

Roadmap

TOOLS FOR NAVIGATING COMPLEX DECISIONS

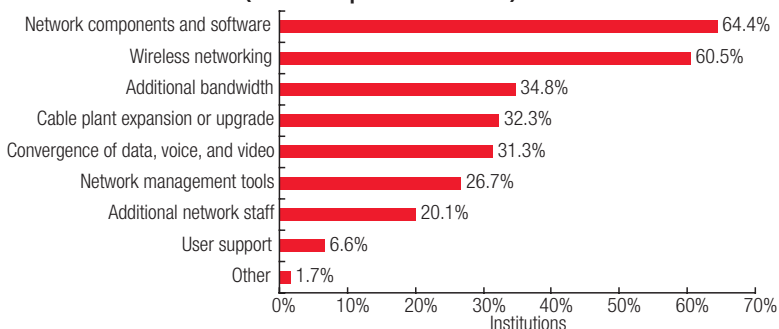
Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator

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KEY FINDINGS

- ▶ Four out of five respondents (81 percent) report that the leaders of their institutions consider the campus network to be a strategic resource.
- ▶ Institutions are now “wired,” giving access to almost all students, faculty, and staff and are actively involved in supplementing the wired network with wireless access.
- ▶ Higher education institutions and organizations are actively building a private infrastructure of state, regional, and national research and education networks.
- ▶ Most respondents are evaluating or running converged networks for some applications.
- ▶ Network redundancy and security are concerns. Forty percent report they do not have a disaster recovery plan for data networking on campus. Of all barriers to the delivery of network services, respondents identified security most often (63 percent).
- ▶ Networking practices often differ between small and large institutions. Large institutions must contend with many more users on the network, running a much wider and more diverse set of applications, with higher-volume operations; smaller institutions can often keep it simpler.

**Largest Networking Investments During the Next Three Years
(Three Responses Allowed)**



Providing a reliable, secure, adaptable, scalable, and fault-tolerant data communications network has become fundamental in higher education. Higher education’s access to networked services and information assets—whether they support core missions of research and teaching or business administration—are increasingly central to enhancing reputation, competitiveness, client satisfaction, business performance, revenue, and accountability. Beyond the campus, the higher education community is actively building a set of interconnected private state, regional, and national research and education networks. Looking further out, higher education continues to play a role as network pioneer—with leading-edge projects under way throughout the academy, investigating a scope of technologies that almost defies the imagination. A robust network is the most basic underpinning for these initiatives, making network planning and management vital institutional concerns.

It is within this context that the EDUCAUSE Center of Applied Research (ECAR) decided to conduct an in-depth study of IT networking in higher education. *Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator* was designed to provide detailed empirical information about the higher education networking environment, both from an everyday-practice perspective and from a strategic perspective. Areas of coverage include infrastructure, management and practices, and future planning. The report offers systematic quantitative data to

This ECAR Roadmap synthesizes 517 responses to a June 2004 survey, as well as interviews with 19 higher education IT executives and managers at 13 institutions about general networking issues that were part of the 2005 ECAR study, Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator, by Judith A. Pirani and Gail Salaway, with Richard N. Katz and John Voloudakis. To order the full study or to learn about subscribing to ECAR, visit the ECAR Web site at <http://www.educause.edu/ecar/> or contact us at ecar@educause.edu.

WHICH INSTITUTIONS REPORT A HIGHER-QUALITY NETWORK INFRASTRUCTURE?

Institutions that...

- ▶ consider the network to be a strategic resource
- ▶ have a primary network goal of providing leading-edge network performance and services
- ▶ do not consider inadequate funding to be a barrier to the delivery of networking services
- ▶ have formal, comprehensive policies and procedures that cover networking issues; enforce these policies and procedures consistently; and update them regularly
- ▶ provide more redundancy measures for the institution's central network
- ▶ have a disaster recovery plan for the institution's data-networking capabilities

help institutions make more-informed decisions regarding their networking approaches and plans.

Higher-Quality Network Infrastructure

Given the integral nature of the network, a solid network infrastructure is an institutional imperative. ECAR's research identifies several characteristics that typify those institutions that agreed they have a higher-quality network infrastructure—one that is secure, fault-tolerant, and optimally designed to meet future needs.¹ Interestingly, ECAR research shows that while technology is indeed important in network design and management, the network is also contextually shaped and constrained by factors like senior leadership attitudes, funding resources, and institutional mission.

Network Is a Strategic Resource

Our data show that campus leadership fully recognizes the importance and strategic value of their networks. Respondents overwhelmingly agree that their leadership views the campus network as more important than it was three years ago (94 percent); an essential resource (98 percent); and critical infrastructure (89 percent). Furthermore, 81 percent of respondents said that their institution's leadership also considers the campus network a strategic resource, with 28 percent going so far as to characterize networking at their institution not only as strategic but as a "strategic differentiator" for the campus. Leadership attitudes appear to make a difference: ECAR found that respondents whose campus leaders consider the network to be strategic rated the quality of their network infrastructure higher than others.

Primary Network Goal

Survey respondents appear to be impelled by four distinctly differing networking goals. Though campus approaches differ widely, responses show a fairly even distribution across the goals.

- ▶ Cost minimizers (20 percent) focus on providing reliable performance and services.
- ▶ Demand-driven providers (28 percent) deliver appropriate levels of performance and services to different users based on their needs.

- ▶ Providers of "high speed for all" (26 percent) provide high-speed networking to the entire institution.
- ▶ Leading-edge providers (26 percent) deliver leading-edge network performance and services to the institution.

Interestingly, ECAR research finds that institutions whose primary network goal is to provide leading-edge network performance and services to the institution rate the quality of their network infrastructure—design of the backbone, desktop connectivity, and wireless networks, as well as network security and fault tolerance—higher than other institutions.

Network Funding Grows, but Is Never Enough

Given the difficult financial situations at many campuses, we were not surprised to find that 59 percent of respondents identify inadequate funding as a barrier to the delivery of network services. Regardless of whether funding is considered a barrier to networking, however, respondents report that network spending is up. Two-thirds say that network spending has increased over the past three years (mid-2001 to mid-2004), and three-quarters expect it to increase over the next three years (mid-2004 to mid-2007). Not surprisingly, ECAR research also shows that institutions reporting adequate funding rate their network infrastructure as stronger, especially with respect to the optimal design of desktop connectivity and the fault tolerance of the network.

Formal Networking Policies and Procedures

We found that data-networking policies and procedures are fairly commonplace in our higher education sample. Nearly eight out of ten respondents (77.9 percent) now have formal policies and procedures to manage data-networking activities. Fewer, however, report that their policies are consistently enforced, comprehensive, or regularly updated. Yet our data indicate that institutions with formal network policies and procedures—and especially institutions that consistently enforce their policies—are more likely to rate higher the quality of their network infrastructure.

Redundancy and Disaster Recovery

Network redundancy is an important part of network reliability, and our data show that we have a long way to

METHODOLOGY

- ▶ A literature review to identify and clarify the study's major elements and create a working set of hypotheses to be tested
- ▶ Close consultation with the EDUCAUSE Net@EDU Integrated Communications Solutions Working Group to validate the most interesting research questions and hypotheses that would frame the quantitative survey instrument
- ▶ A quantitative online survey of EDUCAUSE member higher education institutions, with 517 responses
- ▶ Qualitative telephone interviews with 19 higher education IT executives and managers at 13 institutions about general networking issues
- ▶ Qualitative telephone interviews with 12 higher education leaders about their views of the future of IT networking in higher education
- ▶ Three case studies

go. For example, most institutions (74 percent) report that they have implemented redundancy for some single points of failure, but very few (9 percent) have implemented redundancy for all single points of failure. Paying attention to network redundancy may make a difference in perceived network quality—those institutions reporting higher levels of redundancy also report that their backbone network is both more fault tolerant and better designed to meet future needs. Importantly, 40 percent of respondents report that they do not have a documented disaster recovery plan for data networking on campus. Those who have such a plan characterize the quality of their network infrastructure more positively across a number of dimensions.

Networking Technology and Practices

Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator also offers insight and guidance about current practices for wired and wireless network infrastructures, national research and education networks, emerging technologies, and network management.

The Wired and Wireless Infrastructures

To a significant degree, higher education is wired. Respondents report that almost all faculty and staff offices are wired and that most libraries, residence halls, classrooms (single connection), and research laboratories are wired as well. Institutions also report some progress in wiring indoor public spaces. Campuses, too, have made considerable progress in building their wireless network infrastructure, and they are not stopping. Wireless network expansion is especially prevalent in areas that were not physically wired early, as a result of either structural issues or cost and priority. And wireless is finally making a reality the vision to have every classroom seat connected to the network—we have reached the point where more classroom seats are connected wirelessly than with wires. In addition, campuses are actively expanding network access to outdoor spaces, with almost two-thirds of institutions providing some level

of outdoor wireless access and about 10 percent reporting a considerable number of outdoor spaces with wireless access. A number of respondents say that supporting mobile communications access for students is an essential part of the institution's strategic goals, while others report extending the reach of their wireless networks into the community adjacent to campus.

State, Regional, and National Research and Education Networks

There is currently a great deal of energy and enthusiasm around creating and/or joining private education and research networks. Two-fifths of responding institutions connect to a university-system-wide network, and 43 percent connect to a state educational and research network. Regional gigaPOPs connect 25 percent of responding institutions. At the state and regional level, 34 research and educational networks are now in place or being implemented, and most are moving toward a model of regional facility-based networking built with owned assets, called regional optical networks (RONs).

Emerging Technologies

Evaluating and implementing new technologies is a key role of many central IT organizations. Currently under consideration on many campuses are technologies that support the convergence of the network infrastructures for data, voice, and/or video. Most respondents tell us they are somewhere on the adoption curve between evaluating and actually running converged networks for some applications. About half of the respondents indicate that IP video streaming and/or desktop video conferencing is already in limited use on their campuses; most other responding institutions are either planning to implement or are evaluating these technologies. While relatively few respondents currently use voice over Internet protocol (VoIP)—about one-fourth of institutions—many others are planning to deploy this capability or are actively evaluating their options. A small number of institutions are currently implementing other converged services, such as cable TV over the network and integrated messaging.

RECOMMENDATIONS

Based on its findings in *Information Technology Networking in Higher Education: Campus Commodity and Competitive Differentiator*, ECAR offers the following recommendations to meet the challenges of networking:

1. Align the institution and the network.

It is important to explicitly understand the overarching institutional characteristics and reflect these in campus network plans and goals. For example, an institution with a goal to provide a leading-edge network needs to “future-proof” the network to meet an extensive and diverse set of needs; deploy emerging technologies; and support innovative research. In contrast, institutions with a network goal of minimizing cost have more pragmatic concerns. The differing activities of institutions with leading-edge versus cost-minimizing networks are neither right nor wrong; rather, they are appropriate to achieve the institutional network goal.

2. Ensure ample network investment.

Despite positive spending trends, most respondents consider inadequate funding to be a barrier to the delivery of networking services. IT leaders are therefore taking numerous approaches to secure adequate financing for their networks, including building new funding models to sustain their network infrastructure, enhancing vendor partnerships beyond equipment discounts, and investigating the addition of value-added or new services to generate revenue. Those institutions that have restructured the campus network-funding model to fully provide for the network and its ongoing renewal describe the process as extremely difficult and time-consuming but well worth the effort.

3. Build ahead of user demand.

Because higher education thrives on discovery and experimentation, user networking needs cannot be fully anticipated. As a result, the network is never “done.” IT leaders must constantly look within and beyond higher education to anticipate emerging technologies that will transform the institution yet again and, in their wake, potentially create new security, integration, and support issues. Furthermore, as networks grow, campuses must contend with more users, run a more diverse set of applications, and manage a rising volume of traffic. As the network scales up, demands are made not only for higher bandwidth and transmission speeds but also for more automation to support network management, for extended user support hours, and for stronger network redundancy.

4. Focus resources on network security and reliability.

Respondents were adamant about the importance of enhancing network security and reliability. This poses an enormous challenge in light of growing compliance requirements, the need to continually deploy new technologies, and the generally increasing usage and complexity of campus networks. Yet, as networks become essential—and often strategic—to core education, research, and business processes, network security and reliability become even more critical. Both issues will continue to require significant IT and financial resources. Furthermore, establishing a disaster recovery plan for data networking is recommended.

5. Make use of opportunities provided by private higher education networks.

There is currently a high level of activity devoted to building a private infrastructure of state, regional, and national research and education networks. These efforts are providing extensive opportunities to conduct multi-institutional and leading-edge research, hold cross-institutional classes, and access public networks and other network resources more cost effectively. Supporting, extending, and leveraging these networks to further institutional goals not only benefits higher education institutions but also provides a means for colleges and universities to offer their network resources to the community.

Network Management

Network management, software tools, restrictions, policies, and support are increasingly crucial parts of the campus network and its practices. Specifically, monitoring tools are used actively, most commonly for monitoring traffic, network components, performance of servers, and security vulnerabilities. Metrics are also widely used, mostly for tracking network capacity utilization and uptime. Placing restrictions—on bandwidth, access to external devices, applications, or devices—is also very common.

Endnote

1. ECAR's networking survey asked respondents to give their opinions (strongly disagree, disagree, neutral, agree, strongly agree) for a series of statements about the design, security, and reliability of the campus network: (a) My institution's central network backbone is optimally designed to meet our needs for the foreseeable future, (b) My institution's desktop connectivity is optimally designed to meet our needs for the foreseeable future, (c) My institution's wireless connectivity is optimally designed to meet our needs for the foreseeable future, (d) My institution's network is secure, and (e) My institution's network is fault tolerant.