high priority delivery of multi-media applications
- Low total cost of ownership & maximum ROI—i.e., higher density per AP means fewer APs need to be deployed, no need for costly site surveys, and a coordinated network reduces the need for on-going support

With these advances in the performance, management and investment protection of wireless network infrastructure, schools can now deploy a pervasive wireless network confidently and cost-effectively.

Finally a Wireless LAN Solution that Just Works

With some of the largest K-12 school deployments globally, Meru Networks is leading the charge in delivering a wireless infrastructure that exceeds the wireless expectations of K-12 schools. Designed within the framework of prevalent 802.11 standards, the Meru WLAN System, featuring its patented Air Traffic Control technology, not only delivers comprehensive security and centralized management, but also addresses the critical elements for deploying enterprise-class WLANs that most networks lack, including:

Quality of Service

Recent real-life cases show the timesaving advantages of Meru's patented technology. Their patented switch-like Air Traffic Control technology coordinates over-the-air traffic to enable quick boot for computer carts & labs. In addition, this single channel architecture enables increased capacity/bandwidth in bandwidth-hungry environments by layering channels in a cell up to 162Mb for 802.11b/g and 432Mb for 802.11a. This results in excellent throughput performance for all network clients.

Meru Simplifies Deployment and On-going Management

Meru offers a single-channel architecture to simplify deployment and save valuable time. Technically speaking, its Air Traffic Control technology puts the network—as opposed to clients—in control to enable effective load-balancing across all access points and to deliver seamless roaming for real-time applications.

Meru's unique technology delivers investment protection

Meru protects a school's network investment by delivering a wireless network that supports advanced applications like VoWLAN—without dramatically increasing in the number of Access Points or changes to the network design. In short, it saves money by minimizing operational as well as capital costs. Unlike other WLANs, Meru offers the ability to layer multiple channels in a single cell for high capacity as well as support for high-performance b/g mixed networks also delays the need to migrate to higher data rate 802.11a or 802.11n applications. This results in easier management of the network for the IT staff. In addition, the Meru Wireless LAN System is intentionally designed to deliver a converged voice and data network solution. By building on the system's ability to control channel activity with its Air Traffic Control technology, Meru dynamically recognizes when a VoIP call is initiated and reserves bandwidth over the air for the call. The results—unparalleled call quality and connection reliability.

- By coordinating channel access, Meru minimizes unnecessary RF contention to deliver high-performance service to large numbers of users in crowded classrooms.
- Simple deployment and management: Meru's contention management and Virtual Cell Technology make single-channel deployments possible—no more expensive and laborious channel planning.

- Support for Advanced Applications: Meru provides up and downstream Quality of Service (QoS) to enable you to deploy WLANs with voice, video, and data over a single wireless infrastructure.
- Investment Protection: Guaranteed delivery of advanced applications, delays need for upgrade, easy migration to emerging technologies.

With the Meru WLAN System, schools do not have to sacrifice functionality for price, scalability, or the ability to migrate to future standards. All of this is built into the Meru solution. No matter what a school needs to accomplish with its wireless network solution, Meru Networks delivers the speed, capacity, management capabilities and affordability that K-12 educational institutions demand today and the future.

About Meru Networks

Meru Networks is the global leader in wireless mobility infrastructure solutions that enable the All-Wireless Enterprise for Fortune 500 educational, healthcare, enterprise, and government markets. Its industry-leading innovations deliver pervasive, robust wireless service for business-critical applications. Meru's award-winning Air Traffic Control technology brings the benefits of the cellular world to the WLAN environment, and it offers the only solution on the market that delivers the reliability, scalability, and security necessary for converged voice and data services over a single WLAN infrastructure. Founded in 2002, Meru is based in Sunnyvale, California.

For more information on Meru Networks and its products, visit *www.merunetworks.com* or call +1-408-215-5300.