



Tablets in Education: Is Your Network Ready?



Since its introduction in April of 2010, Apple's iPad has transformed the way users consume and interact with rich digital media. With approximately 30 million units sold to date, and 20 billion iOS-based applications purchased, the iPad is satisfying the world's thirst for anywhere, anytime computing power on a lightweight, easy-to-use mobile device. It's also paved the way for a new era of tablet computing. Confirming this trend in computing preferences, Forrester Research, Inc. noted in its Technology Adoption Profile (entitled *Building an Effective Mobile Device Management Strategy for Education, February 2011*) "the number of post-PC devices, such as slates, tablets, netbooks, and smartphones, has already eclipsed traditional PC devices, such as desktops and notebooks."

The iPad's ability to deliver such a broad range of content and applications – supporting streaming video and audio, along with text, pictures and social media – is already having a profound effect on education. For budget-conscious districts still reeling from the economic downturn, iPad purchases are dollar-wise: contrasted with the cost of laptop computers (which range anywhere from several hundred dollars to \$2000 or more per unit), a \$400 or \$500 iPad or tablet offers a high-potential, low-cost alternative for educational content delivery.

Still more benefits can be derived from iPad investments: already, thousands of applications have become available for the education sector and can be preloaded on the units. Many such applications contain embedded videos, making them still more dynamic and valuable as learning tools. iPads are also an outstanding alternative to expensive, heavy textbooks, which all too frequently are either obsolete the moment they roll off of the presses, or contain entire chapters that go unread.

Perhaps most importantly, the iPad resonates with a young generation that has grown up with (and expects) instant, convenient digital access.

Dr. Scott Smith, chief information officer at North Carolina's Mooresville Graded School District, agrees that students prefer to consume their content from a broad mix of digital devices. Mooresville is the site of one of the nation's most successful "digital conversions," which saw the distribution of Apple laptops to every student in grades 4-12.

"Students today are truly growing up digital, and can't imagine not being 'plugged in.' Mobile devices are awesome tools that offer every child opportunities they may not otherwise have."

Dr. Scott Smith, Chief Information Officer
Mooresville Graded School District, NC

1:1 The Next Generation

The "next generation" of 1:1 computing initiatives – the distribution of iPads in quantity within K-12 school districts – is now underway. The goals are many: support game- and project-based learning, create a collaborative environment, reduce costs, and improve the quality of teaching and learning.

"The iPad is one of several mobile technologies we're using to get us closer and closer to project-based learning," says Jeff Billings, chief information officer at Arizona's Paradise Valley School District. PVSD is the seventh-largest district in the state, with a total of 33,500 students scattered across 31 elementary schools, 8 middle schools, and 6 high schools. "In my district, I actually watch the kindergarteners a lot, to get a sense of what's coming. The iPad supports the way in which they like to interact with the digital world."

Smith says the Mooresville district is currently evaluating the use of iPads, with promising results. “We only have a dozen or so, and they’re all in use in the Exceptional Children’s area. It’s very limited at this point, but we’re seeing great things.”

In higher education, large numbers of faculty members and students are choosing iPads for content delivery and consumption as well, adding them to the range of mobile devices (especially smartphones) already in use. Paired with Apple’s iTunes U – which offers more than 350,000 free lectures, videos, books, and podcasts from global learning institutions as well as the broadcast media—the iPad offers one of the most powerful tools available to faculty and students.

At the University of Ottawa, for example, CIO Sylvain Chalut reports that as recently as two years ago, 75 percent of students used laptops and 25 percent used desktop computers. Today, Chalut says laptop usage has plummeted to 50 percent, with the remaining students employing a range of mobile devices such as tablets and smartphones. Although the University of Ottawa (and many others) once had a list of “approved devices,” those days are rapidly disappearing. Instead, savvy university administrators are deploying guest networks, which provide wireless access to the host of mobile devices that students and teachers now prefer to use.

“Kids today carry their whole world around in their pockets. If you don’t embrace that, you’re doing a disservice to them as students, and to yourself as an educator.”

Charlie Kanavel, Director of Information Technology
Campbell Union High School District, CA

Also, instead of focusing on equipping each student with a standard piece of hardware, the most visionary IT executives are directing their energies toward the deployment of new applications and services, made possible through virtualization technologies. Virtualization enables students and teachers to access their personal desktops from any desired device, such as an iPad, with all files, projects, and data stored in a centralized, cloud-based data center. This model is the essence of the individualized learning experience: users receive and interact with their data in their own way, at their own speed, on their device of choice.

“If I’m a student in a class,” Kanavel says, “I only have access to an application every other day for 90 minutes. But with virtualization, I have 24/7 access, anywhere, on any device, through any web browser.”

Damage Control

Of course, each new trend in computing comes with significant challenges for schools’ IT departments that must support and maintain the systems. On the upside, along with the cost-effectiveness and portability of the iPad, its elegant design includes far fewer parts than a laptop. Thus, breakage and the need to repair or replace will likely be less. Students themselves have demonstrated an unexpected “reverence” for mobile devices that IT directors suggest may further reduce the incidences of breakage.

In the Campbell district, which is home to some 10,000 students and 800 staff members in seven high schools and 13 adult education facilities, Kanavel is just wrapping up a two-year pilot program in which textbooks were virtualized for use on Sony eReaders. Early in the program, Kanavel discovered that students took far better care of the devices than had been anticipated.

“We did a feasibility study to try to determine how many would be lost or broken. Of the 270 that went out the first year, less than 10 came back broken. My theory, which is completely unscientific, is that kids are used to carrying cell phones, and know how to take care of compact digital devices. Also, they know that if all of their textbooks are on one device, and they drop it or break it, they’re in serious trouble,” Kanavel says.

In Mooresville, which saw the widescale laptop distribution in grades 4-12, Smith says students have come to understand that it is their responsibility to care for the machines. “They also know they can no longer function effectively in this digital environment without their device,” he adds. “Of course, much attention is given to proper use and care. But after three successful years, this has translated to fewer repairs and much greater student engagement.”



Special Benefits for Special Ed

In Missouri's Rockwood School District, a pilot iPad program for Special Education students has shown tremendous promise. Based on the results of that initiative the district is formulating a five-year plan aimed at reducing the number of laptops in use, and incorporating more mobile devices such as iPads.

"Recently one of our teachers had a student who had not spoken," notes Rockwood Superintendent Dr. Bruce Borchers. "After using an iPad, that student spoke for the first time in six weeks. So we're seeing some dramatic results, from a student progress perspective."

The Mobility Challenge

Still, deploying any number of iPads does present issues that must be addressed by school IT staffs. These challenges vary, depending on where the user is (on or off campus), the type of device in use (whether it is managed or unmanaged by the educational institution), and the type of network access the user has (wired or wireless).

Typically, IT departments see their resources quickly drained from the explosive growth of portable devices and the increasing need for device management and troubleshooting. In many cases (especially before the "bring your own device," or BYOD era), those demands consumed as much as 30 percent of IT budgets.

Let's take a quick look at the challenges of supporting mobile computing devices in educational environments. These challenges can be broken into two main categories: user experience and utility, and security.

User Experience and Utility

School systems that either sponsor or embrace iPads and tablets are looking to maximize their ROI from those devices, and make students and teachers as productive as possible. "During our last purchase cycle, textbooks cost \$8 million," Kanavel says.

"If we virtualized all of our textbooks and bought every student an iPad, we'd still save millions. Plus, our kids would have a device that's very compelling to them. We need to think about our spending in a different way."

Charlie Kanavel, Director of Information Technology
Campbell Union High School District, CA

The explosion of tablets drives wireless access needs and issues. With the majority of tablets, including iPads, able to connect only through a wireless network (most of them lack an Ethernet port), the importance of a robust wireless infrastructure is paramount. So what impacts end-user experience and utility?

Video

iPads are largely adopted because of their unparalleled capabilities in producing interactive multimedia experiences. To date, schools have deployed applications supporting:

- Distance/remote learning environments, in which an offsite teacher or professor conducts classes across town or across the country
- Portals offering rich digital content, such as lectures, videos, podcasts, and more
- Professional development and special education courses

To provide streaming video (often high-definition) on a tablet, a wireless network needs to effectively handle multicast video streams to multiple endpoints.

Bandwidth Availability

Wi-Fi, the primary network access method for tablet devices, is a shared resource. As more and more devices enter the network, this shared resource is stretched thinner and thinner. Consider that the average high school or college student may now carry several networked devices (laptop, smartphone, tablet, and so on). Improved portability creates a high client-density issue that can significantly impact the user experience. The problem becomes still more complex when many devices are running virtual desktop applications: virtualized desktops have frequent bandwidth bursts, placing even greater demands on bandwidth availability.

Roaming

Most laptops (with the exception of those containing solid-state hard drives, such as the MacBook Air) cannot be operated effectively while walking. By contrast, iPads and other tablets are more like smartphones, in that they allow users to be productive even while moving. But as the number of clients roaming between access points grows, wireless networks will experience increasing pressure. This makes producing a seamless mobility experience still more challenging, especially in schools where the network is not fully equipped to handle such a level of mobility.

Security Challenges

It's a given that in order to be useful to users, a network must provide a strong, secure connection. Obtaining a secure connection and provisioning the right access criteria can be one of the biggest challenges IT must solve with iPads, particularly when dealing with unmanaged devices.

Policy Assignment

Once an iPad or tablet is authenticated on the network, IT must determine the level of access the device should be granted. Normally, policy is dependent on who the user is, what device is being used, where and when access is permitted, and any other attributes the school decides on. Here are some of the typical policy options schools may consider:

- Students and teachers are required to use school-provided devices. Personal devices are not allowed, and there is no guest access.
- Students and teachers can access all resources from school-provided devices. Those using personal devices (including guests to the campus) have restricted access.
- Students and teachers can access everything from either school-provided or personal devices, but guests are blocked.

Off-Premises Access

If schools have allowed access to staff- or teacher-owned iPads or other tablet computers, what happens to sensitive administrative data that may now be on the device when it is being used off-premises? The risks are many:

- The iPad may be lost or stolen, allowing any perpetrator to gain access to proprietary information.
- The staff-member or teacher may not be the only user of the iPad.
- The iPad may unknowingly be connecting to unsecured (and possibly malicious) networks at airports or coffee shops.

Threat Defense

Even with the latest security updates installed, infected devices can still enter the network. A multilayered security approach is needed to protect users against infected websites, which make up the majority of infections today, and malicious traffic, such as social engineering threats through instant messaging or Web 2.0 applications.

Troubleshooting

Unmanaged devices present an even bigger problem, particularly when users call the help desk for problem resolution. It is therefore critical that IT maintain high visibility into all devices accessing the network.

Capacity Planning

The influx of iPads in education also poses a huge planning challenge for IT staff. Having a historical point of view into the types of devices in a school's network, their relative growth, and the demands they place on the network is a vital component of actionable capacity planning.

Guest Access

Just as schools may have unmanaged devices such as tablets accessing the network, they may also have unmanaged users (guests/visitors) requesting access. Effective network management should be integrated to include all device and user combinations.

The Cisco Solution

Cisco® Borderless Networks is the architectural approach recommended to meet all of the challenges described above. As Figure 1 illustrates, Cisco Prime Network Control System (NCS) consolidates wired and wireless client troubleshooting in a single management tool.

Figure 1

The screenshot displays the Cisco Prime Network Control System (NCS) Client Troubleshooting interface. It is divided into several sections:

- Properties:**
 - General:** User Name: Jack, IP Address: 0.0.0.0, MAC Address: 00:24:e8:e7:7b:93, Vendor: Dell, Endpoint Type: Microsoft-Workstation, Media Type: Wired, Hostname: Data Not Available, Serial Number: Data Not Available, Software Version: Data Not Available.
 - Session:** Switch Name: CoreSwitch.wlan.local, Switch IP Address: 172.20.226.1, Interface: GigabitEthernet1/0/40, Wired Speed: 1Gbps, VLAN ID: 0, VLAN Name: Data Not Available, Status: Associated, On Network: Yes.
 - Traffic:** Last Accounting Time: 2011-May-03, 12:24:15 PDT, Packets Tx/Rx: 0/0, Bytes Tx/Rx: 0/0.
 - Security:** Authenticating ISE: ISE, Authentication Method: 802.1X, Auth Status: Authorization Succeeded, Authorization Profile Name: AuthEmp, Posture Status: Not Applicable, TrustSec Security Group: Data Not Available, Audit Session ID: AC14E3810000089BEC90D091, Windows AD Domain: wlan.local, EAP Type: PEAP.
- Troubleshoot:** A row of status indicators: Link Connectivity (green check), 802.1x Authentication (green check), Authorization (green check), and IP Connectivity (yellow warning triangle).
- Problem:** Client could not complete DHCP interaction.
- Recommendation:**
 1. Verify that the DHCP server is reachable.
 2. Verify that the DHCP server is configured to serve the WLAN.
 3. If DHCP bridging mode is enabled and the client is configured to get an address from the DHCP server, verify that the local DHCP server is present.
 4. Verify that the client has a static IP address configured and is generating IP traffic.
 5. Ensure that the DHCP scope is not exhausted.
 6. If there are multiple DHCP servers, ensure they are not configured with overlapping scopes.

With WebEx, Powerful Possibilities

Other Cisco products are helping to maximize schools' investments in iPads. In both the Paradise Valley and Campbell districts, the IT teams have discovered that Cisco's WebEx technology offers multiple advantages when used on an iPad:

- The ability to bring in subject-matter experts from anyplace in the country (or the world)
- Convenient note-taking during lectures
- Support for video, audio, PowerPoint presentations and other digital media
- When underpinned by a robust Cisco network, superior image quality that makes face-to-face connections engaging

Says Billings, "The best WebEx is on an iPad; it's very fluid and intuitive, and it's a really good experience. On a laptop you have a mouse, keyboard, etc. But the iPad supports multiple formats... everything just flows."

In the past, Campbell's Kanavel says, the benefits of being taught by an outstanding teacher were limited to the students lucky enough to attend the school where that teacher was employed. But with WebEx on an iPad, that "analog" model has been turned upside-down. "WebEx offers a way to broadcast that resource. Students log onto their virtual desktop, and then everyone gets exactly the same learning experience...regardless of where they live."

The relative anonymity of online access is an additional benefit, Kanavel continues. "When you have 30 kids in a room there's always hesitation to ask a question, for fear of looking stupid. But by using the 'chat' function in WebEx, no one knows who asked what. We find kids are much more engaged when they're online than when they're interacting with each other in person."

How Cisco Stacks Up

In education, one of the most prevalent support challenges today revolves around students' and teachers' use of personal devices, and the correlating requests to gain network access. As detailed earlier, Cisco has a comprehensive solution that allows an unmanaged device to get onto the network (regardless of the access method used) and be subject to a predetermined policy.

Table 1 summarizes the components making up the solution.

Table 1: How the Cisco Solution Meets Tablet Networking Challenges

Challenges		Solution Elements
User Experience and Utility	Video	Medianet with Cisco VideoStream Cisco Compatible Extensions
	Intelligent Apps	Context-aware software
	Bandwidth	Cisco CleanAir technology Cisco ClientLink Cisco BandSelect
	Roaming	Support for both Layer 2 and Layer 3 roaming
Security	Profiling and Posture	Cisco Identity Services Engine (ISE)
	Policy Assignment	Cisco Identity Services Engine
	Off-Premises Access	Cisco AnyConnect™ Secure Mobility Solution Cisco Prime Network Control System (NCS)
	Threat Defense	Cisco AnyConnect Secure Mobility Solution Cisco Security Intelligence Operations (SIO)
Manageability		Cisco Prime Network Control System (NCS) Cisco Identity Services Engine (ISE)

Table 2 summarizes the benefits derived from the Cisco method, as compared to competitive alternatives.

Table 2: Cisco Solution for Any Device Access: Features and Benefits

Feature	Cisco Benefits
Scalable	<p>Device profiling (fingerprinting) is very scalable because it does not happen at the controller, but rather at the Cisco Identity Services Engine (ISE). The controller is not burdened with yet another service.</p> <p>Competitors using the wireless controller for fingerprinting significantly diminish performance by as much as 60 percent from theoretical throughput based on testing.</p>
Multi-variable Fingerprinting	<p>Instead of using a single profiling parameter (such as the device's browser) that can very easily be spoofed into pretending to be something that is not, Cisco uses more than five criteria, including: Netflow, MAC address, hostname, Dynamic Host Configuration Protocol (DHCP), and HTTP. By keeping the browser type at the end of the process, the Cisco methodology is able to eliminate virtually all false positives and avoid giving full network access to unmanaged devices (assuming that this is the desired policy).</p>
No RF Overhead	<p>Once a device is profiled, it can be placed onto the appropriate VLAN with the right policy controls. Competitive alternatives require the additional step of associating to a separate Secure Set Identifier (SSID), which can potentially slow down the network.</p>
Rapid Profiling	<p>Cisco ISE keeps the device profile in a cache so that the process can be near instantaneous the next time it appears on the network. Controller-based solutions don't have the scalability to cache the information, and as a result perform repetitive tasks that further reduce performance.</p>
Granular Policy Control	<p>The Cisco ISE has the ability to manage very granular and fully customizable access policy levels that include up to four QoS categories and a wide range of customizable access control lists (ACLs) and VLANs.</p>
Integrated Posture	<p>Posture assessment is an integral part of maintaining a secure enterprise network. The Cisco ISE integrates this functionality for a complete solution, whereas alternatives from competitors require a separate appliance that raises the cost of ownership.</p>
Embedded Guest Access	<p>Finally, the Cisco ISE can also manage guest access, all from the same appliance, in order to significantly simplify network deployment and management. Most importantly, however, it does so for both wired and wireless clients. This is crucial because tablets are not the only unmanaged devices attaching to your network.</p>



Cisco's Wireless LAN Controller grants access to resources as appropriate, based on policy. Here's how it works:

- User brings both a school-issued laptop and a personal iPad onto the campus.
- He or she connects both devices to a single-service identifier (SSID) to gain wireless network access.
- The Cisco Identity Services Engine (ISE) uses a number of device fingerprinting variables to accurately identify the device as a school-issued or personal asset.
- An appropriate policy is determined using a combination of criteria such as who the user is, what device is in use, the location and time of use, etc.
- The ISE then enforces the policy by placing each device on an appropriate virtual local area network (VLAN), while staying connected on the same SSID.

Conclusion

The influx of tablets and other unmanaged devices in schools creates a complex set of problems that require an architectural approach for resolution. Competitive technologies are primarily point solutions for wireless only, and ignore most other challenges outlined in this paper.

“Good enough” competitive alternatives don't begin to compare with the Cisco solution, and in the long run, higher operating expenses will far outweigh any capital savings achieved early on. The Cisco Borderless Networks solution for iPads (and other tablets) will reduce the total cost of ownership for schools in the following categories:

- Fewer boxes to manage: The Cisco ISE combines all the functionality required to get iPads (and all other devices) safely onto the network.
- Single management platform: Access is not wired or wireless—it is unified. Cisco Prime NCS will save money in the deployment, troubleshooting, and maintenance of a network for years to come.
- Better wireless network performance: Cisco protects the performance of a network, and optimizes the user experience and utility derived from iPads and other mobile devices.
- Deeper security, more protection: With robust security features integrated into the Cisco solution, every user (and every application) is safe.

For Kanavel and the Campbell district, the key benefit of their Cisco network is its support for all things virtual.

“At the end of the day, virtualization is the resource we're delivering on an iPad via our Cisco network. It couldn't be done without Cisco.”

Charlie Kanavel, Director of Information Technology
Campbell Union High School District, CA

“We're big believers in Cisco's wireless network, because it just works,” Billings concludes. “If I were in a district that was going to have a large deployment of iPads, I would definitely want a Cisco network.”



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