

Cloud-Managed Mobility Platform for Education

Enabling modern classrooms to deliver immersive, personalized learning experiences, enhance campus productivity, and adopt new curriculum standards.

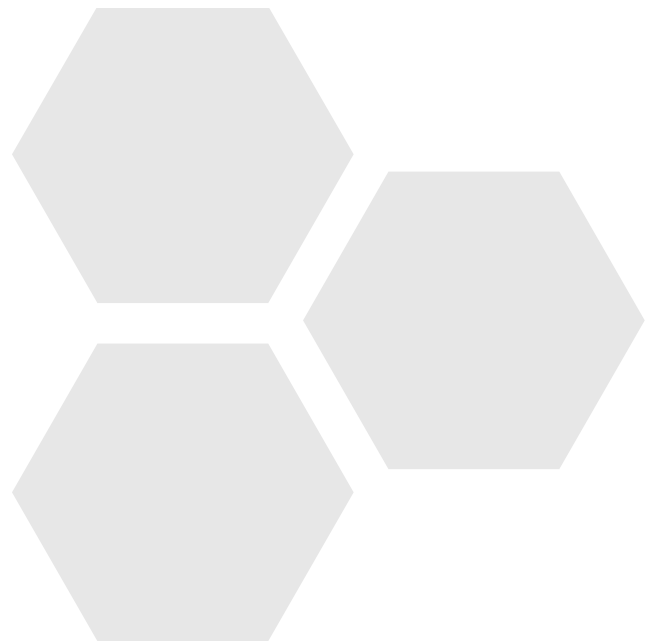


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Executive Summary

The wide-scale adoption of mobile devices and educational applications are transforming the classroom into immersive, personalized learning environments equipped with a variety of digital learning tools aimed at keeping students engaged, on task, and motivated to learn. The “always-on” nature of mobile devices is also allowing learning, collaboration, and creativity to go beyond what was once confined to the classroom. Empowered with mobile devices connected to the school network, students can now continue learning outside the classroom, faculty can continue preparing and delivering learning materials outside of school hours, and school administrators can continue providing campus services anytime, anywhere on campus.

However, as district resource constraints persist, and as the influx of mobile devices pose new security challenges for IT, IT administrators must adopt a wireless infrastructure that not only enriches students' learning environments, enhances staff productivity, and meets digital curriculum standards, but reduces overall cost of operations, and enhances campus IT security too.

Introduction

As the adoption of mobility accelerates in schools, it will have a huge impact on the network architectures they reside on. IT departments are struggling to cope as the demand for better quality user experiences are soaring, and the budget to implement new or upgrade networks is shrinking. In this whitepaper, we will outline the major trends impacting schools, such as:

- The Implementation of Common Core Standards and online standardized testing
- The advent of new mobile devices such as the Google Chromebook and the Intel-based Ultrabook
- The modernized displays and print infrastructures with Apple TV

Mobile Learning Is Here to Stay

Studies have shown that mobile users in schools depend on their wireless devices not only for keeping up with their daily routines – such as checking email, reading the news, calendaring, and sending text – but also for accessing critical learning resources and utilizing classroom technology to enable digital instruction. For example, a survey conducted by the Pearson foundation found that 73% of students surveyed preferred learning from digital textbooks over learning from print textbooks; and 86% believed that tablets help students learn more

efficiently¹. Studies have also shown that modern classroom technology – like Interactive Whiteboards, Apple TVs, and eReaders – is on the rise and considered to be quite valuable to student learning as well. Taken as a whole, the Wi-Fi access that enables these new technologies has been found to be one of the most critical technology components instrumental to academic success, trailing laptop computers, which was rated the most valuable.

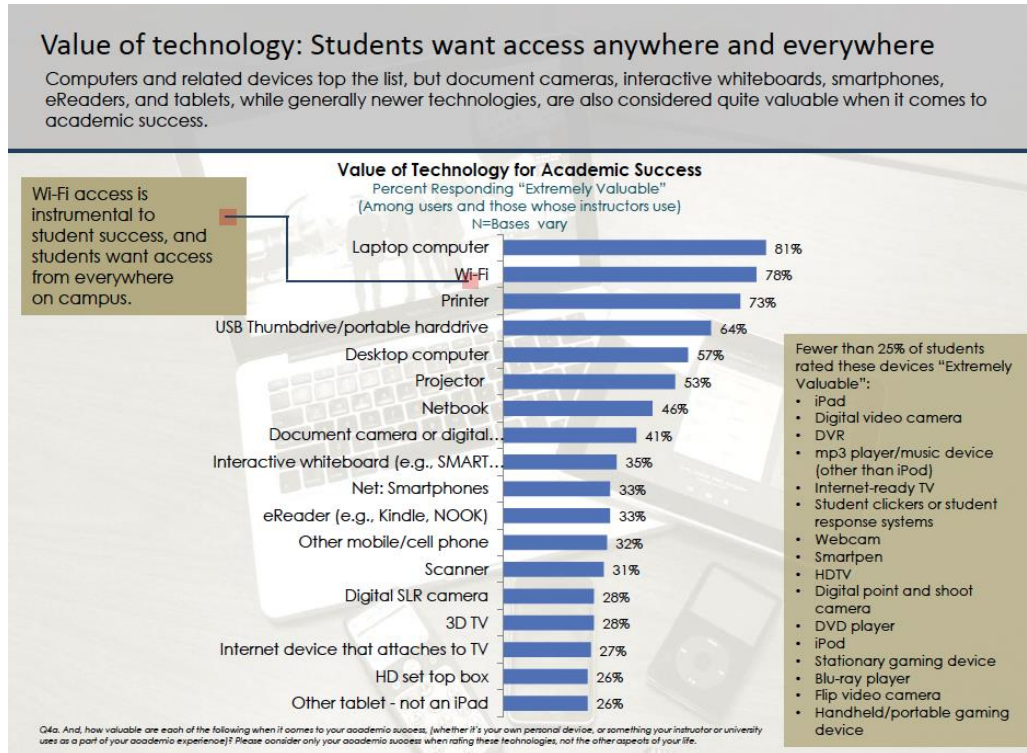


Figure: 1 Pearson Foundation (2013). Survey on the Value of Technology for Academic Success

Federal Funding for Technology in Education

E-rate is the commonly-used program for schools and libraries to obtain affordable telecommunications and Internet access through federally-discounted funding. This program is the primary enabler for schools and libraries to compete in the digital age, and has had overwhelming success in aiding schools to implement modern technologies. For example, in 2013, according to the National Education Association, E-rate provided \$2.4Billion in discounts for

¹ Source: Pearson Foundation: Survey on Students and Tablets, 2012.

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Internet access in public schools, while the demand from the schools for aids were in excess of \$4.9Billion².

Educational institutions across the United States are putting pressure on the government to increase funding to keep up with the evolving technology that is impacting and enhancing student learning. In response to this demand, in July of 2013, President Obama unveiled the ConnectED initiative to increase federal funding to schools to upgrade connectivity technologies. With this new initiative, 99% of schools across the US are expected to get Internet access ranging from 100Mbps to 1Gbps speeds within 5 years³. Additionally, teachers will be given funds to procure new resources to implement interactive classrooms, build online learning communities, and collaborate with top educators from around the world. With the support from federal funding, teachers and students will have access to rich multi-media devices requiring non-stop Internet connectivity for immersive and personalized learning experiences.

Common Core State Standards and Online Testing Mandates

Education in the US is going through a series of government-mandated initiatives, along with the ConnectED program, to promote real-world learning environments that prepare students to succeed in a global, digital workplace. 45 states including the District of Columbia, along with four territories and the Department of Defense Education, have committed to adopting the Common Core State Standards to provide consistent curriculum requirements, which entail mandated, online standardized testing for measuring student success in the new areas of learning. Many of the School IT departments have until the 2015-2016 school year to prepare their networks for online testing, implement policies to include a variety of mobile devices, and enable teachers and faculty to deliver enhanced learning with digital tools.

Both the Smarter Balanced Assessment Consortium and the Partnership for Assessment of Readiness for College and Careers (PARCC) alliance, the approved Common Core assessment providers, have issued guidelines for implementing these curriculum standards and online testing implementations, to ensure that they are consistent across the country. In almost every instance, creating a wireless network has been found to be more cost-effective than expanding a wired network.

² Source: National Education Association: Erate Program Highlights, July 2013.

³ Source: Office of Educational Technology: ConnectEd Initiatives, July 2013.

iPads, Chromebooks and More – Creative Tools, Interactive Textbooks and Rich Content

Much of the changes that are taking place in digital learning today have been ushered by the adoption of portable, mobile devices. These consumer-grade mobile devices are manufactured with form, sleekness and appeal to the consumers in lieu of connectivity ports and optimized for battery life (longer usage time); and as such, the majority of these devices are connected to the Internet with Wi-Fi Ethernet or the 4G/LTE mobile data access. Tablets, such as the Apple iPads, Microsoft Ultrabooks, and Android-based tablets (like the Samsung Galaxy tablets and Google Chromebooks) are the most common mobile devices being deployed to schools, along with the traditional Windows-based laptops.

With an ecosystem of iOS learning apps, digital textbooks, and a popular volume-purchasing program available via iBooks and iTunes, Apple iPads are the most popular mobile devices being used in education. In Apple's quarterly earnings statement in October of 2013, Apple CEO Tim Cook claimed "iPads [currently make] up for 94% of the market for education tablets, with iTunesU app downloaded over billion times."⁴

Google Chromebooks and other Android-based tablets, on the other hand, are being increasingly adopted across schools for educational use⁵. With robust security built-in, a variety of learning applications available in the Chrome Store, and a low cost per device and storage, Chromebooks have compelling advantages that are prompting schools to adopt them.

With this new myriad of devices in the classroom, school IT departments are being compelled to embrace, manage, and control hundreds of devices on their campus networks. Bring-Your-Own-Device (BYOD) initiatives, which encourage students to bring their own preferred devices to school for educational use, are also becoming more prevalent, prompting school IT departments to accommodate and create network security policies not only for school-owned mobile devices, but personal, student-owned devices as well.

⁴ Source: Apple: Quarterly Earnings Report, October 2013.

⁵ Source: Forbes: "Google in Education, Chromebooks now embraced," February 2012.

Mobile Networks for Apple Modern Displays and Network Services

Another major trend impacting school networks is the adoption of Apple TVs for modernizing digital displays, network printing and resource sharing. To make Apple devices a native part of the campus network, support for Bonjour protocol services that manage and control the Apple service availability across the entire network is essential. By monitoring Bonjour advertisements, clients can learn the location (IP address and port) of any service, and then connect to it to utilize that service.

Bonjour transforms the manual process of configuring IP addresses and port numbers into a “plug-and-play” experience where users reference services by type and by a human readable name. Two notable examples are AirPrint (used for wireless printing) and AirPlay (used for wireless audio and video playback support for Apple TVs). Both advertise themselves through Bonjour to enable clients to print and display screens, respectively. AirPlay is especially valuable in many contexts for remote displays from iOS devices and, as of the Mac OSX Mountain Lion release, laptop and desktop devices as well.

The capabilities that Bonjour enables are very attractive to schools for their ease of use and ability to help make BYOD initiatives more productive because IT doesn't have to install all of these services on every device on the network – including those that are not school-owned. Problems arise, though, when one tries to scale Bonjour from home applications to broader, multi-vendor, multi-segment networks. Bonjour advertisements cannot cross the layer-2 boundaries, in a typical multi-segment network and thus, hampers the ability to use Airplay and AirPrint services across network domains.

Advanced Wireless Networking for the Schools

The right wireless network has the potential to be as indispensable to school IT departments as the mobile devices are to students and faculty. The right wireless network will modernize the classroom and unleash new levels of learning by connecting students to smart classroom technology, enabling learning applications on any mobile device, providing seamless network connectivity and security anywhere in the campus, and exceeding the requirements for deploying Common Core curriculum and online testing standards.

Centrally-managed wireless networks that are robust and managed through the cloud can provide all of these of high-performance, high-density and high-availability requirements to enable seamless connectivity and security across campus networks. Deployment, monitoring, and management are also easy and complete with wired and wireless integrated for anywhere, anytime access. With its centralized management component, School IT departments can simply

define and enforce automated security policies that manage the thousands of mobile devices on their network at any given time, on any given school day.

Aerohive Simplifies Wireless for Education

Aerohive's mission is to Simpli-Fi access to mission-critical applications with cloud-managed, self-organizing, and automated Wi-Fi, switching, and routing solutions. Aerohive delivers on this mission by providing automated, secure, and cloud-managed Wi-Fi solutions that meet the requirements of even the most demanding schools and universities, with its:

- **Cooperative Control Architecture:** Aerohive's architecture uses self-organizing, mesh-capable Access Points (APs) that require no network controllers or additional hardware. HiveOS, the operating system that underpins all products, allows routers, switches, and Wi-Fi access points to discover one another as they are added or removed; share information to optimize network security and performance; and dynamically adjust to network changes as needed. This capability is known as Aerohive's "Cooperative Control Architecture." In this way, wireless networks built on Aerohive technology eliminate the cost, performance, and availability issues associated with traditional controller deployments that create single points of failure, failover delays, and throughput bottlenecks. This architecture strikes just the right balance of distributed intelligence and centralized management capabilities. Data forwarding, WLAN security, and performance-enhancement services – such as real-time packet prioritization – are distributed out to individual APs to minimize latency and to ensure that a failed WAN connection to another location won't interrupt users already on the network.
- **Aerohive's Cloud Service Platform - HiveManager Online:** HiveManager Online is a cloud-based Software as a Service (SaaS) network management system for Aerohive network devices. HiveManager Online eliminates capital expenditure associated with dedicated network management appliances and shifts expenses into a pay-as-you-go model. This not only reduces the initial costs of network management, but also allows schools to predictably grow the network to whatever size is needed. There are no management appliances to deploy, manage, or use rack space per location. Since it's a cloud-based solution, HiveManager Online simplifies an organization's ability to manage one or many locations. Network management can be done centrally using a Web browser from any location at any time. HiveManager Online offers the same simple policy creation, firmware upgrades, and centralized monitoring options as on-premises appliances without the need to deploy additional network devices. HiveManager Online is hosted within secure Tier

IV SAS 70 Type II data centers, with scheduled backups and disaster recovery capabilities.

- **Aerohive StudentManager and TeacherView:** Aerohive's StudentManager appliance simplifies the process of bringing wireless devices into the classroom. StudentManager is integrated with Pearson PowerSchool, which allows for automated configuration of student rosters, classes, and teachers. It also has full reporting, making it simple to roll up the statistics on wireless use to a district level. For teachers, StudentManager's TeacherView enables computer carts to be specified by class and allows teachers to create lesson plans that include websites and internal resources. Once class starts, StudentManager's TeacherView feature gives educators a real-time view of students' connection statuses as well as the websites being viewed. Both StudentManager and TeacherView leverage Aerohive's HiveOS APs in the classroom, and are coordinated on the back end via management functionality in the HiveManager. These applications are completely device/OS-independent, making it easier to integrate this functionality across a variety of mobile devices.
- **Aerohive Bonjour Gateway:** Aerohive's patent-pending Bonjour Gateway takes service advertisements that are restricted to a single broadcast link and makes those services available network-wide, without any client modifications or network VLAN gymnastics. Service compatible with any multi-vendor network, schools can deploy this gateway to support wireless display and wireless printing across the network from any Apple device.

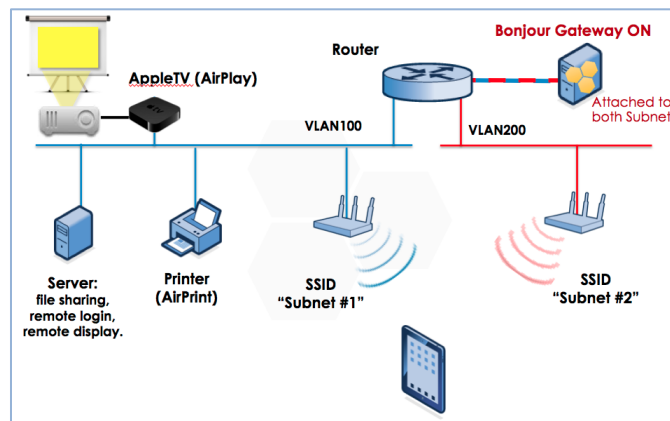


Figure 2: Aerohive Bonjour Gateway: Example of a Multi-Subnet Network.

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- **Aerohive's Mobility Platform – Client Management:** The Aerohive Client Management application gives administrators the power to easily provision, configure, and monitor end user devices. This functionality allows an administrator to clearly differentiate between school-owned devices and student-owned BYOD, giving them the additional layer of context necessary to create granular policies controls over connected devices. The Client Management application includes:
 - ✓ **Client Auto-Provisioning:** Client Management simplifies onboarding of corporate-issued and BYO devices by supporting a single-SSID solution to automatically create and install a unique credential as well as install a secure profile on iOS, OS X, Android, and Chrome OS devices.
 - ✓ **Customizable Enrollment Portal:** Users will see a completely customized, self-service enrollment portal that can display their company logo and corporate-defined details about enrolling their issued and BYO devices. This reduces Helpdesk costs by communicating terms of use and policies directly and in a familiar way.
 - ✓ **Integrated Certificate Authority:** Aerohive's certificate management system automates the entire certificate generation, distribution, validation, and revocation process. This means the IT administrator doesn't have to worry about implementing a certificate authority, and can instead focus on advancing their BYOD and CID initiatives.

Summary

Managing a multi-campus school network that has a demanding mobile user base can be extremely complex. Because traditional, controller-based network architectures in schools were primarily designed for use of wired devices, when confronted with the influx of mobile devices, they will suffer from:

- Complex and rigid architectures that prohibit easy management and scalability
- Spotty connectivity and performance issues due to the wired and wireless networks operated in silos
- High costs associated with procurements and upgrades to keep up with the increasing load, and high operational costs associated with complex management issues

Modern schools are now adopting unified wired and wireless architectures that cater to the mobile-first user community. With a controller-less architecture for schools, IT departments can design, deploy, and manage elastic networks – ranging from just a few wireless APs to thousands – across multiple campuses, without a network forklift, and with a pay-as-you-need approach. With Aerohive, administrators can provide personalized access to its users based on the context (i.e. device type, user group, location, or time of day), and support initiatives like online testing and modern displays. With Aerohive, schools can implement wireless that meets the demands of its current mobile user base, while future-proofing its network for the demands of the future – all within the IT budget.

About Aerohive

Aerohive (NYSE: HIVE) unleashes the power of enterprise mobility. Aerohive's proven technology enables organizations of all sizes to use mobility to increase productivity, engage customers, and grow their business. Deployed in over 13,000 enterprises worldwide, Aerohive's proprietary mobility platform takes advantage of the cloud and a distributed architecture to deliver unified, intelligent, simplified and cost-effective networks. Aerohive was founded in 2006 and is headquartered in Sunnyvale, Calif.



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