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WORLD WITHOUT WIRES: A 'VIRTUAL' ROUNDTABLE

Campus Technology **speaks with three different colleges and universities about how wireless computing is helping to enhance learning and attract students.**

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EXECUTIVE SUMMARY

It's no secret that in the current world of higher education, wireless Internet access is taking hold in a big way. Gone are the days when campus administrators spent millions of dollars and hundreds of hours wiring every dorm room and classroom with multiple ports for Ethernet connections. Instead, today, schools are turning in droves to a bigger, bolder, and broader way of providing campus connectivity: wireless.

Wireless is great in that it enables flexibility to connect to the Internet whenever and wherever users wish. Universities and colleges are among the most aggressive adopters of Wi-Fi technology. The trend toward more collaborative and open learning environments, fueled by the explosive adoption of mobile devices among students and faculty, makes higher education campuses fertile ground for wireless Local Area Networks (LANs).

As universities migrate from hotspot to campuswide deployments, and the perception of wireless changes from a "nice-to-have" to a transformational technology, network administrators will experience significant growing pains. The campus environment presents unique challenges for Wi-Fi technology, such as navigating dense user environments, intense bandwidth demands, and radio frequency interference over time.

To capture what today's institutions are doing about many of these pressing issues, we carefully selected three schools that represent a range of experiences with the ins and outs of a wireless environment. For our discussion, we spoke individually with each participant, then interwove their comments and asked each to respond in turn to what the others said.

All the schools we included recently have revamped their wireless coverage on campus with a new solution from Meru Networks,www.merunetworks.com. The Meru wireless LAN system manages contention, interference and Quality of Service (QoS) automatically with its patented Air Traffic Control technology that schedules client transmissions to mitigate client collisions and allow high densities of clients to have excellent throughput performance.

The Meru approach also eliminates complicated radio frequency (RF) planning with a technology that allows schools to simply place access points (APs) in the best positions to ensure complete coverage. Taken as a whole, the Meru wireless LAN mimics a time-division algorithm similar to the one that most cell phone companies use, a strategy that responds dynamically to customer needs as they arise, balancing bandwidth over the entire user base.

Participant comments show the range of experiences schools have encountered in moving from more traditional wireless networks to the new Meru approach. Still, through each experience runs a common thread: Traditional wireless technology is good, but newer and more dynamic wireless that enables technologists to maximize bandwidth and minimize disturbances is even better. If schools cut their cords, they might as well do it right.

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ABOUT OUR ROUNDTABLE SCHOOLS

Hobart and William Smith Colleges are twin four-year liberal arts campuses located in the Finger Lakes region of New York State. Hobart College is for men and William Smith College is for women, but the schools operate jointly, creating one campus in Geneva, N.Y., that necessitates a one campus network. Together, the schools occupy a 170-acre campus that contains 46 student residences, 48 classroom and administrative buildings, a library, two dining halls, a café, two gymnasia, a sport and recreation center, numerous athletics fields, several computer labs, a studio arts center, an intercultural center, a chapel, a career center, infirmary, theatre, student activities center, pub, post office, bookstore, radio station, boathouse and dock and guest house. All of these buildings and facilities are covered by the school's new wireless network, which was implemented in 2004. To get a good idea of how this implementation has impacted both schools, we spoke with Mike Ruiz, network and systems engineer.

Northern Michigan University, located in Marquette, Mich., on the state's remote Upper Peninsula, recently was ranked 19th among the top 50 "Most Unwired" campuses for 2005, according to the second-annual survey of wireless Internet accessibility by Intel Corp. The school is a dynamic four-year, public, coeducational university which offers 180 degree programs to nearly 9,400 undergraduate and graduate students. The 350-acre campus features 52 facilities, including the newly constructed Seaborg Science Complex, a state-of-the-art venue with more than two dozen laboratories, and the newly renovated Thomas Fine Arts and Art and Design buildings. Most importantly, the school is one of the largest notebook computer campuses in the United States with all full-time students receiving either an IBM ThinkPad or Apple iBook as part of tuition. Since all of these laptops are part of the wireless network the campus rolled out in 2005, we thought we'd get a better sense of what's going on at NMU by chatting with Dave Maki, director of Technical Services.

Leonard M. Miller School of Medicine at the University of Miami, also known as the University of Miami Medical Center, was founded in 1952 as Florida's first accredited medical school. Today, the facility serves Miami, South Florida, South America, and the Caribbean in education, research, patient care, and community service. Each year the medical school's 700 faculty physicians have more than a million patient encounters, in primary care and more than 30 specialties. In addition to Jackson, UM clinical facilities are located at the Miami Veterans Affairs Medical Center, five primary care centers throughout Miami-Dade County, and a half-dozen area hospitals. The School of Medicine has a total of 6,000 employees. The School of Medicine campus consists of 35 acres within the 80-acre complex of the UM/Jackson Memorial Medical Center, including 1.9 million square feet of research space, all of which falls under the wireless network that the school rolled out in 2005. To learn more about this network, we spoke with Chris Bogue, information technology (IT) director.

WHY GO WIRELESS?

What values were you hoping to derive from your wireless LAN, and whom did you hope would benefit most?

Mike Ruiz, Hobart and William Smith Colleges: Wireless wasn't something we were under a mandate to do campuswide. By going wireless, our primary goal was to enable flexibility in our computing environment, and enable our users to decide what they wanted to use that flexibility for. We have a lot of wired ports on campus -- 6,000 ports for 1,800 students and 500 employees -- and we tried to provide connectivity everywhere possible. We discovered as more and more people came to campus with laptops, that there were some places with no accessibility. When we rolled out our solution from Meru Networks, we tried to roll out in a variety of locations, some of which would be more student-centric and some of which would be more targeted toward faculty and administration. We wanted to drive the idea that the network and the wireless network is for everybody to integrate into everything they do, not just into their social lives or business lives, but in every aspect of campus life across the board.

Dave Maki, Northern Michigan University: We have some big lecture halls, and we wanted wireless so that we would have the ability to do online testing for groups of 150 to 200. That was it. Our entire wireless initiative was designed for students in those lectures. I guess you could say we designed it for faculty in the sense that they're the ones doing the testing, but really, the effort was driven entirely for the benefit of students. In the past, we required students to plug into hard-wired Ethernet ports. After years of doing it that way, it was clear something had to change.

Chris Bogue, University of Miami Medical Center: Our primary focus in deploying Meru's wireless LAN services throughout this medical center and its remote sites was to realize the benefits and efficiencies gained in workforce mobilization while keeping an eye on emerging voice, video, and data technologies that are beginning to make more use of wireless LANs.

Editors' Commentary: *It's important to note here that all three schools were seeking increased flexibility from their new wireless LANs. In the case of the University of Miami, technologists wished to run both data and voice over the wireless network. As Voice over the Internet Protocol (VoIP) becomes more prevalent on college and university campuses, we predict that this desire will become more of a trend.*

IMPLEMENTATION CHALLENGES

What were your biggest challenges as you deployed a wireless LAN on your campus?

Mike Ruiz, Hobart and William Smith Colleges: We had realized that there would be some significant obstacles to overcome as we wanted to move into wireless. Despite the fact that we're a small college, we have a lot of buildings. 99 of them, to be exact. Many of these buildings are small houses in town that the school has purchased to use as residences. It would have been easy to throw up an access point and look to cover an area. Instead, we turned to Meru Networks to help us strategize our wireless surveys to cover the area efficiently. Meru's access points perform automatic surveys eliminating the need for H&WSC to purchase additional survey spftware. Not only did they enable us to cut down on the number of access points by helping us survey better, but they helped us strategize channeling our wireless network to make sure bandwidth was high and interference was non-existent.

Dave Maki, Northern Michigan University: Interference: We dealt with that. For us, wireless itself was never a challenge, but the biggest challenges for us were in deploying the wireless LAN. For months, we were working off of traditional access points, but these points couldn't handle more than 15 to 20 clients apiece. In one building in particular, we had so much radio interference that connections were awful. We tried to build pico cells, small WLAN coverage areas, using antennas making targeted areas in classrooms, but that didn't work. We tried to turn radio power down -- we could do it on APs, but we couldn't do that on clients, so they continued to cause interference. Finally, with the help of Meru, we were able to overcome the interference problems. As an additional benefit, we can now offer .11b and .11g radios in the same space, and not significantly degrade the .11g performance as what happens with traditional access points.

Chris Bogue, University of Miami Medical Center: With a moderate deployment of roughly 1,200 access points and growing, [we learned that] organization, documentation and focus are keys to a successful deployment. [My advice to other schools would be to] organize your deployment plan to first address your specific usage and information security concerns; don't build around technology. Clearly define your objectives, figure out which you can actually obtain with available technologies, and then stay focused on the plan. "Mission creep" can quickly overcome a project and before you know it, your deadline's way behind you. Also, document and label everything. You'll be happy you did, a year or two from now when you're trying to physically locate access point number 768 out of a few thousand others. If you're in healthcare, start the permitting process as early as you can.

Maki: In terms of advice, we learned the hard way that the traditional access point/client model doesn't work anymore because it can't handle high densities of users in areas where there's a lot of radio frequency interference. I'm not talking about big open spaces. I'm talking about brick-walled rooms with cement ceilings and floors. We had some buildings where we have 40 laptops in a classroom, right on top of each other. For that kind of environment, you need something that's smart enough to load-balance the clients. In the end, it's all about an unregulated spectrum. Someone can have a cordless phone and take you out. That's our biggest nightmare.

Editors' Commentary: *It should be noted that permits are not required for the purchase and installation of WLANs, except when these devices will be placed in specific areas. In the case of the University of Miami, the WLAN devices were installed above the ceiling, and a permit was required to ensure that these devices complied with local safety and environmental codes.*

MANAGING SECURITY

How did your institution handle particular security issues that were unique to wireless technology?

Mike Ruiz, Hobart and William Smith Colleges: From a social perspective, we had to have a way to educate people about the fact that wireless was different from wired, that it could be made safe, and that there were steps each and every user had to go through to make changes. To do this, we developed new communication strategies to get information out to the campus. Beyond this, we knew we had to treat our wireless network as a trusted endpoint system. This meant we had to tell people to do things on their computers, but in a way that would keep endpoints secure. We had to provide ways to handle things like encryption and access control on the wireless network. The key: There needed to be more than one strategy. We recognized early on that the technology had to provide multiple strategies for security. Whether it was something our users did internally or something we could do with existing systems, it was paramount to secure the network, and we did.

Dave Maki, Northern Michigan University: When I look at the standard wireless access point, it's like a hub, not a switch. It supports everything. We have so many types of clients out there, from handheld PDAs to laptops. Even though we have a laptop program, you can bring your own laptop to campus here if you want. We have too many devices out there to try and use static WEP keys or any other type of newer securities. Going into wireless, my attitude was that I wasn't going to encrypt it at all. Instead, we use MAC Address authentication to get on the network. You have to register your MAC [Media Access Control] Address; we have a homegrown function to do that automatically. Our version of security is that you can't get an IP address unless your MAC Address is registered. Beyond this step, there's no encryption. We tell people that. We also recommend for them to use the Nortel and Cisco VPNs on campus which encrypts their session on wireless, but the sessions always are open to everybody else on campus. We make our users aware of this so they know that things like online banking might be compromised. Still, we haven't had any problems so far.

Chris Bogue, University of Miami Medical Center: [We didn't experience anything] new here [in terms of security]. The bottom line is that data in transit needs to be encrypted. As an added layer of security, we wanted to thwart "man-in-the-middle" attacks, and our engineering and security team devised a crafty addressing schema to do so. An added level of complexity encompasses having to deal with various types of client devices and operating systems. So our team now supports several encryption technologies and security appliances to address the mix.

SURPRISE, SURPRISE

What surprises—pleasant or otherwise—did you encounter during the implementation of your wireless LAN?

Mike Ruiz, Hobart and William Smith Colleges: When we first met Meru in December 2004, they seemed like a too-good-to-be-true situation. We had to prove to ourselves that their system could do what they said it could. As we tested different products, I learned that anything that has to do with radio is inherently problematic. But in a short pilot with Meru, we discovered quickly that it solved our problems. I won't say there haven't been any issues with our wireless, but it's been surprising what the issues have been -- rogue access points and things like that. Radio Frequency interference -- the issue that we thought would be biggest -- started to go away for us as we became more and more comfortable over time.

Dave Maki, Northern Michigan University: Same here. I was surprised that our network from Meru Networks worked the way they said it would work. Radio Frequency is an unregulated spectrum, and I didn't believe Meru's Air Traffic Controller could actually regulate things.

Chris Bogue, University of Miami Medical Center: Our team was surprised by the ease of configuration and deployment with the wireless products we chose, and found that our biggest challenge was in running the horizontal cabling and coordinating permitting inspections. We don't need to conduct site surveys and we've eliminated any issues associated with co-channel interference. Our entire wireless infrastructure operates on one channel for interior coverage and one channel for exterior coverage. It's simple, but very effective.

Editors' Commentary: *Another of the reasons that none of our participants actually believed Meru could do what it promised was because at the time all of these implementations started, Meru was a start-up company with little to no experience in the real world. The company's solution hadn't been battle-tested. That, of course, changed quickly. As Maki says, "We couldn't believe our eyes."*

POWER OF PERFORMANCE

Now that it's up and running, what do you do to evaluate performance of your wireless network?

Mike Ruiz, Hobart and William Smith Colleges: We monitor our top-talking access points, those that are sending and receiving most bandwidth. Beyond that, I wish I could say there's one thing we do; a precise quantitative process to evaluate performance. Still, there certainly are some things we do internally. Some of it happens during site surveys. We know that if a classroom holds 100 people, we estimate that anywhere from 20 to 60 people could be on wireless laptops at a time. So we preplan a bit. As we rolled out wireless, our experience was that a single AP had trouble managing five users for something like terminal services. When we went with Meru, our access points were handling 15, 20, or 25 clients. That's pretty good proof that we've had significant performance gain. There are other qualitative user experiences that get communicated back to us—feedback from users, rumors, stuff like that. With all of this, we think we get a pretty good picture of what's going on.

Dave Maki, Northern Michigan University: We are so short-staffed here that if I'm not getting any complaints, I'm not looking at it and moving on to something else. Understand: If something is wrong, it will get fixed right away. Otherwise, we look at bandwidth stats, and the number of users that come on and off in a day. I use AirMagnet to see how things are running. We also use Nagios, an open-source network monitoring tool, make sure all of our access points are up and running. Meru will provide a graphical user interface management tool. But right now, at least for us, all of the diagnostics are text.

Chris Bogue, University of Miami Medical Center: We've got all kinds of tools that our team uses—both free and purchased—but the proof is in the pudding. Put the mobile device or service in the hands of the clinician, nurse, student or faculty member and see how well they can use it. Don't let your technical staff be the only "testers" prior to production, because they use these tools and systems all day long and can make them work with their eyes shut. You'll find out real quick where you're lacking in both coverage and support processes. We certainly have.

PERFORMANCE REDUX

What particular attributes of your deployment contribute positively to the performance of your wireless network?

Mike Ruiz, Hobart and William Smith Colleges: One of the reasons our network works is the fundamental design of the Meru system. The system is based on a time-division algorithm, similar to the one that most cell phone companies use. By slicing bandwidth into time slices and giving slices to each client, it's easier for the system to handle larger bandwidth and a larger volume of clients. The design of the system enables us to scale out by adding more access points, or by adding access points on different channels to handle things like lack of bandwidth in a classroom. We also have ability with this system to throw in access points on demand, and layer the cells of bandwidth to provide significantly more bandwidth than we could with other systems. For us, the equation is simple: save time, keep performance where it's expected, and we save money. You can't beat that.

Dave Maki, Northern Michigan University: Network design contributes to our performance, too. I have three virtual channels: channels 1, 6, and 11. Overall, there are 36 access points involved in there, so that's 12 on each. It's a standard configuration, and in most buildings, we have people on all three channels. It's a way of dividing the radio frequency spectrum —something that yields high QoS. The other reason they have high QoS is due to the Air Traffic Control software on their controller. This software makes all the difference in the world because it actually manages our traffic, instead of just letting it pass through unnoticed.

Chris Bogue, University of Miami Medical Center: Our engineering team created several Service Set Identifiers (SSIDs) for particular needs such as separating voice traffic from data traffic. The end result presents an ability to smoothly roam within facilities, with varying QoS needs and security requirements.

DOWN THE ROAD

What about your wireless network needs to improve, and what are your expectations for addressing that need?

Mike Ruiz, Hobart and William Smith Colleges: There are few things that need to improve with our wireless network. First, the management interface: While it's better than some that I've used, it can be a little difficult to navigate at times, especially when you want to configure large number of access points or make a large-scale change. There's also some monitoring that doesn't exist in the management system currently that would be nice to see. I have a lot of hope in addressing those issues, especially because Meru is open to discussing requests.

Dave Maki, Northern Michigan University: The management system also is a big issue for me. Hopefully it will give us the ability to drop building maps in the background and see signal strength for a given access point. I hear there's also going to be a location finder so you can type in a MAC Address and see where on the network it is. It will triangulate the access point and give you a point on the campus map where a user is, if you need to find someone or a piece of equipment. These are all Web-based management tools, and that's what I'm waiting for.

Chris Bogue, University of Miami Medical Center: As for us, we're fortifying coverage between the various buildings on campus to ensure seamless roaming for voice and data services.

RETURNS ON INVESTMENT

Overall, which of your constituents has benefited most from the wireless network, and what are the "wins" for the institution as a whole?

Mike Ruiz, Hobart and William Smith Colleges: I think the real win at this point has been that at least with our wireless network so far, we've gotten people interested in thinking about what the network can do for them. People are starting to realize wireless is a valuable resource.

Dave Maki, Northern Michigan University: The biggest "win" for us is that accessing the Internet is a lot more convenient for students today. On top of this, we've learned that our wireless uses less bandwidth than our wired connections. Our wired connections are 100 megabytes, while you get 54 megabytes on wireless at best. By rolling out wireless, we've been able to establish tighter control of our bandwidth, which ultimately has meant better performance for student and faculty users alike.

Chris Bogue, University of Miami Medical Center: Thus far, the wireless network foundation we've established has enabled our team to provide access to clinical information for a practitioner at the point of care, provide cost effective means to locate and communicate with staff and faculty, give support teams mobile access to work order systems, parts or historical service data and, of course, enable access to all IT systems anytime and anywhere, from laptop or tablet computers. Within our IT organization, many members of our team now use mobile laptops and PDAs to access and manage their work orders. With a team average of around 21,000 work orders per year, we've already seen a sharp decrease in turnaround time to complete workflow tasks. That simply equates to less end user downtime and greater potential for increased overall organizational productivity. With new technologies like voice over wireless LAN, we have the ability to reduce cell phone expenditures for on-site support teams that need to communicate with each other throughout the day, as well.

Ruiz: We've experienced that too. With wireless, we found a way to deliver Internet access in a predictable and supportable manner. I'm the only network person here. We have other people who are responsible for helping out when there's an emergency, but I'm really the only person who deals with day-to-day issues, so the win for me has been that I can support wireless all by myself. Another benefit has been to our image. Because students know other schools have wireless, there's been an expectation over the last two years that we'd have it too. Fulfilling this expectation that we'll have wireless has helped us improve the competitiveness of our institution as a whole.

THE NEXT BIG THING?

Everywhere you turn these days in academia, it seems that wireless networks are the norm. We asked our roundtable participants if full wireless coverage was becoming a "must have" for campuses today.

Mike Ruiz, Hobart and William Smith Colleges: I would say that in the future, wireless will be a pervasive and primary means of accessing information. Right now at least, given the current networking situation in academia, wireless is not a replacement for wired connectivity, but it could be, down the road. For most everyday functions like e-mail and Web surfing and the ability to access and grab your files when you need them, current wireless tech is acceptable. For some of the more advanced things like DVD-quality streaming video or IP television, the wireless just isn't quite there yet for large numbers of users.

Dave Maki, Northern Michigan University: Wireless is definitely a must-have, and I think you'll see lots of schools don't have it, transitioning to it in the next few years. The retrofit will become common. We've got wireless in all of our academic buildings already, and my next move is to put it in the dorms. Our dorms are wired, but I'm going to put APs in there, too. Students just want to have wireless. Like I said, it's a must-have for everyone.

Chris Bogue, University of Miami Medical Center: Well, "must-have" may be presumptuous at this point in time. Some campuses simply don't have the volume or need for these types of services yet. [If you're a campus administrator thinking about wireless,] you really need to look at your core business first, before making the investment. Mobility services and applications are clearly picking up steam and becoming more prevalent within operations. That said, I'd wager that pervasive connectivity will eventually become a de facto standard for deployment plans in the future.

CONCLUSION

As one can see, though wireless networking continues to evolve, in the experiences of these three schools, the traditional take on wireless wasn't good enough: Each institution needed something bigger, better and bolder to take its users to the next level of connectivity. In outlining their experiences with wireless from Meru Networks, participants highlighted specific benefits they've discovered, including:

- **Easy Installation.** The next evolution of WLANs simplifies the deployment and adjustment processes, virtually eliminating the need for complex planning tools. Meru's WLAN System takes care of all the RF channel planning issues and allows network managers to get back to the business of managing a network and not managing RF spectrum.

- **Minimized interruptions**. With the help of Meru's patented Air Traffic Control technology which deterministically schedules client transmissions. This significantly mitigates client collisions, allowing high densities of clients to have excellent throughput performance.

- **True voice and data convergence**. By building on the system's ability to control channel activity, Meru dynamically recognizes when a VoIP call is initiated, and reserves bandwidth over the air for the call, resulting in unparalleled call quality and connection reliability.

- **Maximized bandwidth**. While other wireless LAN solutions require complex channel planning in an attempt to mitigate co-channel interference, Meru simplifies this process with technology that allows access points to simply be placed in the best positions to ensure complete coverage. Air Traffic Control technology then manages co-channel interference among access points, so IT administrators don't have to.

- **Flexibility**. Beyond standard advanced encryption and network authentication, Meru access points support up to 16 separate SSIDs [Service Set Identifiers] for each configurable with a different security setting. This allows faculty and students to access resources through secure connections, while guests are automatically redirected to a captive portal with a secure login page before being granted access to the Internet.

To paraphrase Bob Dylan, the times are a' changing in the world of wireless. Clearly, with technologies like those from Meru Networks, the wireless LANs of today are more responsive and efficient than ever before. With this higher level of service becoming the norm, colleges and universities can compete successfully and help prepare students for the future in ways they've never dreamed.

ABOUT US

Campus Technology, the only higher education publication focusing exclusively on the use of technology across all areas of the campus, launched in October 2004, replacing the highly respected *Syllabus* magazine. *Campus Technology* provides in-depth, aggressive coverage of specific technologies, their uses and implementations, including enterprise resource planning, eLearning, and course management systems; presentation technologies; and communication, portal, and security solutions—all the important issues and trends for campus IT decision makers.

Targeting administrators, IT professionals, and tech-savvy faculty, *Campus Technology* provides direction and analysis, expert opinion, product resources, case studies, and detailed coverage of emerging technologies to assist technology leaders in their specific roles on campus.

Meru Networks is a global leader in Wireless Voice over IP (VoIP) infrastructure solutions. With its innovative, award winning Air Traffic Control technology that brings benefits of the cellular world to the wireless LAN environment, Meru's WLAN System is the only solution on the market that offers the reliability, scalability, and security necessary to deliver converged voice and data srvices over a single WLAN infrastructure. Meru's Wireless LAN System provides major Fortune 500 enterprises, universities, healthcare organizations and local, state and federal government agencies with the predictable bandwidth amd over-the-air Quality of Service required to support a wide range of current and future wireless applications. Founded in 2002, Meru is based in Sunnyvale, California. For more information on Meru Networks and its products, visit www.merunetworks.com or call (408) 215-5300.