
Of Nomadicity, Expectations, Campus IT Infrastructure and, Oh Yes, Budget

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Introduction

"We just finished constructing a new building with more than 10 wired data jacks in each open access classroom. The request for wireless access came within 3 days of the building opening." David Melzer, Evergreen State College

"Digitization is creating products that can't be categorized as tech or consumer electronics. The walls are coming down," Gottfried Dutine, Philips Electronics, quoted in an article on convergence of technologies, *Business Week* June 21, 2004.

Nomadic end-users are pitching and striking their technological tents on our campuses, bringing with them multifunction cell phones, personal wireless networks, voice over IP (VOIP), peer-to-peer file sharing, digital video capture and editing, personal storage, wireless data cards and, primarily, the need to remotely access all existing campus software and services electronically.

Aware that the sands of change were blowing, the Evolving Technologies Committee (ETCOM) of Educause, set out to find out if we in higher education technology were risking our IT future by ignoring (or actively opposing) this nomadic trend by continuing to build, overbuild, or inappropriately preserve our hard-wired, place-bound infrastructures. Or were we adapting to these new trends and attempting to accommodate them while still protecting the integrity of our campus technology resources?

Frankly, we were not startled by the findings. The majority of the dozen CIOs responding to our e-mail query reported a bombardment on our campuses of consumer technology – think PDA, MP3, DVD, videogames, laptop computers, tablets, wireless hotspots – creating havoc with support and security expectations, budgets, and infrastructure. Yet, most answered that mobile technology, in particular wireless, would not replace their current wired network but would, instead, augment it.

Therefore, to illustrate the present nomadic landscape, we have divided this article into three parts. The first, gleaned from the literature, is an overview of the emerging issues arising from the increase of nomadic users. The second is a distillation of the responses from higher education CIOs that highlight these issues.¹ The third is a focus on three issues that will need close monitoring as the demand accelerates for more wireless access, Internet availability 24/7 and for support of multiple devices and platforms.

¹ The responses received, while not statistically significant was representative of the vast array of types of higher education institutions including public, private, small liberal arts and community colleges.

What is Nomadicity?

There is actually a name to describe the plethora of devices and technological convergence of this shifting landscape – nomadicity. Nomadicity, a term coined in several articles, means the consumer – really our community of users – is basically now in charge of how, when, and to what they want to be connected.² This phenomenon stems not only from a multiplicity of devices, but also from the immediacy that the Internet itself has facilitated.

Nomadicity has already had a significant impact on higher education. In his recent *EDUCAUSE Review* article, Bryan Alexander describes a new world of “mobile learning” that impacts the student, the classroom, and the campus through new uses of a wide range of nomadic technologies:

“Mobile telephony. Laptops, increasingly wireless. Personal digital assistants, including PalmPilots and Pocket PCs. The Danger Hiptop. Tablet PCs. Handheld gaming tools, such as the N-Gage. MP3 players. Wireless connectivity detectors. Bluetooth-enabled devices. Wireless access points, which can irradiate a room or area or be knitted into a cloud covering a block, a campus, or an urban sector. Digital cameras, still and motion, which are increasingly found in cell phones. USB drives. Fusion devices, such as combination phone/PDA/MP3-players. RFID tags in the millions. All of these are supported by ambitious, shifting, emergent infrastructure networks of connectivity, access, and payment.”³

Nomadicity and the Consumer

To understand nomadicity is to consider the changes in locus of control of information technology, primarily the sandstorm kicked up by the Internet. In the past five years, there clearly has been a proliferation of devices offering some degree of Internet connectivity. Alan Livingston’s recent *EDUCAUSE Quarterly* article⁴ notes that people may access the Internet more frequently from mobile devices than fixed devices by 2005. While some of us may question the underlying adoption rate for mobile devices, other mobile technologies, notably the laptop computer, have become mainstream in just a few years. Much of this drive toward mobilization has been associated with the consumer electronics marketplace. Think back to even five years ago: how many retail outlets sold computer technology compared to today, and what percentage of consumer electronics was Internet capable? We call this mushrooming of end-user owned technological contrivances the ‘consumerization’ of IT.

For the purposes of this article, we note that consumerization and nomadic computing intersect when nomads purchase their technology from the consumer marketplace and assume, or do not check – or do not care – whether the device is or can be supported by the campus IT infrastructure and service organization. As soon as a technology appears in the consumer electronic stores, it materializes on campuses. The expectation, from student, faculty and administrator alike, is that the campus IT department will support it no matter how arcane, how new, or how complex that support may be. Probably the most blatant current example is the PDA (Personal Digital Assistant). These handheld computers come from a variety of manufacturers and with several different operating systems and application suites.

² Authors note: While wireless is certainly included within nomadicity, nomadicity is not limited to wireless. Nomadicity includes multiple devices and methods of mobile computing and communications.

³ Alexander, Bryan, “Going Nomadic: Mobile Learning in Higher Education,” *EDUCAUSE Review*, Volume 39 number 5, September/October 2004, pages 28–35 .

⁴ Livingston, Alan, “Smartphones and Other Mobile Devices: The Swiss Army Knives of the 21st Century,” *EDUCAUSE Quarterly*, Volume 27 number 2, 2004.

With our already stressed IT budgets,⁵ the thought of supporting more and more devices with less and less money and fewer people is perplexing. Yet, it isn't as if we didn't see this one coming. Almost five years ago, in an ETCOM white paper for Educause 2000, Laura Joyce Moriarty of Emory University, presciently wrote:⁶

"The burgeoning of wireless computing and telecommunications in information technology no doubt causes us some degree of dismay as we ponder on the size of our computer networks, the closets, and all the tangled wires beneath our desks. ...It is going to take some practice managing wireless within your environment. While the convergence of voice and data are driving business decisions, working with a multitude of carrier opinions that change on a weekly basis, as well as daily innovations may become the most frustration piece of going wireless."

We may even have had an inkling of what was to come as much as 35 years ago. Leonard Kleinrock, Professor, Computer Science Department of the University of California, Los Angeles (the Internet (Arpanet) pioneer responsible in 1969 for development of the packet switch)⁷ describes his early vision of the Internet: "...the vision was that the Internet would be ubiquitous, always on, anyone would be able to plug in any device at any location, and would be invisible, just like electricity."⁸ The first three decades of Internet connectivity on our campuses have been, as Kleinrock predicted, increasingly ubiquitous, always available, and always on.

The "sea change" event came around 1995 when, through commercial Internet Service Providers (ISPs), the public 'discovered' the Internet. At about the same time, wireless devices – largely cell phones – exploded in the marketplace, followed shortly thereafter by wireless Internet technology. Less than a decade later, society no longer wants to be tethered when accessing the Internet, the "invisibility" that Kleinrock predicted. However, the difficulty in achieving invisibility, Kleinrock admits, is that "the Internet's TCP/IP protocol assumed that end users and their devices and IP addresses would all be found in the same location and would all be tightly coupled."⁹ The Internet has evolved into an environment where static connectivity is no longer the norm and control of it, in the way we in academic technology have known, is no longer possible.

How Is Nomadicty Evolving?

What is needed now is a way to support a continuing proliferation of devices. Kleinrock describes nomadicty as "transparent virtual networking." The essence of these terms is that the end user should be able to access programs, computational and communication needs "as they move from place to place in a way that is transparent, integrated, convenient and adaptive."¹⁰ Simply stated, but not so simply executed, is the wide range of campus information services, once limited to a physical site such as the tethered desktop, will now need to be accessed from just about anywhere and on just about any type of Internet-enabled gadget. And the consumer – our community of users – will not want to have to duplicate information on each of the devices.¹¹

⁵ Young, Jeffrey, "Will Colleges Miss the Next Big Thing?", Chronicle of Higher Education, from the issue dated April 23, 2004: www.chronicle.com

⁶ "How Evolving Technologies Will Impact Higher Education," Report of the EDUCAUSE Evolving Technologies Committee, EDUCAUSE 2000 Proceedings. See <http://www.educause.edu/asp/doclib/abstract.asp?ID=EDU0057>

⁷ Kleinrock, Leonard, "Breaking Loose," Communications of the ACM, September 2001. Vol. 44. No. 9 pp 41-45.

⁸ Ibid. p. 41.

⁹ Ibid. p. 41

¹⁰ Ibid. p. 43

¹¹ Authors' Note: We really don't want our community to duplicate information, as this creates problems of data integrity and loss of confidentiality.

The literature supports this evolution. Karlene Cousins and Daniel Robey of Georgia State University refer to the new home base as the “command center”¹² from where the consumer can access resources in a format accessible from the device literally at hand. Lyytinen and Yoo concur,¹³ noting that the new infrastructure will need to be interoperable between protocols and standards. Joel Hartman, CIO at the University of Central Florida, in an interview in Syllabus Magazine, outlines the challenge:¹⁴ “It’s not just our desktop machines, laptops, servers, and mainframes, but now also hand held PDAs of various kinds, tablet computers, and even security devices and video projectors – all kinds of things – are now getting IP addresses and interacting through the network or exchanging information, that several years ago would not have been part of the picture.” People want to access information and other people from a myriad of devices that fit specific form and function. Hartman, himself, says he finds himself “looking up information minutes before the meeting starts, as opposed to hours or days before.”¹⁵

Why Should We Care about Nomadicity?

Nomadic/mobile technologies have already made an impact on our campuses. A distillation of responses from CIO’s to our query of what changes they were seeing fell into five categories:

- Most people defined mobile technology as wireless;
- Most saw wireless technology augmenting, not replacing, wired networks;
- Many questioned how to control the nomads and how to address security ;
- Several envisioned a more mobile environment might alter the type and shape of computing and service (such as reducing the need for general purpose labs and 24/7 support); and
- All saw a growing demand for multiplatform/device support

The following are specific examples of how the nomad is creating a sandstorm on campuses.

At Evergreen State College, David Metzler reports faculty are beginning to use wireless enabled tablets to access information immediately or email before a meeting takes place. At the College of New Jersey, keeping the wired network primary is the intent of Craig Blaha. This is because of spotty wireless security and reliability.

In the area of wireless augmenting the wired network, Phillippe Hanset of the University of Tennessee said many people are dropping their wired connections completely. “We thought of it as a complement and it’s becoming for many people a replacement.” This makes support issues “huge.” At Oakland University, Theresa Rowe offered this example of imposed changes to support:

“Our university decided that hand held computers are personal devices and therefore cannot be purchased with university funds. That didn’t stop people from buying them with personal funds, then asking central IT to ‘make it work’ – and we had to stop support. We can’t afford to buy one of everything to figure out the individual wireless connection’s intricacies and such.... There are laptops that wander all over our campus and use all sorts of network access points, wired and wireless, across campus... I have a lot less control over how they work or what they look like or how the computers are patched.”

¹² Cousins, Karlene and Daniel Robey, Patterns of Use within Nomadic Computing Environments: An Agency Perspective on Access- Anytime, Anywhere, prepared for the Workshop on Ubiquitous computing Environments, Case Western Reserve University October 2003. See <http://weatherhead.cwru.edu/pervasive/default.htm>

¹³ Lyytinen, Kalle and Youngjin Yoo, Information Systems Research. Vol. 13. Issue 4. December 2002 (pp.377-388)

¹⁴ Campus Networking—A CIO’s Perspective. Retrieved from the World Wide Web April 6, 2004; www.syllabus.com/article.asp?id=8711

¹⁵ Ibid.

Support for all of this, many of the respondents noted, is predicated on a robust WLAN. This is the case at University of Tennessee and the new Olin School of Engineering. At Olin, only four years old and unfettered by old buildings and pre-existing technology, keeping up with the current nomadic changes still requires careful planning: "As a new institution, we have fully converged category 6 network. Wireless AP's are automatically specified and planned for in new construction along with the wired network. We are working with our vendor partners regarding the next generation of wireless IP phones," noted Joanne Kossuth.

Despite the demand for wireless, for multiplatform/device support, almost all of the CIOs reported that wireless was still being viewed as an "add-on" to the infrastructure. Tracey Leger-Hornby of Brandeis added that the faculty has not yet requested mobile technologies. At the University of Tennessee, Philippe Hanset said that 'wired will not lose its trend.'" David Smallen of Hamilton wrote that he saw "central services as essential to interoperability."

What Are The Challenges Posed by Nomadicity?

Nomadcity and its associated consumerization will impact our campus in three significant ways:

- How we build and support our infrastructure;
- How we staff our IT organizations and provide IT services to the campus community; and
- How we fund IT infrastructure and services

Nomadcity and Infrastructure

To say that nomadcity has a profound impact on IT infrastructure is an understatement. The nomadic user essentially puts the infrastructure on its head. The key to nomadcity is flexibility, often an anathema in information technology. It is especially an anathema when faced with the dichotomy of maintaining an open, flexible network and needing security and protection against malware and other vicious attacks. True, as in the traditional infrastructure, nomadcity comes with the usual problems of bandwidth, latency, reliability, error rate, delay, storage, processing power, component to component interface, interoperability, user interface and cost, writes Kleinrock. Yet Lyytinen and Yoo add new categories that we may now need to monitor, establish governance for or control: synchronization, directory information, access, privacy, partnerships of services, maintenance of geographically dispersed computing resources, regulatory policy, shared social ontologies, business frameworks, surveillance, privacy and even 'new time regimes of work.'¹⁶ We add to this growing list: network attached storage; open source and multiple vendor options; video capture and editing and a myriad of peripherals.

Impact on Staffing and Services

Whether the infrastructure as we have come to know (support, protect) it, remains wired, wireless or a combination of both, we observe two areas where we conduct our business that will need to be monitored and possibly soon changed to address nomadcity.

For colleges and universities accustomed to a wired network, control, and some level or predictability, nomadcity will have an obvious impact on IT services. Nomads are likely to be more advanced users who deal with technologies such as voice/data convergence, PDAs, video and audio capture and editing, peer-to-peer applications, open source alternatives to vendor software suites, and specialized software applications. They will come to campus with multiple devices of

¹⁶ Lyytinen, et al. op. cit. (pp.377-388)

their own and may expect that each of these devices be supported regardless of where it is permanently or temporarily housed.

In other words, these are our students, our researchers, our faculty and our administrators.

This suggests a model very different than having a Help Desk that only services a certain brand or two of desktop computer. It means gathering and interpreting data about what technologies nomads are using and how they are using them. Actually, it suggests that we may better serve our community by regularly reading cell phone advertisements, wandering the aisles at Best Buy and Circuit City, and by attending consumer electronic shows.

Nomadcity and, oh yes, Budget

The consumer/nomad will, and is already, having an impact on the budget. Possibly the best, most visible, and quantifiable example is the cell phone with its multiple modes of connectivity. The multifunction cell phone has reduced the need for sophisticated residence hall phone systems eliminating the need for upgrading of that equipment on the plus side but also drying up that source of revenue.

For years, we have put considerable amounts of money into the corporal manifestations of technology – hardware, computer labs, smartrooms, cybercafés – all stationary locations for computing and communications. While the shift to multiple devices may serve to extract us to a greater or lesser degree from hardware currency costs as we ‘decommission’ campus computing labs, we may see those cost savings absorbed by the increase in support costs and licensing fees needed to access software remotely; by the need to offer storage capacity; by the requirement for WAP and other tools to provide learning and administrative services to PDAs and cell phones; and by the increased costs for security.

What Are The Likely Impacts In The Coming One to Three Years?

All of the current trends in the consumer marketplace – from hardware to software to services to networking – will accelerate the pace at which nomadcity will evolve. An article in *Business Week* states that “the networks now taking shape will link together more than 1 billion people, not just with words or voices, but with music, video, games and commerce. This revolution won’t quiet down anytime soon.”¹⁷

The impact of the entertainment industry on nomadcity should not be underestimated. The market successes of products such as Apple’s iPod® and XM Radio® have been driven by consumers’ desire for personalized entertainment services. It will not be long before the applications used with these portable entertainment devices converge with applications already in use on mobile laptops. Duke University’s iPod alliance with Apple is an early move in this direction, and underscores the impact that corporate marketing strategy can have on campus IT infrastructure, services, and learning.¹⁸ This convergence of entertainment and productivity technologies will dramatically accelerate the need for mobility and personalization that will likely characterize the next wave of the “always on” paradigm – not only will the technology itself be “always on” but it will likely be “always on the consumer.” And consumers will not be removing their personalized technologies when they commute to the campus. Rather, they will expect that campus IT services are able to seamlessly integrate with their own technologies of choice.

¹⁷ Baker, Stephen and Heather Green, “Big Bang”, *Business Week*, June 21, 2004. p. 71

¹⁸ Carlson, Scott, “Duke U. Will Give iPod Music Players to All New Freshmen in a ‘See What Happens’ Project,” *Chronicle of Higher Education*, July 20, 2004. See <http://chronicle.com/free/2004/07/2004072001n.htm>

How Should We Proceed?

In addition to the impact of nomadicity on our campus infrastructure discussed earlier in this paper, we need to be aware of the potential confluence of other technology trends with nomadicity. These include miniaturization, dramatic increases in storage density, integration of video into multiple devices, and establishment of international standards. Nomads on the one hand reduce demands on traditional campus IT infrastructures (storage, workstations, etc.). On the other hand, they may bring exotic applications/data to campus. This may require additional end-user or technical support.

We do not know yet what the impact will be on IT staffing. We can expect, however, that IT technical staff will be among the vanguard of the nomadicity movement. One way we can prepare for these changes will be to look to our own staff to help identify trends, experiment with emerging technologies, and address integration issues. Support staff will need to be able to respond to “demand pull” rather than “provider push” issues as a matter of course: customer perceptions of service are likely to switch from an assessment of “how well the campus supports what it has provided” to “how well the campus supports my personal technology needs.” In this regard, IT staff will need to be both generalist and specialist at the same time. From a managerial perspective, IT support organizations will need to draw more of their mandate and agenda from customers than from campus IT management, and agendas will change more frequently and be driven more by consumer market forces.

The range of how IT is funded, as reported by our e-mail responses and by last year’s EDUCAUSE IT Funding Working Group,¹⁹ is vast. Some have included wireless in R&D budgets; others are paying for WLAN on an ad hoc basis (but stated this may change); a few use capital funds as part of building and/or renovation costs; several reported that they use a cost recovery model. There were those who used the word – “struggling” – to indicate how they were keeping up with what clearly is a technology culture shift.

If we cannot control the types of devices coming to campus, then we will likely need to make every effort to “unravel” complex funding schemes to become able to rely upon pooled funding to support a wide variety of legacy and next-generation technologies. We can no longer hope for subsidies transferred from “cash cows” to support advanced technologies and to gratuitously obtain commodity services provided at less than cost to the campus.

Conclusion

It is the culture shift that is at the root of the “consumerization of technology.” We now have to take the message of the nomad to all who control the money. One argument is that we need to continually prepare students for the technology of commerce.²⁰

Perhaps a better argument is to educate senior administrators, faculty, boards of directors, legislators and, yes, our own information technology staff that, pardon the mixed metaphor, the technological nomad is here to stay.

¹⁹ “Report of the EDUCAUSE IT Funding Working Group,” Presented at EDUCAUSE 2003 annual conference. See <http://www.educause.edu/asp/doclib/abstract.asp?ID=EDU0337>

²⁰ Young, op cit. p. 2 of 5

Related Information and Sources

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2. Baker, Stephen and Heather Green, "Big Bang", *Business Week*, June 21, 2004. p. 71
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7. Kleinrock, Leonard, "Breaking Loose," *Communications of the ACM*, September 2001. Vol. 44. No. 9 pp 41-45.
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Related EDUCAUSE2004 Sessions

1. Faculty Instructional Development Labs: Now That You've Built Them, Are They Coming? 8:10 a.m. - 9:00 a.m. Thursday (Faculty, Support Services)
2. Just-in-Time Faculty IT Support: A Scalable Model for Delivering Technology Tutorials in Faculty Offices; 11:45 a.m. - 12:35 p.m. Thursday (Faculty, Support Services)
3. Collaboration at New Heights; 8:10 a.m. - 9:00 a.m. Friday (Collaboration, Faculty, Support Services)
4. Charting New Frontiers: The Mobile Digital Campus; 11:40 a.m. - 12:30 p.m. Wednesday (Network Infrastructure and Equipment, Wireless Technology)
5. Transforming a Campus Environment through Wireless; 2:20 p.m. - 3:10 p.m. Thursday (Network Infrastructure and Equipment)