

# Shaping the Higher Education Cloud

An EDUCAUSE and NACUBO White Paper

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# Shaping the Higher Education Cloud

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## Abstract

As technologies like virtualization and cloud computing assume important places within the IT landscape, higher education leaders will need to consider which institutional services they wish to leave to consumer choice, which ones they wish to source and administer “somewhere else,” and which services they should operate centrally or locally on campus.

In February 2010, chief information officers, chief business officers, and industry leaders gathered in Tempe, Arizona, for a two-day EDUCAUSE/NACUBO Cloud Computing Workshop to explore what shape a higher education cloud might take and to identify opportunities and models for partnering together.

One important option is the development of collaborative service offerings among colleges and universities. Yet, substantial challenges raise at least some near-term concerns including risk, security, and governance issues; uncertainty about return on investment and service provider certification; and questions regarding which business and academic activities are best suited for the cloud.

This white paper captures key findings from those two days of exploring, including recommendations for cloud action.

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## Executive Summary

IT is a critical component of modern higher education. Despite miraculous improvements in price and performance, total IT costs in higher education seem destined to remain on an upward trajectory, in part because of the voracious demands of researchers for bandwidth and computing power and of students for sound and video-intensive applications. Equally to blame for higher education's IT cost management challenge may be higher education's long tradition of building its own systems and tendency to self-operate almost everything related to IT.

The question of whether colleges and universities can continue their long-standing model of operating unique and enormously expensive IT environments seems rhetorical. The worst economic recession in decades is one more layer over what has become a steady dwindling of state coffers and the transition for many institutions toward alternate funding sources and models to remain competitive with traditional and for-profit entities at home and abroad. Likewise, growing external expectations—for institutions to address issues of student access and affordability and to account for student outcomes and performance—require higher education to sharpen its focus on its core mission and competencies.

The unsustainable economics of higher education's traditional approaches to IT, increased expectations and scrutiny, and the growing complexity of institutional operations and governance call for a different *modus operandi*. So too does the mass consumerization of services, for which students and faculty are more likely to look outside the institution to address their IT needs and preferences, noted James Hilton, vice president and CIO, University of Virginia. Cloud computing represents a real opportunity to rethink and re-craft services for the academy. Among the greatest benefits of scalable and elastic IT is the option to pay only for what is used. Robust networks coupled with virtualization technologies make less relevant where work happens or where data is stored. Cloud computing allows the flexibility for some enterprise activities to move *above campus* to providers that are faster, cheaper, or safer and for some activities to move off the institution's responsibility list to the "consumer" cloud (*below campus*), while still other activities can remain in-house, including those that differentiate and provide competitive advantage to an institution.

The cloud is no longer just a concept. Commercial cloud computing already encompasses an expanding array of on-demand, pay-as-you-go infrastructure, platform, application, and software services that are growing in complexity and capability. The flexibility the cloud offers coupled with the mounting economic pressures, along with the massive unbundling and commoditization taking place in IT and a variety of industries, are prompting higher education leaders to consider new sourcing arrangements. While some leaders are acclimating to this new IT environment and testing the marketplace with ventures ranging from computing cycles and data storage to student e-mail, disaster recovery, or virtual computing labs, most remain cautious observers as they assess its potential impact.

As with past outsourcing initiatives, questions abound regarding which cloud-sourcing opportunities make the most sense; criteria for selecting providers and services; and how to mitigate the risks of third-party handling of sensitive information. There are calls for creating a higher education capacity to aggregate network-based demand and supply for services commonly found on campus.

Key questions surrounding such a venture include:

- ◆ Who should be involved in and lead this collaboration?
- ◆ Could an industry-led entity develop decision-making tools and standards and provide leverage within the commercial cloud marketplace to significantly reduce costs and maximize efficiencies?
- ◆ To what extent would these efforts ease the burden for uncertain institutional leaders to conduct business above campus despite the potential risks?

Voicing the desire for a higher education aggregator or broker may be the first step toward coming to terms with a very real need for collaboration. Including both IT and institutional business interests is a critical second step. Third, institutional leaders must collaborate in determining what infrastructure or activities can be operated effectively and efficiently. Finally, leaders must assess when to, how to, and who should take the logical next steps for defining and controlling the shape and direction of an industry consortium, aggregator, or cloud broker.

This past February in Tempe, Arizona, at a workshop sponsored by EDUCAUSE and NACUBO, a group of approximately 50 leaders from higher education institutions, corporations, professional associations, and state and national networks gathered to discuss how to enable shared services to take advantage of this emerging potential. This white paper strives to describe the technical and institutional context of these talks and to capture their highlights, including the potential of the emerging capabilities to transform campus operations; issues that may hinder participation; and action steps for making a higher education cloud a reality.

As EDUCAUSE President and CEO Diana Oblinger noted at this meeting, “IT itself is a disruptive technology that will continue to shape what campuses and their leaders can do and how they will need to respond going forward. A fundamental shift occurring in the cost structure of higher education will likewise disrupt IT and will require new business models for individual institutions and the industry as a whole.”

NACUBO President and CEO John Walda concurred. One driving force that compels the business office to search for long-term innovative solutions is to find models to address changes brought about not only by the recession but also in response to competition from proprietary groups and international education that will continue to be forces of change for the future. “We need to come together in

groups to optimize our strength, not simply determine how to bridge the gap,” urged Walda. “This is the right time for this conversation because of our necessity to take advantage of emerging technologies to change how we do business on campus. And that includes looking at a higher education solution for maximizing the benefits of cloud computing.”

Attendees also recommended that EDUCAUSE and NACUBO undertake a set of actions to educate their members about the emerging opportunities and risks, to clarify issues related to cloud computing, and to provide members with tools to make informed campus sourcing decisions. Participants asked EDUCAUSE, Internet2, and NACUBO to convene a Task Group to evaluate the possibility and issues of creating or otherwise facilitating an entity that would aggregate demand for and supply of services on behalf of higher education.

## The Promise of Cloud Computing

### Cloud Attributes

To understand the current push toward the cloud, it's worth noting some of the attributes that set cloud computing apart from other types of outsourcing or shared services models in which higher education has engaged, as well as conditions that now make movement to the cloud arguably inevitable. While each industry group defines cloud computing in its peculiar way, certain key attributes persist. For instance, Burton Group identifies cloud computing as “the set of disciplines, technologies, and business models used to render IT capabilities (software, platform, hardware) as an on-demand, scalable, elastic service.”<sup>1</sup> Gartner likewise frames cloud computing as “a style of computing where scalable and elastic IT-enabled capabilities are delivered as a service to customers using Internet technologies.”<sup>2</sup>

**Provides elasticity and scalability.** The notions of scalability and elasticity are largely what distinguish cloud computing from other sourcing models. There is great value in provisioning a range of capabilities as a service to customers being able to scale them up to more users, resources, or storage when needed and scale them down as needs shift. This way, an institution can better map its technology use to meet the demands of its various operational cycles and activities.<sup>3</sup>

**Offers on-demand consumption.** In hand with the ability to scale IT use is the flexibility this offers to customers to consume as their need emerges, allowing more control and faster return on investment. This consumption-based pricing model in turn demands that cloud providers adjust pricing on a granular basis.<sup>4</sup> As such, cloud computing holds the capacity to fully change business and cost models and expedite the provision of a wide range of applications and services.

**Promotes standardization.** Standardization of activity is another key feature—and a core promise—of cloud computing. The possibility of a maturing cloud capable of delivering infrastructure, application, and support services on-demand is important for a host of reasons, not the least of which is to foster further IT standardization. The EDUCAUSE Board of Directors identified this attribute in the association's future role in the cloud: “The maturity of standards...the availability of high-performance network capacity, and the emergence of virtualization technologies are combining to enrich the sourcing options at our disposal.”<sup>5</sup>

**Simplifies and optimizes IT.** The full range of service delivery models made available via the cloud—including infrastructure as a service (IaaS), software as a service (SaaS), and platform as a service (PaaS)—ensures a broad continuum of use and support. In addition to providing efficient IT service delivery, the cloud reduces complexity and offers competitive and reliable options for outsourcing nonessential IT services. This in turn allows institutional staff to refocus their time and energies on core competencies and mission-specific activities.

**Lowers capital and total IT costs.** Because customers pay for only the services they use, the cloud offers significant opportunities to expedite an institution's return on investment. Likewise, for many institutions, maintaining data center space and data storage capacity poses significant challenges to budgets. By enabling the sourcing of cycles and storage and the option to defer capital-intensive investments such as new data center construction, institutions can shift focus to managing operational costs and to better budget forecasting.<sup>6</sup>

**Accelerates time to market.** The cloud allows IT personnel to efficiently install new applications and provision needed IT resources. In this way, the cloud's self-service, on-demand model increases the agility of IT organizations and reduces IT response times throughout the institution.<sup>7</sup>

**Increases access to scarce IT talent.** Because cloud providers must employ, train, and retain highly skilled IT professionals to ensure quality of service, institutions that leverage this expertise stand to gain immediate access to vital IT talent. This access can also help institutions address unpredictable resource demands. Likewise, external IT services may allow for better support of an increasingly mobile higher education workforce.<sup>8</sup>

Of course, not all cloud service providers are equal. Relatively immature markets and new companies introduce some level of consumer uncertainty to the cloud marketplace. Even more significant drawbacks range from data security and compliance concerns and licensing issues to vendor lock-in, exposure to service failures, and inflexible or nonexistent service level agreements.

Yet, to the extent that institutional leaders are able to balance the concerns with the promise of the cloud, they might move toward a vision of the "meta university" espoused by Charles Vest, president emeritus of MIT. His understanding of "a transcendent, accessible, empowering, dynamic, communally constructed framework of open materials and platforms on which much of higher education worldwide can be constructed or enhanced"<sup>9</sup> seems to perfectly describe the cloud with its potential as a disruptive and transformative vehicle for propelling higher education to operate above the level of any single institution.

Brad Wheeler and Shelton Waggener argue that the types of aggregation made possible with the adoption of cloud computing could in fact be a step toward the kind of multi-institution, meta-university activity that Vest had in mind. This is especially true with regard to a consortial sourcing model that centers on collaboration and open values and an understanding that like-minded entities may opt in or opt out in concert with individual interests and needs.<sup>10</sup>

## **Cloud Computing Classifications**

Unclear for some is how to determine the best cloud-sourcing model for a particular institution or a particular venture.

**Consortial versus commercial versus institutional.** One way to classify cloud computing is to distinguish between consortial, commercial, and institutional models. A consortium sourcing model implies use of a not-for-profit means of aggregating demand to then either self-operate services or contract with a commercial or institutional provider to do so. Such a model allows for sustained participation even as the needs of the group change, it avoids one-on-one negotiations, and it leverages resources to improve economies of scale. A commercial or public cloud model suggests a third-party marketplace in which individual or groups of customers buy services that are so commoditized that there is no real differentiating value for an institution to provide the service on its own. In an institutional sourcing model, one or more institutions with particular competencies provide services directly to others for the benefit of all—not with a profit motive, but as a way to recover the costs of providing the service.<sup>11</sup>

At any given time, an institution may take part in each of these scenarios or various hybrid models. One clear advantage of a consortium is the aggregation of demand that would allow institutions to better control their risk and cost.

**Public versus private versus hybrid.** Another distinction can be made between public and private clouds. Public clouds may offer low-cost services, but in return they may not provide needed assurances of security for those services. Private clouds, sometimes also referred to as community clouds, seek secure collaboration with external providers. Certain hybrid cloud architectures may balance concerns about cost versus risk mitigation.<sup>12</sup> A private cloud may be as simple as an IT unit provisioning services to the institution's internal customers. Specific attributes that help distinguish between public and private clouds include levels of service control and ownership, and service access.<sup>13</sup> Rather than an either/or framework, it is most helpful to consider where a cloud falls on the spectrum between public and private models. For instance, more common than having complete lack of ownership or implementation control, an institution might have partial control of implementation or be given limited, industry-only access.

**Ecosystems versus brokers.** Within the broader cloud marketplace, a cloud service provider might participate as a kind of cloud ecosystem, both delivering services to customers and also facilitating business with other cloud service providers. Cloud brokers, on the other hand, facilitate relationships directly between cloud service providers and their customers to negotiate better services, access, security, costs, and so forth.

## **Identity Management and Federations**

If higher education is going to have the maximum flexibility to make good decisions regarding cloud services, it must have robust identity and access management. Historically, processes for authenticating users and deciding what privileges to extend to them were embedded in the logic of individual back-end applications, while separate identity mechanisms had to be overlaid on an Internet that was

originally designed without them. Institutions have made some progress in updating their identity management regimes, but the key technology of federated identity—the ability of users authenticated in one domain to access resources elsewhere—has only been implemented by a small proportion of institutions.

Exploiting the cloud will require institutions to develop both the technical means of federated identity and the possibly more challenging trust relationships that allow different entities to accept each other's assertions. Furthermore, with its special regulatory concerns about student data and traditions of free inquiry, higher education has particular needs from an identity ecosystem that may not be recognized in commercial identity products or federations. Participation in higher education-centric identity federations like InCommon and in education-related state or consortial federations can help institutions develop the multilateral, flexible, and secure identity capabilities they need while bypassing expensive and exhausting point-to-point integrations. Institutions are also likely to have to develop policies for handling increasingly popular user-controlled web-based identifiers, such as those offered by Internet services like Google and Facebook.

### **Cloud Computing and the Hype Cycle**

Despite the promise of cloud computing to transform higher education learning and business processes, it is important to underscore that the hype has grown exponentially within the past year or two. A number of companies have simply been relabeling old technologies under the cloud computing banner.<sup>14</sup> Steve Auerbach predicts that many small and midsize businesses could potentially move much of their computing needs to the cloud during the next five to eight years: "Appropriate investments in private cloud computing will make it easier for enterprises to gradually use public cloud services as needed, if and when the services mature. Because public cloud computing is years from fulfilling many enterprise needs, it is likely that IT organizations will spend more money through 2012 on private cloud-computing investments than on offerings from public cloud providers."<sup>15</sup> Workshop participant David Cearley, vice president and fellow, Gartner Group, advised proceeding with caution. Cloud computing is prone to the same hype cycle as for other new technologies and solutions. "Presently, cloud computing has rocketed to a peak of anticipated expectations, but we must be careful of grandiose expectations," noted Cearley. "We are already starting to see folks approach cloud computing in ways that will fail," he added. "This is a 5- to 10-year phenomenon, so we need to make sure we don't ignore the lessons we should all learn during the interim as this phenomenon moves from disillusionment into enlightenment."

### **Aggregation: Safety in Numbers**

Aggregation of service is key, asserted Brad Wheeler, vice president for IT and CIO, Indiana University. "For some things we have enough scale internally, but for others, the benefits will come only from economies of scale when we join together. This is an emerging model with an unknown ending point," Wheeler

stressed. “We need to adjust fundamental cost structures and business models so that new opportunities will arise. And we need to instill a discipline of fine-tuning as we go based on experience—not wait to have it all figured out first.” Aggregating higher education demand would also help keep providers accountable and focused on addressing client needs. “If we as institutions each continue to contract separately, the balance of power remains on the other side. On the other hand, where we aggregate our demand, we retain our negotiating leverage,” explained Wheeler. “In my conversations with cloud providers, they relish the idea of not having to negotiate with each of us but instead enact a bigger deal with some structure to it. This could be an efficient step that is valued by both sides.”

## **Economics of Cloud Computing**

In its simplest form, the proposition is that cloud computing users can avoid capital expenditures on hardware and software, paying providers only for services they use. Other purported benefits include low entry barriers, shared infrastructure and costs, low management overhead, and immediate access to a broad range of applications. Importantly, cloud computing services are scalable and elastic. When you need more, you pay for it. When you need less, you don’t pay. Service quality is assured through service level agreements, and consumers can terminate contracts at any time. When delivered, these features alter the long-standing need to build IT capacity (for computing cycles, storage, and bandwidth) in case such capacity is needed. Successful sourcing of elastic cloud services allows some IT costs to behave like variable costs that can be more readily managed—or even lowered. As well, variable costs can be more closely tied to programmatic goals, accounted for and assigned to the common good, or allocated where they are incurred.

In addition, the cost of cloud-based infrastructure, platforms, applications, and services is likely to be lower than the comparable costs of hosting on campus. Cloud-based infrastructure, for example, often depends on large-scale, state-of-the-art, highly automated and green facilities. The ability of cloud providers to leverage hardware suppliers, utility rates, and real-estate costs—and to substitute capital for labor—makes it unlikely that higher education can compete on cost.

Notwithstanding this positive proposition, as cloud services rise in complexity, the transaction costs (contract development, monitoring, and administration) are unlikely to stay low, and switching costs could become quite high. Further, the shift to managing a mixed portfolio of premises-based and cloud-based services will likely require new approaches to assessing risk and performance in IT-enabled services. Many analysts add cautionary tales of vendor lock-in, a potential that exacerbates the risk of rising costs as cloud computing matures. Finally, college and university IT organizations will likely continue to need to integrate infrastructure, applications, and services in ways reinforce the institution’s brand, self-image, and aspirations. The institution will also remain responsible for identity and access management, a responsibility that will surely grow in size, complexity, and cost as the interconnections among physical and virtual organizations multiply.

The economics of cloud computing are not yet clear. Considerable unknowns exist, and empirical data is not yet available. That said, the economic potential of cloud computing suggests that all campus leaders begin now to evaluate, test, and experiment to uncover these economics. As with most IT innovations, new offerings will not be universally more cost-effective. IT and business leaders will have to determine which applications make sense and under which conditions.

## **The Economics of Above-Campus Services**

Above-campus services are enabled by cloud computing but do not depend on cloud computing narrowly defined. Robust and plentiful networks, an increasingly standardized IT environment, virtualization tools and techniques, and higher education's improved capacity to undertake large-scale technology collaborations represent the conditions for a shift to an economics of sharing. Already institutions like Drexel University host enterprise systems for other universities. The Quali Foundation aggregates demand for open-source higher education software and services, makes and distributes software, and plans to host services that are based in software developed at a variety of institutions. These initiatives demonstrably lower the institutional acquisition costs of software and, in the cases of hosted services, spread the costs of hardware and software maintenance across a larger base of users, raising the operating efficiency of these services as well.

## **Issues and Concerns**

Despite the economic potential of these and other models of shared services, valid concerns remain for leaders deliberating the particulars of their institution's involvement in the cloud. A number of primary concerns were articulated by workshop participants.

## **Integration and Security**

"Integration of services is among our largest challenges and likely takes most of our time and resources, and I do not see that changing," said Joanne M. Kossuth, vice president for operations and CIO, Franklin W. Olin College of Engineering. "If anything, the availability of new services in the cloud and the drive to incorporate those services will increase the integration challenge."

Among other key challenges are security issues, such as security of the facility where data is stored; security of data transport; and reliability of the provider, its service track record, and its business bona fides. Data integrity is also top of mind, as are data privacy and confidentiality. Issues regarding ownership and access of data and identity management, along with issues of accreditation, certification, and audit, all lead to broader questions about liability and the role of cloud providers versus cloud customers. For workshop participants, key hurdles are often characterized as risk and governance concerns.

## Risk and Compliance Issues

Not unlike other outsourcing arrangements, cloud computing raises a number of red flags for the risk-averse, including questions about FERPA protection in connection with outsourcing of e-mail and data security and privacy issues with regard to shared storage. For instance, in a shared services environment, an institution doesn't control where its information is stored and how or by whom it is accessed. Data residing in foreign countries may be more readily subject to seizure or disclosure, legally and practically, than data stored in the United States. Even in the United States, placing institutional data with a third party may allow broad government access without a warrant or other judicial order. If your institution's data resides with that of other customers or clients of the provider, a discovery order aimed at another customer could expose your data to seizure even if you aren't a party to the legal action. How do you manage those risks, especially when you don't necessarily have transparency in the handling of your data? How do you protect against risks to data security, integrity, and availability resulting from service failures, vendor lock-in, and security holes?

Also of concern for the business enterprise are bandwidth, standardization of licenses and certifications, RFP processes, and getting contracts and agreements to scale. Risk assessment and compliance requirements are essential in deciding when and where extramural sourcing makes sense. Yet, institutions face many of these same challenges whether they run the IT systems themselves or outsource them to a third party. "There is often a false sense of security around institutional operations. Doing something in-house doesn't automatically equate to zero risk," noted Philip Goldstein, ECAR Fellow and workshop facilitator. Key questions for institutional leaders include what level of proof they will accept as evidence of compliance, what they will do if standards aren't met, and whether they can hold a third party to a higher standard than they would themselves.

**The need for common standards and third-party risk assessment.** One key benefit of cloud computing within a shared services environment is that it can force a degree of standardization. A service provided using standard forms and solutions would also help minimize duplication of efforts. A best practices approach would improve higher education's approach to third-party risk assessment to ensure that providers are meeting "reasonable standards" expectations. Examples include REN-ISAC (Research and Education Networking Information Sharing and Analysis Center), which has identified security best practices, and AAHRPP (Association for the Accreditation of Human Research Protection Programs, Inc.), which provides accreditation for human subjects groups that are following rules and guidance required by law and campus policies.

**Making the case to state legislatures.** A key concern for public institutions is articulating to state legislatures how moving to the cloud can be a substantial cost-savings measure; a key concern for all institutions is to work with state and federal

lawmakers to approach data protection in a manner that serves privacy and security interests while allowing institutions to use cloud sourcing strategically to promote academic missions and drive economic growth. Given the array of broadly worded regulatory standards and reasonable security measures, institutions would benefit from a certification process for cloud services. What might help is the creation of an advisory body that could identify best practices, certify services, and help institutions speed up the RFP process, suggested workshop participant Beth Cate, associate general counsel for Indiana University System.

**Reasonable contracts.** Noted Cate, “We spend an enormous amount of time negotiating things that are important if something goes wrong, but when you really look at where the rubber hits the road, things don’t go wrong very often, and so I question whether we are spending our time and energy wisely. What is also unfortunate about the ‘battle of the forms’ contracting process is that it often gets in way of provider-customer relationships, with language that specifies what won’t be warranted or what providers won’t be liable for, and that feeds into a cycle of distrust.” She believes the role of university counsel is to articulate and quantify to institutional leaders the legal risks posed by a given activity and alternatives for addressing those risks. “Otherwise, we are constantly butting heads over what doesn’t get into an agreement, and we can’t move forward.” Contracting is another area that could be helped by aggregating demand and developing a mechanism to alleviate the need for every institution to develop its own cloud-sourcing RFP process, added Cate.

**Exit strategies and SLAs.** Among the concerns about provider relationships that cloud sourcing raises are corporate transparency, how to manage supplier performance, issues of service portability and vendor lock-in, switching costs, and the structuring of service level agreements. Developing an exit strategy up front can help identify areas of risk and levels of commitment. It can also unearth hidden costs for getting out of a service agreement—which could be as expensive as getting in. For instance, while cloud-sourcing infrastructure as a service layer requires a fairly standard management approach, since the institution owns the assets, this becomes a bigger risk as you move up the technology ladder (e.g., to application service provider) because you are more at the whim of the provider for continuity of service, noted Cearley.

In general, workshop participants concurred that a standard agreement with a clear exit strategy would help higher education as an industry move more boldly into cloud-computing initiatives. Among the questions raised: Can standards allow for a higher degree of portability? Can we stipulate that data quality assurance is an entry point for the cloud? What happens if a company is purchased? While institutions must be willing to accept some level of risk inherent in conducting business within the cloud, outlining reasonable performance expectations would provide some assurance.

## **Governance Questions**

One hurdle for many institutions may be convincing key stakeholders on campus of the need to embrace cloud computing as a viable option for running the enterprise. “We must look at the cloud as an emerging phenomenon that will require some care and feeding of decision makers,” said Cearley. Failure to deal with the organizational implications of this move is the number one cause of failure within the cloud, he added. “How we employ governance mechanisms to make significant advances will be critical.”

Successfully persuading decision makers of the cloud’s benefit may be difficult for processes in which individuals have a vested interest, noted workshop participant Natalie Krawitz, vice president of finance and administration, University of Missouri System. “ERP implementation became difficult for many institutions because it not only entailed putting new IT in place but also sought to remake business processes for which many wanted a direct say in how things would be done,” she explained. While in theory many processes could readily move to the cloud, cloud sourcing certain business functions would require a more complex or lengthy decision-making approach. “If someone suggests to me that we should put payroll in the cloud, then I have to bring together all who touch payroll, and that becomes a much broader conversation,” noted Krawitz.

Institution leaders must also contend with faculty and staff who, for various reasons, make their own decisions about accessing cloud services. “Without trying to control those decisions, we need to at least manage that migration so that we have a stake in those relationships and in those agreements,” said Hilton.

**Shared services scenarios.** Governance-related questions encompass internal issues specific as well as decision-making approaches on behalf of a group of institutions. Because some cloud initiatives require a fluid response to establishing goals and solving problems, making certain the right people have a seat at the table is a key concern. Critical perspectives include the CIO, the chief business officer, the provost, university counsel, and procurement and risk management.

Also key to have on board is the expertise and insight of the institution’s HR officer. One direct result of moving the locus of higher education’s administrative work above and below campus will be the restructuring of certain elements of the workforce, including the likely displacement of some current workers. This impact is especially true longer term as the range of cloud services being offered includes business processes and so forth. Having the right HR policies and practices in place to bring about this transition in a respectful and positive way will be essential.

## **IT Staffing Implications**

While employees throughout the enterprise will be affected by changes from cloud computing, the institution’s IT personnel will be directly impacted. With so much focus on risk and security concerns and matters of governance and cloud

provider-consumer relationships, one “silent” issue lurking in the background is that of internal staff competencies and responsibilities. In this new world of cloud computing, institutional leaders must not only concern themselves with impacts of cloud sourcing on IT staffing levels but also discern the implications of the cloud for the skills and experience required by IT personnel going forward.

What is the role of the CIO when cloud computing or outsourcing is prevalent? Workshop participants agreed that, in general, the role of the CIO is already evolving to one of “relationship manager” and “strategic investor,” and this shift requires a new set of skills and competencies.

If in fact the new expectation for an individual IT staff member or for an IT department is to serve as a contract and relationship manager, that requires a different set of skills and training, including more business, communication, and relationship management skills, and greater understanding of outsourcing and contractual issues and practices. IT personnel and departments will need to assume a variety of perspectives and expertise in areas they may currently lack, noted Richard Katz, vice president of EDUCAUSE. “Because that kind of transformation doesn’t happen overnight, institutions must begin preparing now for those shifts in skills and knowledge and to build these capabilities, since an unprepared workforce will itself become an obstacle to cloud success.”

In addition to greater focus on the professional development needs of IT staff, certain collaborative efforts could help IT personnel fulfill new job expectations. One example raised by workshop participants was the creation of a consortium of CIOs for sourcing services that could act in a tactical procurement role to facilitate demand for this expertise. In fact, collaboration emerged as not only a worthy goal but also a necessary component for taking full advantage of the cloud. The potential benefits of broad-scale industry aggregation of demand to achieve greater economies and leverage with cloud computing companies and the ability to spread risk and investment led attendees to envision a full menu of opportunities that higher education institutions can pursue together for the good of all.

## **Actions**

### **What to Move to the Cloud and When**

Higher education institutions must determine what makes sense to move to the cloud and why—to essentially develop a mission statement for operating within the cloud. This is important from a risk standpoint as well as from a cost perspective. For instance, while a number of institutions have already offloaded student e-mail to commercial providers, using the cloud for undergraduate admissions may prove a bad idea if your institution experiences a leak in its prospect files or if a service disruption occurs during a peak enrollment period, suggested workshop participant James Dolgonas, president and CEO of CENIC.

As a starting point, institutions must gain a better handle on institutional costs in order to fairly assess the value of a cloud computing alternative. Leaders must also determine the rationale for these decisions beyond cost savings and identify the consequences of outsourcing and eliminating IT staff positions. According to Cearley, consuming public cloud services requires follow through on four key steps.

1. **Conduct a business impact analysis.** Institutions should classify their data by levels of importance and sensitivity to determine what adds differentiating value for the institution versus what could easily be moved to the cloud. “If you don’t know how important your data is, you will miss opportunities because you will assume that all data is too important,” noted Cearley. Consider security levels surrounding your data, and realistically examine controls and the business impact associated with each type of data.
2. **Establish governance, trust, and security models.** Understand the risk profiles of various processes to make decisions about workloads and service level guarantees.
3. **Build on existing service procurement models, layering additional criteria for cloud computing.** If you begin by reviewing your institution’s other outsourcing models, you are about 80 percent of the way toward how you should think about cloud services, noted Cearley.
4. **Develop an exit strategy up front.** Before you sign on with a cloud provider, identify your options for exiting the relationship or switching to another provider. Likewise, determine how you could bring the service back in-house, or whether you would even want to.

## Cloud-Sourcing Assumptions

In brainstorming possibilities for cloud initiatives, workshop participants agreed that reorganizing business processes should not be the sole or primary reason for cloud sourcing. Certain overarching objectives can apply in assessing what to send to the cloud.

**Edge services.** In general, the more embedded a service is within a core business process, the more difficult—and perhaps less appealing—it may be to release to the cloud. Conversely, the closer something is to a commodity, the easier it is to move it to the cloud. Services at the “edge” of institutional mission and for which IT does not add value if retained are likewise good contenders for the cloud. Determining which services should remain close to the user requires evaluating associated issues of privacy, security, and customization, said workshop participant Donald Welch, president and CEO of Merit Network, Inc.

A best-practices concept is one good way to approach the cloud. “Cost benefits are not always believable, so if you can define and articulate what you want to do

in terms of best practices, this can help justify moving into the cloud,” argued Hossein Sadid, vice president for business and finance, University of Richmond. Another approach is to look at emerging needs not currently being met or new areas of activity that have not yet become embedded in institutional processes.

**High-ROI ventures.** One commonly debated initiative is cloud-based supercomputing and data storage. While concerns persist over data security and privacy, the potential for significant financial savings is great when considering the possibility to offset high utility costs and eliminate substantial capital outlays for building and maintaining data centers on campus. Those savings can be further compounded within a consortium model.

According to Ted Dodds, vice provost of information technology, University of British Columbia, a recent survey of 30 higher education institutions in British Columbia revealed hundreds of thousands of square feet and hundreds of millions of dollars in planned data center projects. That set in motion a broad conversation to determine how these institutions might band together to fulfill their individual data center needs. “We’re currently looking at how and where to create a cloud to satisfy Canadian privacy regulations that require we keep the data in Canada. We’re assessing locations that would be earthquake-free and pose little risk of fire,” said Dodds.

Corporations likewise must assess what services make the most sense to offer in the cloud. In addition to making upgrades and enhancements easier for clients to access, SunGard’s approach is to bring into the cloud what is cheaper, faster, and better if delivered in that manner, noted Michelle Reed, senior vice president of marketing, SunGard Higher Education. “We are identifying priority areas where costs can be reduced for both sides, and in some instances pulling software into component pieces to lower the total cost of ownership.”

**Low-risk initiatives.** As with most new endeavors, it makes sense to start with low-hanging fruit—what you can quickly move outside the enterprise with little risk. Based on that criterion, fully integrated ERP systems almost certainly drop lower on the list, because the risk is high and the systems are so critical to maintaining the institution.

The idea of a single grand plan for moving to the cloud is a pipe dream, asserted Welch. “If we have overall failure with ventures that carry substantial risk, institutions will retreat.” What is needed instead is deliberate experimentation with well understood, low-risk services, echoed Dodds. “Then if we fail, little will ultimately be lost.” And, as higher education experiments with a variety of projects and approaches, all involved will learn by doing and can augment future initiatives with improvements based on lessons learned.

**Prioritize the cloud.** “This is not about the technology first, but about what four or five big challenges we are facing as an industry and to what extent something

like cloud computing might accelerate some trend or provide a better way to influence that trend,” argued Cearley.

Leaders should also conceptualize solutions that recognize higher education anomalies, noted Fred Rogers, vice president and treasurer, Carleton College. “The reality is that the applications of the world haven’t always addressed some of the unique needs of colleges and universities. That makes a collaborative industry cloud all the more appealing if we can find common ground to leverage our involvement in ways that help us all uphold the mission of our institutions.”

The cloud is going to happen with or without higher education, but colleges and universities have the opportunity to be agents of the change, added Marilyn McMillan, associate provost and chief information technology officer, New York University. “I like the concept of trying a number of things at once, but not as a thousand flowers blooming. We need an incubator similar to ones we operate on our campuses for small businesses that would encourage cloud experimentation and bring institutions together.”

**The need for trust.** Participants agreed that effective cloud-sourcing relationships—like any business partnership—hinge on trust, continuity of service, and a high level of responsiveness from providers. Whatever the nature and extent of an industry cloud initiative, successful ventures will first happen where patterns of multi-institutional trust already exist for working together.

While most institutions are not likely at the point of developing a joint financial system, many low-risk activities on the edge could be tackled, argued Wheeler. “We need to be clear that this conversation should encourage success by demonstrating viability and build relationships that are extensible, where we can move together in a couple of areas to demonstrate success and ability.” In fact, some of higher education’s most vexing and complex issues such as scholarly publishing likely can’t be solved *without* industry collaboration, noted Wheeler.

Workshop participants agreed that for common and strategic cloud ventures alike, an industry “broker” that could aggregate higher education demand would increase the likelihood that individual institutions would join together to leverage the cloud on behalf of the entire industry. This role of a brokering agent is already a trend within the broader cloud-computing industry, noted Cearley. “This function essentially begins with aggregation of demand for a core group that also extends opportunities and value to a full constituency.”

## **Defining Industry Roles**

So what shape would a higher education broker entity take? What specific attributes would it possess, and what functions would it perform on behalf of college and university participants? The idea of an aggregator as a “dating service”—an entity to match providers with groups of institutions for which common needs exist—resonated strongly with workshop participants.

“What I want is an aggregator that can influence open standards, lower barriers to switching, influence targeted providers, and make the provisioning aspect of those services as user-centric as possible,” said Shelton Waggener, associate vice chancellor and CIO, the University of California, Berkeley. “And, I want all of that done under contract umbrellas that I don’t have to negotiate each time.”

Successful aggregators should also be able to lower real costs and contractual friction costs on both sides by successfully negotiating standard agreements on behalf of multiple customers, argued Dolgonas.

**Aggregator attributes.** Among other key roles of a higher education aggregator that workshop participants outlined were these:

- ◆ Bring institutions seeking services and the corporate entities that offer those services together within a robust marketplace.
- ◆ Bundle demand so that the best prices can be negotiated on behalf of the full group.
- ◆ Get the group aligned on risk tolerance and a common ambition/focus.
- ◆ Facilitate a transparent process for arriving at common definitions and industry standards and requirements.
- ◆ Develop a roadmap for how to approach the cloud, including key roles and questions for decision makers.
- ◆ Alleviate the burden for individual institutions of one-on-one negotiation with cloud computing providers.
- ◆ Build trust and offer early hand-holding to regularize relationships and enhance responsiveness.
- ◆ Help create higher education competencies to build a community cloud.

More than one type of broker will likely be required to address diverse concerns and to fulfill the variety of initiatives that industry partners may want to pursue, said Cearley. Likewise, institutions should not think about demand aggregation as a buying club, cautioned Hilton. “What higher education needs is an entity or entities that can serve as convener, facilitator, and incubator for entrepreneurial efforts,” added Hilton. “What we are really talking about in this space is changing fundamentally not only how IT thinks about services but how campuses think about risk.”

**Role for associations.** Workshop participants voiced a strong appeal for known entities at the national level—including EDUCAUSE, NACUBO, and Internet2—to leverage their resources and serve as cloud aggregators of institutional demand in multiple capacities. Participants noted that while such a role is not explicit in

the missions of any these organizations, they possess the established relationships and expertise needed to fill this role. For instance, these and other professional organizations could develop decision models for practitioners, form advisory groups to pursue pilot cloud initiatives, and create a social commerce site of cloud service providers and products. Possibilities exist as well for state and regional networks with established governance structures to facilitate participation and to leverage cloud procurement and other activities.

**Role of institutions.** For their part, institutions must approach cloud aggregation in a multifunctional manner. This requires fiscal, IT, and academic officers among others to collaborate across their institutions. In doing so, cloud sourcing stands to transform the way IT-related decisions are made on campus, said Reid Christenberry, assistant vice president and CIO, Georgia Perimeter College. Partnership in a shared services model will also require synchronizing institutional clocks. And, institutional partners must be willing to commit from the beginning to participate in the pilot testing in which the industry will need to engage, said Dodds.

**Learning from past initiatives.** In moving forward, workshop participants voiced a strong appeal for gleaning lessons learned from other higher education collaborations in order to establish hallmarks of success that might be transferrable to the cloud. United Educators and Common Fund are examples of successful aggregator models. According to Rogers, “We have to discern in what ways the cloud presents a compelling need versus an alternate vehicle for conducting operations or facilitating student learning.”

**The need for a paradigm shift.** Even in the current economic climate, that may be easier said than done, noted Douglas Van Houweling, president and CEO, Internet2. “There are any number of areas where we could incorporate better ways to operate if we didn’t work one at a time.”

Overcoming institutional and cultural resistance to change might require creative new tactics. Fresh approaches should include finding ways to make the higher education market more appealing to providers, argued Waggener. “Relative to other industries, higher education represents a small niche industry that is expensive for companies to partner with. A cost shift in our traditional models could provide a really dynamic force that we should consider.”

Van Houweling concurred. Organizing a standard interface, providing clear specs, and creating a single sign-on environment for corporations to engage higher education as an industry would go a long way toward building a bridge between commercial providers and institutions. “One thing we must be clear about is that we can’t expect 100 percent buy-in, and we don’t need that to get started,” argued Van Houweling. As a case in point, he noted that Internet2 was founded with a critical mass of 32 institutions. “The reality is that institutions will opt in and out based on political issues and needs and their own risk tolerance.”

The cloud offers prospects for greater savings and efficiencies for a host of common business processes. Workshop participants concluded that institutions would be wise to first focus on nondifferentiating, high-transaction activities that don't carry a lot of institutional or cultural baggage. These might include accounts payable, procurement, and benefits management. Other opportunities could include archiving, library repositories, and low-value administrative services. Important to keep in mind, however, is that even for a common business practice such as travel management, an internal cultural transformation may need to occur to gain acceptance, noted Krawitz. "Ultimately, it may be easier to get buy-in to consider a function as a whole rather than a particular process."

While many higher education services could be provisioned through the cloud, it's not necessarily in a provider's interest to identify those needs for the industry, noted Mark Olson, higher education industry associate partner, IBM Corporation. "Ultimately this is something that must come from within higher education itself."

**Toward a sustainable business model.** Although higher education has proven that it has the capacity to deal with tough issues, too often the bar has to be very high to make institutions commonly motivated, said Rogers. "The past year and a half has been traumatic for most of our institutions. We have seen happen at our institutions things that we never before entertained." The common motivation for many institutions today is survival in both the short run and in the long term, he added. "When we extrapolate everything we want to do into the future, we don't know how to predict how it may play out, but we know that our fundamental business models are not sustainable."

**Cloud leadership challenge.** Institutional leaders likewise can't afford to get stuck in the weeds, said Wheeler. "One of the fundamental changes that higher education is beginning to understand is that institutions are competing as an alliance that moves the whole industry forward. One of our greatest leadership opportunities is to not simply think about optimizing our local campuses but the entire industry." This leads to the notion that institutional leaders must be willing to be uncomfortable in being out in front of their campuses leading this charge, argued Wheeler. "This is not a challenge of good stewardship behavior but of measured leadership behavior—looking at things that are going to happen and taking action now." Fundamentally, these changes are going to come from visionary CIOs, CFOs, and chief academic officers, he added.

Finally, the demand for aggregation will only become more acute, noted Hilton. "We can alter the environment in which we operate—we can shape the higher education cloud—but we will begin to lose control to do so if we don't start now."

Kossuth holds high hopes for the cloud. "Ten years from now, higher education should be a more collaborative, innovative place where unique resources are readily available to all students, which will change the financial model and the modes of delivery of higher education." Ultimately, the cloud must help higher

education consolidate and collaborate, she argued. "A higher education cloud might act as a repository for modular courses that institutions can use or build on, making it possible to reduce redundancies. This cloud might precipitate shared repositories for transcripts, financial aid, and make the entire K–20+ education experience seamless and accessible for all."

## Recommendations

In the spirit of building a higher education cloud, workshop participants offered a range of recommended actions and next steps.

1. **Create a map of the cloudscape.** Services such as Google Apps and Amazon's Elastic Cloud are well known, but beyond a relatively short list, little is known about what IT infrastructure, applications, or services are available "as services" in the cloud. Research the cloud services market, especially in areas that are good candidates for higher education. Specifically, develop a map that describes by category (infrastructure as a service, platform as a service, applications as a service, and software as a service) available cloud-based services and the companies competing in these categories.
2. **Create a campus cloud computing roadmap.** Develop a "roadmap" to guide an institution's decisions about whether to create or operate a service or infrastructure element on premises or in the cloud.
3. **Publish a guide to writing a business case for cloud sourcing.** Develop a short document that describes the key questions to ask to frame an effective decision about hosting a system or service on campus or in the cloud. What is compelling us to consider change? Economics? Is cloud sourcing cheaper? What about functionality? Are cloud options more full featured? Reliable? Robust? Accessible? Nimble? What are the comparative risks? What is the risk of inaction?
4. **Develop a costing template.** Identify uniform cost categories in both on-premises and cloud-based delivery alternatives, and recommend preferred guidelines and methods for calculating said costs, when appropriate.
5. **Develop a risk-assessment framework and guide.** This guide would lead practitioners and policymakers through a risk analysis of premises-based and cloud-based delivery alternatives.
6. **Develop audit guidelines for examining cloud-based offerings.** This document would guide auditors through a risk assessment and audit of cloud-based transactions and portfolios.
7. **Develop a "What Campus Leaders Need to Know About Above-Campus Systems and Services" guide.** Publish a short, strategically positioned document to educate trustees, regents, chancellors, presidents, senior staff,

and academic leaders about cloud computing and the migration of infrastructure, systems, and services above the campus.

8. **Identify needed skills and develop a model curriculum for higher education staff working in mixed-premises and cloud-based environments.** IT professionals, business professionals, lawyers, auditors, and others will need new skills to manage an infrastructure and service portfolio that is hosted elsewhere or merely invoked “as needed” as an Internet service. Skills such as contract management, creation of service level agreements, and security management change as the portfolio changes. A new curriculum needs to be articulated and new professional development opportunities offered.
9. **Explore new governance.** The rapid evolution of the consumer market delivered via cloud computing—where faculty, students, and staff are choosing to use a wide variety of consumer services in lieu of services being offered by the institution—may have untoward economic effects and may create undocumented risks of security and privacy spills, data corruption and seizure, FERPA nondisclosure, and so forth. The unregulated movement of IT and services off the campus represents an important opportunity to rethink IT governance. The deliverable would be an essay that would guide “safe” consumerization of IT infrastructure and business and academic services.
10. **Develop and publish model service level agreements.** Provide a deconstruction or anatomy of a service level agreement that defines the purposes of an SLA, typical areas covered by SLAs, tips for negotiating service levels, and effective practices in managing contractual relations through such agreements. Ideally this would include examples of effective SLAs.
11. **Develop a new policy series.** An ongoing series of short policy perspectives could include topics such as Privacy and the Cloud, Data Ownership and the Cloud, Exit Strategies, and Above-Campus Services.
12. **Encourage identity management.** EDUCAUSE, NACUBO, and Internet2 should continue to value, invest in, and promote middleware initiatives in and for higher education and the InCommon Federation in particular.
13. **Create a higher education demand aggregator or broker function.** A higher education cloud consortium would operate as a venture philanthropy, finding and evaluating cloud delivery experiments and matching their sponsors with funding sources. Its mission would also include facilitating the aggregation of providers and standards for the purpose of making the provisioning aspects of services customer-friendly. Such a broker/facilitator would reduce the barriers to usage and eliminate or reduce the need to negotiate new contract terms each time a service is consumed or invoked.

## Endnotes

1. Drue Reeves, Burton Group, "Cloud Computing: Transforming IT," a presentation given at the Annual Symposium of the EDUCAUSE Center for Applied Research (ECAR), December 3, 2009.
2. Steve Auerbach, Gartner, "Technology Trends You Cannot Afford to Ignore," December 2009 Gartner Conference, Las Vegas.
3. David Cearley, Gartner, "Cloud Computing Basics," a presentation given at the February 2010 EDUCAUSE/NACUBO Cloud Computing Workshop, Tempe, Arizona.
4. Reeves, "Cloud Computing: Transforming IT."
5. Richard Katz, Phil Goldstein, and Ron Yanosky, "Cloud Computing in Higher Education," at [http://net.educause.edu/section\\_params/conf/CCW10/highered.pdf](http://net.educause.edu/section_params/conf/CCW10/highered.pdf).
6. Reeves, "Cloud Computing: Transforming IT."
7. Ibid.
8. Ibid.
9. Charles M. Vest, "Open Content and the Emerging Meta-University," *EDUCAUSE Review*, vol. 41, no. 3 (May/June 2006), pp. 18–30, see p. 30, at <http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume41/OpenContentandtheEmergingGloba/158053>.
10. Brad Wheeler and Shelton Waggener, "Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education," *EDUCAUSE Review*, vol. 44, no. 6 (November/December 2009), at <http://tinyurl.com/ybxdlmq>.
11. Ibid.
12. Dan Blum, Burton Group, "Cloud Computing Security in the Enterprise," July 15, 2009, at <http://www.burtongroup.com/Client/Search/Search.aspx?searchTerm=dan%20blum%20cloud%20computing%20security%20in%20the%20enterprise&siteArea=all>.
13. Cearley, "Cloud Computing Basics."
14. Auerbach, "Technology Trends You Cannot Afford to Ignore."
15. Ibid.

## Appendix 1. Cloud Computing Workshop Readings

The following list of resources was provided to participants to review in advance of the workshop.

- ◆ For a primer on cloud computing in higher education, see “Cloud Computing in Higher Education,” by Richard Katz, Phil Goldstein, and Ron Yanosky, at [http://net.educause.edu/section\\_params/conf/CCW10/highered.pdf](http://net.educause.edu/section_params/conf/CCW10/highered.pdf).
- ◆ For an overview of the primary cloud-sourcing alternatives that are evolving, see “Above-Campus Services: Shaping the Promise of Cloud Computing for Higher Education,” by Brad Wheeler and Shelton Waggener in the vol. 44, no. 6 (November/December 2009), *EDUCAUSE Review*, at <http://tinyurl.com/ybxdlmq>.
- ◆ For understanding why cloud computing and alternate sourcing are critical, see James Hilton, “The Future for Higher Education: Sunrise or Perfect Storm,” *EDUCAUSE Review*, vol. 41, no. 2 (March/April 2006), pp. 58–71, at <http://www.educause.edu/EDUCAUSE+Review/EDUCAUSEReviewMagazineVolume41/TheFutureforHigherEducationSun/158046>; and Richard N. Katz, “The Gathering Cloud: Is This the End of the Middle?” *The Tower and the Cloud*, Richard N. Katz, ed. (Boulder, CO: EDUCAUSE, 2008), pp. 2–42, at <http://net.educause.edu/ir/library/pdf/PUB7202d.pdf>.
- ◆ On the consumerization of campus services and governance and control, see Ronald Yanosky, “From Users to Choosers: The Cloud and the Changing Shape of Campus Authority,” *The Tower and the Cloud*, Richard N. Katz, ed. (Boulder, CO: EDUCAUSE, 2008), pp. 126–136, at <http://net.educause.edu/ir/library/pdf/PUB7202m.pdf>.
- ◆ On issues and risks, see: Use of Cloud Computing, University Information Policy Office, Indiana University, at [http://informationpolicy.iu.edu/resources/articles/cloud\\_computing](http://informationpolicy.iu.edu/resources/articles/cloud_computing).
- ◆ On workforce implications, see Philip Goldstein, “The Tower, the Cloud, the Workforce, and the IT Leader,” *The Tower and the Cloud*, Richard N. Katz, ed. (Boulder, CO: EDUCAUSE, 2008), pp. 238–261, at <http://net.educause.edu/ir/library/pdf/PUB7202x.pdf>.
- ◆ On common legal issues that can arise in contracts for cloud computing services, see “Legal and Quasi-Legal Issues in Cloud Computing Contracts,” by Steve McDonald, General Counsel, Rhode Island School of Design, at [http://net.educause.edu/section\\_params/conf/CCW10/issues.pdf](http://net.educause.edu/section_params/conf/CCW10/issues.pdf).

## **Appendix 2. Cloud Computing Workshop Attendees**

Vance Allen, Chief Technology Officer, Pearson eCollege

Peggy L. Boord, Vice President for Administration and CFO, University of Great Falls

Wendell C. Brase, Vice Chancellor for Administrative and Business Services, University of California, Irvine

Roger V. Bruszewski, Vice President, Finance and Administration, Millersville University of Pennsylvania

Beth Cate, Associate General Counsel, Indiana University System

David Cearley, Vice President and Gartner Fellow, Gartner, Inc.

J. Reid Christenberry, Assistant Vice President and CIO, Georgia Perimeter College

Dean Currie, Vice President, Business and Finance, California Institute of Technology

Amir Dabirian, Assistant Vice Chancellor and CIO, California State University, Office of the Chancellor

Ted Dodds, Vice Provost, Information Technology, University of British Columbia

James Dolgonas, President and CEO, CENIC

Thomas J. Elzey, Senior Vice President, Treasurer, and CFO, Drexel University

David J. Ernst, Associate Vice President and CIO, University of California Office of the President

Larry Free, Regional Vice President, Gartner, Inc.

Kathryn F. Gates, CIO, University of Mississippi

Philip J. Goldstein, Fellow, EDUCAUSE Center for Applied Research, and President, Goldstein & Associates, LLC

James L. Hilton, Vice President and CIO, University of Virginia

Darrel Huish, Vice Chancellor and CIO, Minnesota State Colleges and Universities (was CIO at Maricopa Community College District in February 2010)

Susan Jurow, Senior Vice President, NACUBO

Richard N. Katz, Vice President, EDUCAUSE

Anne K. Keehn, Senior Vice President, Pearson Learning

Mike King, Vice President, IBM Corporation

Brian Knotts, General Manager, SunGard Higher Education

Joanne M. Kossuth, Vice President, Operations and CIO, Franklin W. Olin College of Engineering

Natalie Krawitz, Vice President, Finance and Administration, University of Missouri System

Timothy Lance, CEO and Chairman, NYSERNet, Inc.

Bruce Maas, CIO, University of Wisconsin–Milwaukee

Marilyn A. McMillan, Associate Provost and CITO, New York University

Kevin M. Moroney, Vice Provost for IT and CIO, The Pennsylvania State University

Diana G. Oblinger, President and CEO, EDUCAUSE

Mark A. Olson, Associate Partner, Higher Education Industry, IBM Corporation

Rodney J. Petersen, Director, EDUCAUSE

Richard F. Porreca, Senior Vice Chancellor and CFO, University of Colorado at Boulder

Michelle Reed, Senior Vice President, Marketing, SunGard Higher Education

Frederick Rogers, Vice President and Treasurer, Carleton College

Theresa Rowe, CIO, Oakland University

Hossein Sadid, Vice President, Business and Finance, University of Richmond

Patrick Sanaghan, President, The Sanaghan Group

Adrian Sannier, Vice President of Product, Pearson eCollege (was Vice President and CIO, Arizona State University in February 2010)

Teresa E. Smith, Vice President, Administration, Tallahassee Community College

George O. Strawn, CIO, National Science Foundation

Douglas E. Van Houweling, President and CEO, Internet2

Shelton M. Waggener, Associate Vice Chancellor and CIO, University of California, Berkeley

John Walda, President and CEO, NACUBO

Donald J. Welch, President and CEO, Merit Network, Inc.

Brad Wheeler, Vice President and CIO, Indiana University

Gordon D. Wishon, Higher Education Consultant

Catherine W. Yang, Senior Director, EDUCAUSE