Some breakthroughs are the result of new technologies becoming available. Others, like most of those studied by the 2006 EDUCAUSE Evolving Technologies Committee, are the result of social forces. iPods and podcasting are not groundbreaking technical realizations of new physical theories. But they’re cool (and that’s official)! Their humanized and stylish approach allows users to easily manage multimedia content. This changes a paradigm. In the past, campus technologists had the primary role of leading their communities in the intelligent use of technology by adapting whatever resources were thought to be efficient and appropriate. Now, however, one of their main roles is to scout, identify, and intelligently sponsor technologies that their constituents may already have adopted. When considering open-source learning management systems or research portals, institutions must consider not only the official uses of these systems but also the effects of the impromptu bursts of collaboration among groups of researchers or students engaged with these systems. What’s next? Watching videos on an iPod, instead of just listening to audio files, provides a pretty good idea of what’s out there. Funky video snippets from every corner of the world on YouTube.com, the sometimes murky waters of MySpace.com, 2006 FIFA World Cup highlights from Germany— institutions need to prepare their campus wireless networks, mobile phones, and Web systems to handle not only this rich content but also that yet to come.
Each year, the members of the EDUCAUSE Evolving Technologies Committee identify and research the evolving technologies that are having the most direct impact on higher education institutions. The committee members choose the relevant topics, write white papers, and present their findings at the EDUCAUSE annual conference.

This year, under the leadership of Committee Chair Pablo G. Molina, the committee selected six evolving technologies, presenting a brief overview at EDUCAUSE 2006. Published below are excerpts from the white papers on each topic, written by individual members of the committee: Web 2.0 applications, by Malcolm Brown; cell phones, by Leslie P. Hitch; vortals, by M. Christine McMahon and John S. Moses; podcasting, by Carlos Morales and John S. Moses; open-source learning management systems, by Saiid Ganjalizadeh and Pablo G. Molina; and wireless, by Art St. George.

The full white papers can be found on the EDUCAUSE Evolving Technologies Committee Web site (http://www.educause.edu/EvolvingTechnologiesReports/869). These white papers address many other strategic areas for each evolving technology: key questions to ask; the implementation challenges; the major vendors and how to judge among them; how to proceed and the issues to be addressed; and the likely impacts in the next three to five years.

Web 2.0 Applications Are Closer Than They Appear

Why use such an ungainly term as “Web 2.0 applications”? Because we’re focusing here primarily on the Web-based applications that people use directly. The alternative term “web services” is understood by most to refer to the underlying technological architecture of those applications. In addition, the applications considered here all exhibit important Web 2.0 characteristics: they enable people to collaborate and to share information; and they give users a desktop-like operational experience.

The paradigm shift that the term “Web 2.0” signifies is precisely why this particular evolving technology is highly relevant to IT planning for higher education. Defining this technology is thus challenging, but we can make a start by identifying the key characteristics.

They are collaborative. Beyond blogs and wikis, Web 2.0 applications include online “malls” and sharing/tagging collectives such as Facebook, MySpace, Flickr, and del.icio.us, all claiming collaboration as a central theme. Even the replacements for Office are quick to tout their support of collaborative work.

They use thin, cross-platform technology on the client side. In most cases, all a user needs is a Web browser. Even those applications that employ client-side technology such as Ajax are relatively lightweight.

They “think big.” In addition to the “folksy” applications, the new wave of Web 2.0 applications provides office and computer desktop functionality. Ajax and similar technologies allow Web 2.0 applications to offer operational continuity much like an operating system. And indeed, some people are already talking about the “WebOS.”

They are free. It’s hard to beat the price of many of these Web 2.0 applications, especially when a gigabyte or more of storage is part of the package.

They are constantly upgraded. Unlike standard applications and operating systems, Web 2.0 applications are continually upgraded in small increments. Most often, these changes are largely invisible in the interface.

They are highly interwoven. Web 2.0 applications draw on other Web 2.0 applications to create new applications. One example is the selective recombination of information and resources collected from various
Web 2.0 applications are evolving, expanding, and diversifying at an astonishing rate. They are coming—or have already come—to a campus near you.

Web 2.0 applications to create another Web 2.0 application, such as diggdot.us (http://diggdot.us/). Another example is a mashup, a kind of layering of new content on top of content from another site. One charming mashup is PublicLoos, a Google Maps mashup showing public restrooms in San Francisco (http://paul.kedrosky.com/publicloos/). Web 2.0 applications not only permit this repurposing but actually encourage it.

Why Are Web 2.0 Applications Important to Higher Education?
At their inception, applications such as Skype and Wikipedia were novelties. Would anyone consider using Wikipedia when the Encyclopedia Britannica is available online? Would anyone really use Skype instead of the campus phone system? The answer is yes and yes.

Likewise, will those in the academic community abandon PowerPoint for Thumbstacks, or Excel for iRows? And will they really choose to use an Ajax-based desktop like Pageflakes or Netvibes instead of the campus portal? The answer is that they very well might.

How Are Web 2.0 Applications Evolving?
This technology is expanding into areas that have been dominated by standards, many of these from Microsoft. Here are two of the more important examples.

Imagine that someone says: “I can give you, at no cost, an online word processor that enables you to access your documents from any Web-equipped device; that imports and exports Office documents; that can share documents online; that posts automatically to major blog engines; that generates PDF, DOC, and HTML files; and that provides multilingual support.” This feature set—not at all uncommon for Web 2.0 applications—is taken from the Zoho Writer site. Other Web 2.0 applications (such as Writely) offer compelling collaboration functions and revision history tracking. For those weary of continually paying for Microsoft applications, this compelling list of features offers an attractive package.

A good number of start-ups are developing something they call a Web operating system: “WebOS.” Examples include YouOS, eyeOS, Orca, goowy, Fold, and Xin. These sites describe their applications also as portals or start pages, but many call them desktops, and this may be the most accurate term. These applications aspire to be a user’s online desktop, a kind of Internet base of operations, offering a computing experience similar to the Windows or Mac OS X desktop.

Conclusion
Web 2.0 applications are anything but marginal Internet sideshows. A recent posting on eWeek.com documents that...
MySpace has become the most-visited single Web site, moving past both Yahoo’s e-mail gateway and Google. It has more than 73 million subscribers worldwide. And MySpace has experienced all this success despite the fact that its technology and design have been, relatively speaking, rather behind the times. What brought in new subscribers—and continues to bring them in, at the rate of 250,000 a day (according to MySpace)—is the functionality of the site.

Web 2.0 applications offer a lot that is often lacking in traditional campus services: a tailored network experience, a social venue, and the opportunity—through blogs, tagging, and voting—for users to shape their environment. Rather than dismissing these resources, perhaps those of us in higher education information technology should help guide our users to make the best choices and to begin to experiment with our own mashups.

In short: Web 2.0 applications are evolving, expanding, and diversifying at an astonishing rate. They are coming—or have already come—to a campus near you.

**Egad, My Phone Is Running CAD!**

Ernestine, the telephone operator immortalized by Lily Tomlin on *Rowan & Martin’s Laugh-In*, might find today’s telephones quite amusing. They are no longer attached to wires from poles, do not need switching through large consoles, do not require connections through walls, and are as tiny and wafer-thin as a small candy bar. Most humorous to Ernestine, perhaps, would be how little this technology is now actually used as a telephone.

For traditional-age college and university students (eighteen to twenty-three years old), using a cell phone is so pervasive that many higher education institutions have abandoned a once-lucrative...
revenue stream and have discontinued landline phone service in residence halls. It’s no wonder that these students—and older students also—are so enamored. Consider the findings of a ten-minute Web search of the major cellular-service providers: cell phones can take photographs, download music, offer games, receive text messages and e-mail, and let the user browse the Web. Although data storage on cell phones is still rudimentary, it will soon increase. Some cell phones are actually miniature televisions, showing the latest programs from HBO and other networks. Cell phones (the term mobile is often used outside of the United States) also serve as alarm clocks, calendars, and GPS receivers. And if the pundits are correct, the convergence of all of these services onto the device invented by Dr. Martin Cooper thirty-three years ago is imminent as we hurriedly move to “3G,” or third-generation technology—which, with greater bandwidth, will open up a host of other services including showing short video clips and paying for pizza.

Why Are Cell Phones Important to Higher Education?

Cell phone technology, converging just about every communication medium, will influence higher education in the administrative area, in the classroom, in student affairs, in security matters both on and off campus, and soon, in information delivery of all varieties. The following is a partial list of areas now or soon to be affected:

- **Emergency and regular phone numbers:** A single home phone number is no longer adequate. Students and parents have several telephone numbers, as do also faculty and staff. Institutional data fields need to expand to capture these additional numbers.
- **Classroom:** Acceptable Use Policies (AUPs) may need to be revised or at least reworded to disallow Web access via phone or other devices unless sanctioned by faculty.
- **Information delivery:** Just when e-mail and portals seemed to be the preferred form of communication for most of the campus constituency, text-messaging appears to be increasing in use as a more effective means. This communication method will require different delivery channels and processes, as well as graphical user interfaces (GUIs).
- **Security:** Campus administrators are already grappling with the consequences of MySpace and Facebook. The connection of these popular Web sites to the cell phone may create additional concerns about students’ safety.
- **Fundraising:** With so many people abandoning their landlines, telethons as fundraising events may be on the way to extinction.

How Are Cell Phones Evolving?

Paul Levinson gives new meaning to technological evolution in his informative and provocative book *Cellphone: The Story of the World’s Most Mobile Medium and How It Has Transformed Everything*. In a future that is already here, Levinson contends that this device “puts information in its proper place: part of life, part of the real world,”
CIOs and other IT directors will have to judiciously offer cell phone services by examining cost and efficiency and by replacing other service-delivery systems. By allowing users access to the Web, to connections, and to data outside, inside, and anywhere. IEEE and Microsoft agree, noting that a British market-research firm reported that twice as many data-ready cell phones were shipped by mid-2005 than the year before.

These devices have location-based applications that allow the user to find information about nearby eateries, businesses, and movies, to send photographs and messages to friends far and near, and to manage business assets through the incorporation of RFID (radio frequency identification). Further expansion of the cell phone is already in place in Europe and sections of the Pacific Rim where Bluetooth-enabled devices can be used as payment for everything from toothpaste to concert tickets. This all is made available through 3G technology that allows faster and faster uploading and downloading.

Colleges and universities can use these applications on and off campus as electronic tour guides, as deadline reminders (or for pop quizzes), for access to restricted areas, as a way to find library material, or for videoconferencing across the world. The need for coders and designers of the small-form GUI interface becomes a growth course of study.

Conclusion

The immediate concern about the ubiquitous cell phone is not what it will soon do but how higher education institutions should—or will be able to—fund applications for it. Society and consumerism are again dictating what campuses need and how rapidly they need to have it. CIOs and other IT directors will have to judiciously offer cell phone services by examining cost and efficiency and by replacing other service-delivery systems. If they don't, they may end up having to use Ernestine's timeless line: "Next time you complain about your phone service, why don't you try using two Dixie cups with a string?"

Portals Evolved: Vortals for Research Services and More

As Leslie Maltz noted in her 2005 Evolving Technologies Committee white paper on portals, "Fifth-generation portals are beginning to emerge with an orientation toward application delivery." These portals, generally concentrated around certain cohesive focus areas, are today referred to as vortals. The word portal is a union of vertical and portal. A vertical portal, or vortal, is a community-based Web location that provides a self-managed, personalized, and customized information environment. This environment is focused on serving the needs of particular constituencies within the community.

In higher education, students and faculty use learning management systems such as Blackboard or Sakai to organize and manage course content. Such systems could be referred to as learning vortals. These work well in the learning process. However, when faculty members want to use an administrative or research application, they have to use external systems that don't dwell within the same portal environment. A research services vortal is part of the overall campus portal that will allow faculty to seamlessly migrate to the needed applications. Similarly, students could seamlessly migrate between campus-life vortals and learning vortals.

The mission of the research services vortal is to effectively promote academic and clinical research by using advanced technology to reengineer research compliance and communications management systems that are nested in the context of the college/university portal. The research services vortal will

- simplify administrative tasks for faculty;
- assist research investigators with crucial compliance issues by leveraging computer-mediated communications that will manage, archive, and monitor research events; and
- create appropriate electronic venues by which investigators can collaborate and can share information about research activity with both internal and external constituents.

The development of a vortal-based tool suite provides the investigator with a competitive advantage when pursuing research funding opportunities; it also assists in strategic IT planning and aids in the leveraging of resources allocated to promote the research agenda.

Communication is essential for collaboration to take place. Also central to the collaborative effort is the development of a comprehensive and powerful computer-mediated research services suite that will

- provide the high-quality and accessible information needed by the college/university community for monitoring performance, both at the local department level and in a broader array of extramurally supported research efforts; and
- provide researchers with a system designed to effectively capitalize on the campus enterprise systems to record and manage unique information sources that will leverage the researcher's project-management activities.

Why Are Vortals Important to Higher Education?

Vortals are important to higher education because they abstract applications and make those applications available to users depending on the user's role and function, all within a single interface. Vortals will be the delivery tier for most applications currently used or being developed within higher education. It is all about convergence. Why should faculty and students have to go to a learning management system to attend to the needs of
Vortals will be the delivery tier for most applications currently used or being developed within higher education. It is all about convergence.

their courses and then go to a completely different location to access applications that are relevant to their many other roles? Faculty involved in research can instead be provided with access to services specifically designed for their research, via a research services vortal. Grants can be prepared, submitted, and managed via the vortal—in turn a part of the campus portal environment. The trend will be to collapse the number of methods for delivering applications to users.

How Are Vortals Evolving?
Why should we be interested in vortals and, more specifically, in research services vortals? After all, higher education has managed to survive without a vortal of this nature. Separate applications have been made available to those in the research community in support of their needs.

To answer this question, one has to look at the changes taking place in the research administration environment, namely Grants.gov (http://www.grants.gov/). Grants.gov is the new interface for all grant submissions to any U.S. government granting agency, including the National Institutes of Health (NIH) and the National Science Foundation (NSF). Institutions must adapt to the new rules, and larger institutions have a particular issue with its effects on existing processes. Most institutions are looking into systems that help manage the grants submission and administration process internally within the institution and that also allow for a system-to-system submission of applications to Grants.gov. A suite of tools to accomplish this could be and is being made available to faculty and staff in a few select institutions. If integrated as a vortal, such tools could be delivered to users seamlessly.

Conclusion
The concept of vortals is not new. Vortals for students are commonplace. But the depth of integration within campus portals is set to grow. The next stage for innovation in the portal space may very well be the integration of an institution's core business applications into the existing campus portals framework.

Podcasting has revolutionized education, particularly higher education, by making up-to-date content available immediately to large audiences via download or subscription-notification system. For example, students can subscribe to a podcast and have the content delivered automatically to their audio software, which in turn can be transferred to their MP3 player, thereby allowing time and place shifting to access the content.

Podcasting has also revolutionized higher education by addressing multiple intelligences. In 1983, Howard Gardner developed the theory of multiple intelligences, which groups the way people learn into eight categories: linguistic, musical, spatial, logical-mathematical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalist. This theory, which has been used as the foundation in the design behind instructional and curricular content, provides instructors with specific indicators and corresponding strategies to best serve students who show one or more of the intelligences.

Related to the theory of multiple intelligences are learning styles, or the ways people learn, which are categorized into three areas: visual, auditory, and kinesthetic. Visual learners need to see the teacher's body language and facial expression to fully understand the information being conveyed. These types of learners learn best from visual displays including diagrams, illustrated textbooks, overhead transparencies, videos, flipcharts, and handouts. Auditory learners learn best through lectures and discussions. For them, written information may have little meaning until it is heard. Auditory learners often benefit from reading text aloud, listening to audio books and music, and recording narrations or lectures. Finally, tactile or kinesthetic learners learn best through a hands-on approach—by moving, doing, and touching. These learners are very active in exploring the physical world around them.

Podcasts allow learners to learn at their own pace, to listen to the audio or video object as many times as they want to, and to rely on time shifting for classes...
Podcasting has revolutionized higher education by allowing for the anytime-anywhere delivery of instructional content.

and learning. Podcasting is of particular use to auditory and visual learners. For auditory learners who have shown auditory, musical, and verbal intelligence, podcasting may allow for increased retention levels, though controlled studies using audio objects point to the contrary. In addition, podcasts may influence the level of interaction within a class, by triggering discussion around the audio or video object.

Lastly, podcasting has revolutionized higher education by allowing for the anytime-anywhere delivery of instructional content. A course enhanced with audio or video files can make the learning experience a portable one, resulting in independence for the learner.

How Is Podcasting Evolving?
Podcasting is evolving on many fronts. Software vendors are incorporating this technology into course management systems (CMSs); colleges and universities are expanding the use of podcasts into areas other than teaching. New delivery frameworks such as iTunesU have increased the feasibility of content generation and management at an institutional level. Examples include lectures, narrations, individual and group presentations, institutional announcements, and training. These delivery frameworks increase student interaction with the content, with the institution, and with peers. In the future, podcasting may enhance the learning experience through audio books. Content creators can easily insert material that will position the learner closer to the subject under discussion.

Conclusion
The podcasting movement has provided an excellent delivery medium for instructors, students, and staff. Students, in particular, have been able to unleash their creativity in many ways—from narrations, video recordings, and radio shows to homemade recordings and the spontaneous archival of audio and video. In podcasting, learning has found the perfect ally to create on-demand, anytime-anywhere delivery of instructional content.

Open-Source Learning Management Systems: As Good As the Commercial Ones?
For many years, commercial learning management systems (LMSs)—such as WebCT, Blackboard, eCollege, ANGEL Learning, and Desire2Learn—have served faculty and students as enterprise applications. But with the rising cost of proprietary LMSs, there is now a growing market demand for an open-source alternative. In January 2004, the University of Michigan, Indiana University, and Stanford University joined MIT, the Open Knowledge Initiative (OKI), and uPortal to develop a new learning
Higher education institutions, particularly those with budget constraints, are very attracted to open-source LMSs, which allow institutions to both save money and have more control of the system.

“Sakai has shown a tremendous potential over the last few releases. From an administrator’s perspective, a bare-bones Sakai system is relatively easy to install and set up. However, like many other open-source projects in their early stages of development, there does not seem to be a comprehensive documentation on advanced topics (e.g., LDAP integration). While many user groups and organizations have written how-to’s on various topics, the information is widely dispersed, usually hard to find, and not always accurate. Blackboard users comment that the Sakai user interface feels very much familiar. However, for a non-Blackboard user, the interface may be slightly intimidating at first. Comments from faculty who have tried Sakai for the first time indicate a level of uneasiness navigating the site. But similar concerns are inherent with any new user interface.”

Numerous institutions are pilot-testing, customizing, and deploying Sakai. A small number of higher education institutions have gone beyond the initial phases into full-blown implementations. As of today, the two showcase examples are the University of Michigan and Indiana University. However, during their presentations at the 2005 Sakai Conference in Austin, Texas, representatives from both institutions candidly shared with the audience that they have “received a black eye” from some community members because of initial functionality or technology problems.

Moodle, another open-source LMS, has proven very popular in European and Latin American countries. For example, many of the institutions belonging to AUSJAL, the association of Jesuit universities in Latin America, are heavy users of Moodle. A few years back, when these institutions were looking to implement an LMS, they realized that either they could develop or continue to develop their own homegrown systems or they could take advantage of the maturity of the open-source Moodle. The latter approach made sense for many of them because they have the professional teams and spirit to make technology work with limited resources and support.

How Are Open-Source Learning Management Systems Evolving?
The main question is: “Are the open-source LMSs as good as the commercial ones?” Using the WCET’s EduTools course management systems comparison Web site (http://www.edutools.info/course) to compare Blackboard, WebCT, Sakai,
Free software is not free. The total cost of ownership of open-source software is hard to calculate.

and Moodle, we found that the open-source LMSs indeed meet the quality of Blackboard and WebCT in a majority of features.

Paradoxically, free software is not free. The total cost of ownership of open-source software is hard to calculate. The lack of formal support mechanisms and the pioneering spirit of open-source initiatives require highly skilled, motivated, and creative technical personnel.

Embracing a new LMS has high entry costs because there are few efficient migration tools. Faculty members and educational technology personnel who have invested heavily in one particular system find themselves having to redo much of their work to switch to another one. Academic leaders must consider LMSs as strategic systems to be upgraded annually but changed only every five to ten years.

Interoperability is one of the key developments for all LMSs, particularly open-source ones. To reap fully the benefits of an LMS, institutions must integrate them with identity directories, internal and external Web sites, portals, student information systems, library catalogs, multimedia and learning objects repositories, e-portfolios, e-mail, calendars, instant messaging, wikis, blogs, Web conferencing, and other collaboration tools.

Conclusion
A highly functional open-source LMS integrated with other campus systems is very complex. Until new open-source LMSs are fully developed, several platforms must coexist. Commercial LMSs provide faculty members with a certain level of comfort, which open-source LMSs must meet.

Several LMSs will be in use at most higher education institutions for the foreseeable future. Perhaps it is time for current and new developers to work on better migration tools to attract more faculty members to their systems. It may also be time for developers to work on an umbrella system that can act as a broker among various systems, therefore unifying and simplifying access for faculty and students. Finally, all developers and implementers must continue to improve the interfaces of their products.

Higher education institutions and their faculty members must investigate and experiment with new pedagogical approaches and the technologies to support them. Open-source software movements are in tune with the collaborative nature and the intellectual freedom that are characteristic of academic institutions worldwide. Learning management systems—particularly open-source learning management systems—have a crucial role to play in closing the digital divide through education.

The Next Wireless Wave: Sea Change, Rogue Wave, or Just High Tide?
The “E” in the EDUCAUSE “ET” Committee stands for Evolving, the definition of which usually includes the phrase “to undergo gradual change.” Sometimes the “E” is thought to stand for Emerging, defined as “newly formed or just coming into prominence.” For wireless, neither of these definitions is suitable. My preferred interpretation of the “E” is Explosive. Some aspects of wireless do evolve gradually or are newly formed, but taken as a whole, wireless is more aptly described as explosive, with a very steep growth curve.

For most IT professionals on campus, wireless means “WiFi” or wireless LANs,
Recent developments in the broader definition of wireless are blurring and perhaps dissolving the boundary between the campus and the outside world.

with the off-campus analogy being hotspots. Even if the discussion is restricted to this somewhat narrow view of wireless, explosive would not be an entirely inappropriate label. But recent developments in the broader definition of wireless are blurring and perhaps dissolving the boundary between the campus and the outside world. This fact is nowhere more apparent than to students in the incoming freshman classes.

Why Is Wireless Important to Higher Education?

Using the broadest definition of wireless, the technology is of importance to higher education on two levels. First, to maintain institutional predominance, colleges and universities must continue to invest in those technologies that their communities expect to have available. This fact is not lost on those who are responsible for recruiting the best students, staff, and faculty—many of whom arrive on campus only to discover that technology plentifully available off-campus is described as too leading-edge and is thus unavailable at the institution.

Second, wireless is important to higher education as a tool to promote and enhance productivity and convenience. Beyond this, wireless will come to play an increasingly prominent role in teaching and learning. With anytime-anywhere access to global resources, students can conduct their business in unconventional places such as outdoor areas, the student center, the library, or anywhere that spontaneous collaboration is required or desired. Wireless also allows students to collect and analyze authentic, real-time data. And of course, wireless permits an institution to conduct real-time monitoring of environmental, clinical, and security data.

Those institutions that have implemented even a partial-campus wireless
network know that wireless primarily attracts people who are already using technology and allows them to continue working in less constrained and perhaps more creative ways. Certainly one of the principal incentives for investing in a wireless network is the opportunity to foster spontaneous collaboration, in support of learning, between students.

How Is Wireless Evolving?
Wireless is a shape-shifter: just when it appears to be within grasp and identifiable, it changes form to something unrecognizable. Some aspects of wireless, such as WiFi, retain their original shape, whereas others, such as broadband wireless or ubiquitous wireless, have yet to take on their final form.

In the WiFi arena, security remains confusing due to the complex issues of and prerequisites for deploying 802.11i. As a result, many campuses are locating wireless access points outside the primary firewall and are requiring all users to connect through a VPN with either SSL or IPsec.

For those tired of the slow speed of the tried-and-true 802.11b/a/g standards, 802.11n promises speeds to a maximum of 540 megabits per second (Mbps). The good news is that most 802.11n devices will be backwards-compatible with 802.11b and 802.11g devices (but probably not 802.11a). Lack of agreement from the IEEE 802.11n standards group means that a formally ratified standard is unlikely before the middle of 2007. Higher education institutions must exercise caution in acquiring pre-standard 802.11n equipment, which may include features not available in the final standard.

Wireless mesh networking looks more promising, since the IEEE agreed on a single proposal for its 802.11s ESS Mesh Networking standard. Mesh networks are
Currently in production in many metro areas, mainly in the public safety sector. Mesh networks enable automatic topology learning and dynamic path configuration and are self-healing and resilient. However, questions remain about their ability in the areas of traffic management, load balancing, Quality-of-Service (QoS), and scalability.

The next two to five years will see major developments in mobile and fixed broadband wireless. Although there may be cost and technical reasons for putting a broadband wireless “umbrella” over the campus, the usefulness of the technology is realized only when the broadband becomes mobile. As broadband wireless converges to the handset, and as the handset becomes more powerful and diverse, people will have access to high-speed information, including streaming video and interactivity, anytime and anywhere. This personal broadband will rest on evolving standards such as WiMAX. Users will be able to roam between different services, such as voice and Internet access, without having the connection drop or the service degrade.

Conclusion
As wireless converges onto a mobile handset, campuses must pedagogically and technologically redefine what it means to invest in a mobile wireless community. Previous concerns regarding expense, security, and reliability are continually being addressed with lower costs, new and enhanced security standards, and more efficient network hardware and software. The best time for campuses to dive into the next wave of the wireless tsunami is now. Much like the failed strategy of waiting until the cost of the PC reached its lowest point before purchasing, waiting for wireless to “settle down” only gives the next wave time to gain in size and speed.

Notes
2. At a general session during the ELI (EDUCAUSE Learning Initiative) 2006 Annual Meeting, the audience members were asked to indicate, by a show of hands, who used Skype and Wikipedia routinely. At least two-thirds of the attendees raised their hands.