



**The iPad, Wireless LAN, and Education  
Making Sure Your Environment Is “Tablet-Ready”**

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## The iPad and the Education Environment

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### The Ingredients for Success

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Apple introduced the iPad with a lot of fanfare a few weeks ago. The launch was met with a mix of cheers and sneers from industry observers. But the negative reaction centered fundamentally on what the iPad isn't, rather than what it could be.

The iPad is not a portable PC with a touchscreen and no keyboard. It doesn't have a hard drive, a conventional USB port or support for a mouse. It doesn't allow multitasking for applications, or Flash for web-based videos. In short, it wasn't what many people were expecting.

The iPad is something entirely different. It is something new. But is the iPad "great", "magical", or "revolutionary"? Does the iPad represent a new category of mobile computing device? Is the iPad a Kindle killer? Is it the savior of the publishing industry? It is too early to make those proclamations. The device has not even shipped yet.

It is pretty clear, however, that the iPad will be very influential in the education market. The iPad has all the essential ingredients for success in education, both primary/secondary and higher education.

### The WLAN Factor

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Realizing the iPad's potential will be as much a factor of the wireless LAN that supports it as the device itself. More than virtually any other vertical, Wi-Fi is key infrastructure for higher education and primary/secondary education, and the iPad will depend heavily on it.

The large-scale deployment of simple, tablet style wireless clients such as the iPad, the Amazon Kindle, and Sony reader will place increasing pressure on enterprise-grade WLANs in schools and universities. As it is, these systems already face system overload from multimedia applications and a proliferation of clients like the iPhone. The iPad promises to raise the ante.

From the educational ICT perspective, the arrival of the iPad will be a tremendous new tool for technology learning but could be an operational headache if your WLAN is not up to supporting it. The need for WLAN that support seamless mobility and high user densities while still ensuring performance is clear. Otherwise the coming iPad wave may turn into a flood of unhappy students, teachers, and superintendents.

## The Apple Education Advantage

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### *Existing Ecosystem*

Apple already has the right ecosystem in place to drive the iPad into the education marketplace. Apple has always been strong with hardware distribution for Macs in the education market. Apple also has the content side through the iTunes store, the App Store and now the iBook store. The third part of the ecosystem is the consumer side where Apple has been dominating with iPod and iPhone through the online and physical Apple Store locations.

### *eBook Reader*

The iPad is an excellent eBook reader that supports the standard formats but also offers a platform for enhanced curriculum and books with interactive multimedia elements. Apple is already attracting many of the major textbook publishers to develop content for the iPad, according to a recent article on the device's impact.

“Major textbook publishers have struck deals with software company ScrollMotion Inc. to adapt their textbooks for the electronic page, as the industry embraces a hope that digital devices such as Apple Inc.'s iPad will transform the classroom.

The publishers are tapping the know-how of ScrollMotion Inc. to develop textbook applications and test-prep and study guides for the iPad.

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Though Apple didn't outline its strategy to target the educational sector with its iPad last week, people familiar with Apple's thinking have said that the iPad's use in schools was one of the focal points of discussions in developing the product. In its exploration of electronic book technology, it thought particularly about how it could re-invent textbooks, these people said.”

“Textbook Firms Ink E-Deals For iPad”, *The Wall Street Journal*, February 2, 2010

Note: Please see “Appendix A ” on p. 9 for the complete article. The original is also available on the WSJ's website (may require registration) at:

<http://online.wsj.com/article/SB10001424052748703338504575041630390346178.html>

### *Multimedia Content Player*

The iPad will be a great way to consume multimedia content. It features beautiful and fast graphics on a large screen. It has a built in accelerometer and a multi-touch interface.

There is no mouse or physical keyboard. You interact with the iPad and manipulate its content by touching it directly. There is a new language of multi-touch gestures that is very intuitive for most people and delivers a more direct experience. All of this will encourage educational application developers and textbook publishers to enhance their content for the iPad platform.

## Operational Considerations

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### *Controlled Software Platform*

Like the iPhone, the iPad only runs software that is distributed through the Apple App store. There is no other way to load software onto the device. Software approved by Apple and distributed through the App store will not be able to run in the background or support multi-tasking.

While there have been many complaints about Apple exerting this level of control, there are many benefits for the consumer and education customer. The iPad will always be responsive to user input, it will never crash, it won't get viruses, and you will never have to reboot it.

Indeed these qualities (or limitations depending on your perspective) are one of the key experiences that define a "new category" for the iPad. This is very different than the PCs (or Macs) to which we are accustomed.

### *Sealed Hardware—No Moving Parts*

The iPad is a thin slab of glass and aluminum. The only "expansion ports" are the headphone jack and the dock connector. There no other ports, connectors or hatches.

The iPad uses solid state memory. There is no hard drive. There are no moving parts other than the Home button, volume button and the sleep button.

This means that the iPad will be a very durable device. There is nothing to lose or break. Particularly in the primary/secondary education environment, this is an important consideration.



### *Battery Life*

The iPad spec asserts a 10-hour battery life. This means a single charge easily lasts for a full school day.

## Aggressive Pricing

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A low end iPad is priced at \$499. This is about the same as a fully featured Netbook targeted at the education market, such as the Mirus Intel Classmate Touchscreen Netbook shown here.

For many high school students, Apple's iPod Touch is already a popular choice for games and multimedia player. The iPad is \$300 more for an equivalent configuration with a much bigger screen that delivers everything that the iPod Touch does only better.

An iPad will also be an eBook reader and



the most stylish-looking graphing scientific calculator you have ever seen. It is not too difficult to imagine some families supporting the additional expense and getting an iPad for their student particularly as more and more of the curriculum is optimized for the device.

The aggressive pricing of the iPad, combined with the great-looking display and user experience, raises the bar for Netbooks in education. The Netbook category will be pressured to improve their user experience or reduce their prices even more to remain competitive.

## Wi-Fi and 3G

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The iPad has 802.11n Wi-Fi and optional 3G data capability for connecting to the internet. iPad is a prodigious multimedia content consumer. In an education environment most of that content will come through Wi-Fi from the local network or the internet. You can think of the Internet as iPad's expansion port.

The iPad will be a [voracious consumer of wireless bandwidth](#), so it is important that iPad use the latest Wi-Fi technology, 802.11n. There is room for a few antennas around the display, but power will certainly be constrained on the iPad, so we can expect it to be a mid-range Wi-Fi device.

It will likely be single stream only, and capable of some MIMO. This will put the iPad between smart phones and full fledged laptops in terms of Wi-Fi performance and range. The iPad will likely be able to get twice the throughput of a legacy 802.11g laptop when using an 802.11n infrastructure under ideal conditions, but it may operate at slightly less range.

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## iPad Educational Deployment Scenarios

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### Institutional Deployments

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The iPad is a great platform for *institutional deployments* in primary schools. The sealed nature of the device that many pundits are now complaining about is perfect for education. The iPad gets its programs and content only by syncing with a computer, i.e. physically connecting to a laptop or desktop and downloading programs via iTunes.

Schools will be able to load the iPad with exactly the desired applications and only the desired applications to support their curriculum. They will be able to wipe the iPad if it is stolen and “lock it” to prevent syncing with a different computer.

The iPad already delivers the educational material developed for the internet or the iPod Touch. As more and more textbooks and curriculum are optimized for iPad, it will be an attractive (but slightly more expensive) alternative to the education Netbooks that are already rolling out today.

The unique multi-touch interface also creates the opportunity to use the iPad for younger students in primary schools. There is no need to learn the mouse, cursor, desktop and folder abstractions that have driven the PC based user experience for the last generation. A more direct learning experience is possible.

### Individual Educational Deployment

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The *individual educational deployment scenario* for iPad is obvious. Apple products are already very popular with high school and university students. The iPad will be no exception. For high school students, an iPad could replace a backpack full of text books, a scientific calculator, a dictionary and thesaurus - and it is also a great iPod and gaming device that is small enough to take with you.

For many university students, an iPad may be just enough. The iPad is smaller and light than notebook PCs and it doesn't require and computer expertise to maintain it - updates are automatic and there are no viruses. “Installing software” is the same as buying an album on iTunes. The iPad may be a more appealing portable device than a notebook PC that students can take to class for notes, web surfing, email, calendar, address book, book reader, games, and simple document creation.

Does the iPad replace the netbook in primary schools? No. Absolutely not. The iPad adds to the momentum that netbooks are already building in the education market. There will be more and more wirelessly connected devices in schools and they will become increasingly integrated into the fabric of the education experience.



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## iPad and the Wireless LAN

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The iPad is fundamentally an internet tethered device, and its only connection is wireless. Local storage on the iPad is modest and it will access the internet or a local school intranet for much of the multimedia content it displays. The iPad accelerates a trend that is already underway in schools—a wide variety of wireless client devices are generating more and more traffic on the wireless LAN infrastructure.

Universities have already experienced an explosion of wireless traffic. Each new batch of incoming students brings with them new laptop computers. Over the last two years there has also been a tremendous influx of Wi-Fi enabled smart phones like the iPhone and the various Android models. The iPad is another wireless device coming to campus that is seamlessly connected to the internet and encourages constant connectivity. It will definitely put more pressure on a university's wireless LAN infrastructure.

In primary schools iPads and netbooks are coming in, and they will be an important vehicle for delivering the curriculum. For schools at all levels, wireless LANs are now essential infrastructure, not just a nice thing to have to support casual mobility.

The iPad is both a challenge and an opportunity for Wireless LANs in schools. The challenge is simply the additional traffic load, and the increased emphasis on multimedia traffic that requires Quality of Service guarantees on the wireless LAN in order to deliver a positive user experience.

The opportunity presented by the iPad is 802.11n. Since iPad's Wi-Fi interface is based on 802.11n technology, it is possible to optimize the network for higher performance 802.11n thereby handling some of the increased load on the system.

General guidelines for supporting iPad in schools:

- **Move to 802.11n:** There is no reason to wait to deploy 802.11n. iPad is another reminder that it is time to upgrade.
- **Build a more dense wireless LAN infrastructure:** The laptop is no longer the typical wireless LAN client for wireless LANs in schools. The sweet spot for iPad range will likely be less than PC laptops but more than a smartphone. It is important to survey for coverage using the typical device you will be using on the network.
- **Increase capacity:** Design your entire network - both wired and wireless - to *deliver enough capacity* to support the increasing wireless user base.

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## Extricom and iPad in the Education Market

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The iPad is on its way. Is the wireless LAN in your school prepared? The Extricom wireless LAN is designed to handle the coming iPad blitz in education.

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### The Extricom Value-Add in the Educational Environment

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#### *A Stable, Resilient System*

The increasing wireless traffic in schools will put pressure on existing infrastructure and highlights the value of the Extricom architecture. One of the main reasons that schools value the Extricom solution is that Extricom wireless LANs remain stable under heavy load and can support many simultaneous users in the same area.

In the Extricom Channel Blanket architecture, adjacent access points operate on the same channel, creating large blankets of continuous coverage. The Extricom switch coordinates the AP transmissions, eliminating co-channel interference which reduces collisions and retransmissions, and leads to predictable performance and stability.

Extricom's Channel Blanket Architecture provides system-level diversity; each wireless client transmission is heard by multiple APs operating on the same channel. This creates an exceptionally robust WLAN infrastructure.

For transmissions from the APs, the Extricom switch decides, on a packet-by-packet basis, which AP is best to transmit to the client for optimal reception. The system-level diversity enhances 802.11n operation and enables the Extricom system to work well in the harshest RF environments.

#### *The 802.11n Difference*

Extricom's system approach is the perfect complement to 802.11n systems. Extricom enables practical and simpler deployment of 802.11n. 802.11n access points have erratic coverage patterns that are very sensitive to the environment. It is very difficult to design a conventional multi-access point 802.11n system that has no coverage holes but minimizes the overlap between coverage areas from adjacent APs.

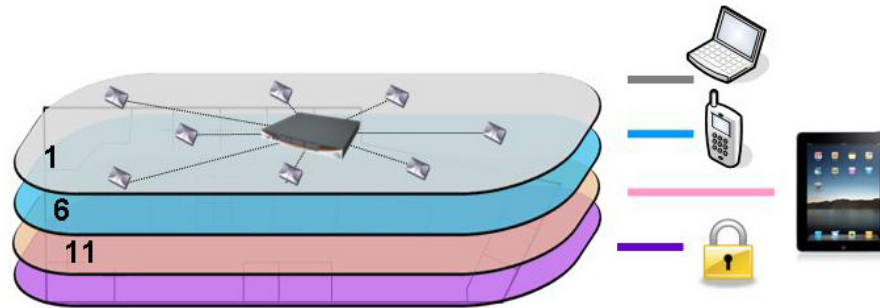
In the Extricom system, you only design for one variable - coverage. The overlap of adjacent AP coverage is beneficial in an Extricom system, as the central switch will coordinate the APs and eliminate self interference. As described above, iPads may require a more dense WLAN infrastructure, more APs operating in a given area. Extricom's system supports this very well.

#### *The iPad Layer*

Extricom's wireless LAN infrastructure for schools features three or four radio APs, which enables the creation of multiple independent channel blankets from the same infrastructure. The layered channel blankets allow flexible organization of the network.

In the simple example shown here, we organize the network by device type - there is a layer for laptops, a layer for smart phones, and an iPad layer. The fourth radio is used for security - intrusion detection and prevention. Each layer is physically separate from the others, operating on a separate channel. Organizing the network into separate channel blankets allows you to

optimize the security and QoS parameters for each blanket according to the type of traffic it carries.



### Configuring for the iPad

A common approach is to put voice traffic on one blanket and data on another. It is also possible to group all of the legacy traffic into one blanket and have the newer 802.11n clients on a separate blanket that runs at full speed (in “greenfield mode”) for 802.11n. The Extricom system is much more than “dual band” - it allows any combination of channels in either band.

It is possible to define a Channel Blanket configuration that is optimized for iPad. If our assumptions about iPad’s 11n capabilities are correct (single stream, 2x2 MIMO), it will support raw data rates up to 75 Mbps in a standard 20 MHz channel.

The expected throughput may be around 40 Mbps, or about twice that of 802.11g. We can double the throughput for iPads by using channel bonding and creating 40 MHz channels. By default, this will be possible in the 5 GHz band only.

Extricom’s infrastructure is the only wireless LAN that can support 2.4 GHz networks with 40 MHz channels. Using layered channel blankets, we can define one 2.4 GHz blanket for high performance iPads (combining channels 1 and 6 for example), and we would still have another channel available (channel 11) to support legacy devices in the 2.4 band. We could support more 802.11n devices in the 5 GHz band by creating other blankets from the same infrastructure.

## Extricom’s Success in Education

Extricom switches and access points, based on the unique Channel Blanket Architecture are already being used to successfully support high-capacity wireless LAN in many primary/secondary and higher education institutions including:

Essa Academy: <http://www.extricom.com/content/technology/multimedia/essa-academy>

Texas State Technical College:

[http://www.extricom.com/media/Xc5r\\_extricom\\_cs\\_tstc\\_v1.pdf](http://www.extricom.com/media/Xc5r_extricom_cs_tstc_v1.pdf)

New Mexico Military Academy:

[http://www.extricom.com/media/nhld\\_extricom\\_cs\\_nmml\\_v1.pdf](http://www.extricom.com/media/nhld_extricom_cs_nmml_v1.pdf)

Lewiston Regional Technical Center: <http://www.extricom.com/content/news/press-releases/lewiston>

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## Appendix A

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**Note:** this article was originally published in the February 2, 2010, edition of the *Wall Street Journal* and is available here (may require registration to read):

<http://online.wsj.com/article/SB10001424052748703338504575041630390346178.html>

### **Textbook Firms Ink E-Deals For iPad**

By JEFFREY A. TRACHTENBERG And YUKARI IWATANI KANE

Major textbook publishers have struck deals with software company ScrollMotion Inc. to adapt their textbooks for the electronic page, as the industry embraces a hope that digital devices such as Apple Inc.'s iPad will transform the classroom.

The publishers are tapping the know-how of ScrollMotion Inc. to develop textbook applications and test-prep and study guides for the iPad.

"People have been talking about the impact of technology on education for 25 years. It feels like it is really going to happen in 2010," said Rik Kranenburg, group president of higher education for the education unit of McGraw-Hill Cos. and one of the publishers involved in the project.

Other publishers include Houghton Mifflin Harcourt K-12, which is a unit of Education Media & Publishing Group Ltd.; Pearson PLC's Pearson Education, and Washington Post Co.'s Kaplan Inc., known for its test-prep and study guides.

Many developers and publishers are working on applications that will work on the iPad and other digital devices. Publishers have been investing heavily in digital education in recent years.

Compass Intelligence, a market research firm in Scottsdale, Ariz., estimates that technology spending in the U.S. educational market could grow to \$61.9 billion in 2013, from \$47.6 billion in 2008.

So far, digital education has largely been confined to desktops and laptops, but many college students have been slow to embrace e-textbooks on their computers. Portability could make the difference, however.

Maureen McMahon, president of Kaplan Publishing, said a recent Kaplan study showed that students remain big fans of printed books but that they would be more receptive to e-textbooks on portable digital devices.

Whether the iPad will be the digital device to transform the classroom remains to be seen. "Nobody knows what device will take off, or which 'killer app' will drive student adaptations. Today they aren't reading e-textbooks on their laptops. But ahead we see all kinds of new instruction materials," said Mr. Kranenburg.

Though Apple didn't outline its strategy to target the educational sector with its iPad last week, people familiar with Apple's thinking have said that the iPad's use in schools was one of the focal points of discussions in developing the product. In its exploration of electronic book technology, it thought particularly about how it could re-invent textbooks, these people said. Apple declined to comment on the role of textbooks on the iPad. Apple has an edge in the educational sector because its Macintosh computers have always enjoyed a strong following in the academic sphere, and it already offers educational audio and video content through its iTunes U service.

The iPad also will be helped by the interest that schools have always had in tablet-form computers. Science teachers, for example, could use them for taking lab notes, which often use a combination of sentences, charts and mathematical equations, while others could use them on field trips. "This is the beginning of handheld education," said John Lema, chief executive of ScrollMotion.

But the iPad faces competition from other devices, notably the cheap portable laptop computers known as "netbooks" that can be purchased for a couple hundred dollars, and that have already started making in-roads in schools. Amazon Inc., which initially failed in its attempt to pitch its bigger-sized Kindle DX to schools, says it has plans to offer "active content" that works more like programs and less like plain books.

Jeanne Hayes, an educational consultant in Littleton, Colo., said the iPad's lower-than-expected entry-level price of \$499 will interest schools, but some of them may not be able to purchase the device right away if they've already purchased netbooks.

"It will be a matter of how Apple represents this to schools and how they fold it into their offerings," said Ms. Hayes.

It's also unclear whether ScrollMotion will emerge as the leading applications provider, with many others in the works. A closely held New York-based firm, ScrollMotion has already developed applications for Apple's iPhone and iPod Touch. ScrollMotion takes digital files provided by publishers for the iPad, adapts them to fit on the device, and then adds enhancements such as a search function, dictionaries, glossaries, interactive quizzes and page numbers.

The features of its iPad deal with publishers include applications to let students play video, highlight text, record lectures, take printed notes, search the text, and participate in interactive quizzes to test how much they've learned and where they may need more work.