

# **Demystifying the Cloud: Implications for IT Funding in Higher Education**

Philip J. Goldstein, ECAR

**ECAR Research Bulletin 4, 2010**

# Overview

Money is better than poverty, if only for financial reasons.  
—Woody Allen

Cloud computing is a mixed blessing. It both alleviates—and exacerbates—several of the historical funding challenges for higher education IT organizations. Adopting computing services provided through the cloud impacts an IT organization's funding mechanisms (including chargebacks), financial flexibility, budget development, and management practices.

A 2009 ECAR research bulletin, *Demystifying Cloud Computing for Higher Education*,<sup>1</sup> presented a synopsis of the broad issues surrounding cloud computing and a framework for thinking about its place as a solution within an institution's IT portfolio. This bulletin extends the discussion by looking more deeply at the economic model underlying cloud computing and teasing out its implications for institutional IT funding practices. It draws upon recently completed ECAR research, *Alternative IT Sourcing Strategies: From the Campus to the Cloud*,<sup>2</sup> about the benefits, complexities, and issues surrounding cloud computing and other alternative sourcing strategies.

As in earlier ECAR publications on the topic, this research bulletin uses a broad interpretation of what constitutes cloud computing. Our view is based on the definition developed by Gartner, Inc., that cloud computing is a “style of computing where massively scalable IT-enabled capabilities are delivered as a service via the Internet.”<sup>3</sup> Our discussion of IT financial implications focuses on institutional funding and budget management practices and how they must evolve to enable cloud computing adoption.

## Highlights of Cloud Computing and IT Funding

The economic argument for cloud computing is fairly straightforward. It asserts that by aggregating computing at great scale and locating those computing assets in locations that offer comparative advantages for the costs of inputs such as power, labor, and space, IT services can be delivered to consumers via the Internet at significantly lower costs. Further, the scalable nature of cloud computing enables institutions to buy just the technology capacity they need, and they can do this when they are ready to consume it. This allows organizations to avoid over-investment in infrastructure capacity that they don't yet require or will need only during peaks in utilization, such as during student registration.

Researchers at the Reliable Adaptive Distributed Systems Laboratory (RAD Lab) at the University of California, Berkeley, estimated that creating large-scale data centers in cost-advantageous locations enables commodity cloud providers to operate with costs that are five to seven times lower than those of a mid-size data center.<sup>4</sup> The RAD Lab research team, in a paper called *Above the Clouds: A Berkeley*

*View of Cloud Computing*, described three aspects of cloud computing that they believe drive its economic advantage for cloud consumers. They view the cloud model of computing as:

- Creating an illusion of infinite computing resources available on demand. This eliminates the need for users to buy capacity far in advance.
- Eliminating the need for an upfront commitment, thereby allowing users to start small and then increase resources only when their needs change.
- Providing the ability to pay for computing resources on a short-term basis, as needed, and then release them.<sup>5</sup>

In short, cloud computing promises the opportunity to access capacity at a lower unit cost and with finer levels of control over the timing and amount of capacity being consumed. The cloud model also shifts the cost of computing from a capital expense to an operating expense. Organizations avoid the need to make large upfront investments in computing capacity and instead shift to a “pay as you go model.”<sup>6</sup> This is an attractive shift in funding sources given that the current budget climate has left institutions with limited capacity to assume new debt.

The economic model is thought to work from the cloud providers’ points of view because of the magnitude of the operational savings through lower energy costs, lower staffing costs, and an opportunity to spread fixed costs over a much larger base of users. This model promises providers the capability to offer services at lower cost than a single organization could provide for themselves while covering costs or making a profit. In addition, the provider can reap the benefits that have long been enjoyed by individual institutions of leveraging hardware price and performance.

The economics of the cloud is also influenced by, or perhaps distorted by, the emergence in the software as a service (SaaS) market of providers with interests or business models that are driven by factors other than revenue from software subscriptions. Google and Microsoft are both offering higher education “free” solutions for e-mail and general office productivity applications. In fact, the move to adopt outsourced e-mail has been the highest profile, and potentially most widespread example, of cloud adoption in higher education.<sup>7</sup> The high-profile nature of these solutions is contributing to a misperception on the part of some that cloud computing is free computing. This presumption ignores the investment that adopters of SaaS-based solutions still must make to implement and integrate cloud-based software into their institutional environments.

## Expectations for Cost Savings

The decision to adopt a cloud solution is not just an economic one. Many more factors come into play, including concerns regarding the security and privacy of data, the reliability and sustainability of the service, and the capacity of the service to meet the requirements of end users. In fact, ECAR’s 2009 research on alternative sourcing strategies found that expectations of cost savings was not yet a particularly strong driver

for the adoption of cloud computing or other (non-Internet-delivered) forms of outsourcing. As Table 1 illustrates, respondents were more inclined to agree that adoption of alternative sourcing strategies improved services rather than reduced costs. Further, survey respondents who self-operated all services most frequently reported that cost of effectiveness of self-operation was one of the top three reasons they had *not* adopted cloud or non-cloud-based alternative sourcing strategies. These respondents did not regularly use any external providers or contractors to deliver IT services, nor had they adopted any forms of outsourcing including cloud computing, collaborations with other institutions, or hosted software solutions.

**Table 1. Perceptions of the Benefits of Alternative IT Sourcing**

Alternative IT sourcing strategies ...	N	Mean*	Std. Deviation
Reduce IT costs	361	2.95	0.969
Improve service	363	3.17	0.997

\* Scale: 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree

Source: Philip J. Goldstein, *Alternative IT Sourcing Strategies: From the Campus to the Cloud (ECAR Research Study 5, 2009)*, Boulder, CO: EDUCAUSE Center for Applied Research, 2009, 38, available from <http://www.educause.edu/ecar>.

This is not to suggest that outsourcing in general or cloud computing in particular never produces cost savings. Rather, it confirms that up to this point other factors, such as improving services or freeing up IT staff time to work on other priorities, were more important drivers of adoption of all forms of alternative sourcing, including cloud computing.

These findings may also be a byproduct of the types of cloud computing respondents most frequently used at the time of our research. Adoption rates were relatively low for the forms of cloud computing that have the characteristics observed by the researchers at UC Berkeley's RAD Lab, such as large economies of scale and easy scalability (e.g., servers, storage). Fewer than 10% of respondents reported adoption at any scale of cloud-based servers, storage, security applications, or development environments. Far more were engaged in using SaaS solutions (nearly 50%) or non-cloud forms of outsourcing (10% to 20%, depending on the particular form).<sup>8</sup>

## Anticipated Growth in Cloud Adoption

ECAR's research into cloud computing also suggests that adoption might be moving toward cloud technologies, based on the more favorable economics anticipated by the Berkeley research team. Overall, respondents to the ECAR sourcing survey anticipated incremental growth in their adoption of cloud-based and non-cloud-based alternative sourcing strategies over the next three years.<sup>9</sup> However, the areas in which respondents on average anticipated increasing their use of alternative sourcing the most were all cloud-based solutions, including two forms of cloud-based infrastructure (see Table 2).

**Table 2. Anticipated Change in Adoption of Alternative Sourcing Strategies**

How is your institution's adoption of the following alternative sourcing strategies likely to change in the next three years?	N	Mean*	Std. Deviation
Application software via the Internet (Software as a Service)	295	3.76	0.536
Internet or "cloud"-based storage	282	3.58	0.593
Internet or "cloud"-based servers	277	3.48	0.593
Internet or "cloud"-based software development environments	272	3.28	0.511
Contract with a third party to operate a help desk (e.g., call center)	279	3.27	0.520
Internet or "cloud"-based security applications	269	3.21	0.459
Primary data center provided by a third party	284	3.18	0.506
Contract with a third party to provide ERP project management	288	3.18	0.547
Contract with a third party to provide desktop computing support	279	3.17	0.445
Contract with a third party to provide network design	291	3.16	0.482
Contract with a third party to manage network operations	285	3.14	0.448

\* Scale: 1 = greatly decrease, 2 = decrease, 3 = stay the same, 4 = increase, 5 = greatly increase

Source: Philip J. Goldstein, *Alternative IT Sourcing Strategies: From the Campus to the Cloud (ECAR Research Study 5, 2009)*, Boulder, CO: EDUCAUSE Center for Applied Research, 2009, 63, available from <http://www.educause.edu/ecar>.

In fact, 48% of respondents who engaged in some form of alternative sourcing today expected their use of cloud-based storage to increase in the next three years. Among that same segment of respondents, 40% expected their use of cloud-based servers to increase.

The sharp downturn in the economy and the resulting cuts that have occurred to institutional budgets could accelerate adoption of cloud services as a means to generate cost savings. At the time ECAR conducted its survey of alternative IT sourcing strategies, most institutions were still implementing their initial responses to the recession. Since that time, the budget climate has continued to worsen, and many IT organizations have experienced even deeper cuts. Growing financial pressures may be strong enough that we will see an increase in the number of institutions willing to tolerate the perceived risks associated with cloud computing in an effort to reap the promise of lower operating costs. For all the reasons identified by Berkeley's RAD Lab, this would suggest more aggressive growth in adoption for commodity infrastructure areas such as servers and storage.

A second factor that could speed up adoption of cloud computing is the emergence of private clouds. Private clouds are cloud computing services operated by or for a specific industry or organization. While they may not achieve the same scale or economies as public clouds, if large enough they have the potential of offering commodity IT services more cost effectively than individual, smaller data centers. Further, they can tailor their services to address the unique security and risk management concerns specific to a community such as higher education.

# What It Means to Higher Education

Despite the attention cloud computing has garnered, we are still very early in its adoption. Perhaps with the exception of student e-mail sourcing, only a minority of institutions have done more than experiment with cloud computing. However, the potential benefits of public and private clouds make it unlikely that it will remain a marginal IT strategy. As the cloud becomes a more significant presence in IT organizations' sourcing portfolios, its underlying economic model will begin to impact institutional IT funding and budget management practices. Some of the very attributes that make cloud computing models financially attractive will also create fissures in traditional IT funding practices. This section identifies four key implications of greater cloud adoption for how IT leaders work with their institutions to structure and manage technology funding.

1. *Know your costs before going to the cloud marketplace.* Evaluating the financial implications of adopting a cloud service requires that an institution first have an accurate understanding of the costs of its current services.

On the surface this seems an easy task. IT organizations know what they spend on hardware and software. Many can even allocate their staff costs to particular activities, such as managing the data center. Evaluating the true potential for cost savings from cloud services will require an even finer level of understanding of the costs of self-operation. Institutions considering broad adoption of cloud services will want to have a sense of their total costs of operating the infrastructure or software services that could go to the cloud. This implies understanding a total picture of costs, including items that are often difficult to discretely identify, such as energy utilization, staff costs, costs of capital to finance purchases of equipment, and the costs of space. Having an exact sense of these costs for a particular service would be ideal. Even a reasonable approximation, however, will enable an “apples to apples” comparison of the costs of self-operating a service to the costs of sourcing it from the cloud. Likewise, institutions will need to estimate some of the costs that they would be likely to incur if they were to adopt a cloud service. In many cases, these costs will exceed the provider's charges and include internal IT costs to integrate cloud solutions with other institutional applications and identity management systems, extend help desk support, retrain staff to ready them to work on other priorities, and implement appropriate security practices.

As the marketplace for cloud services matures, it is anticipated that the pricing models for cloud services will grow more sophisticated. Organizations will be able to buy cloud services (e.g., server capacity) on demand and for discrete periods of time. Similar to pricing models for electricity, the cost of cloud capacity may vary based on the amount being consumed and whether the purchases are made during peak or off-peak periods. Similarly, just as airlines price seats on a plane, the cost of cloud capacity may vary based on supply and demand at the time of the purchase.<sup>10</sup>

To be an effective consumer of significant levels of cloud services in such a dynamic marketplace will require institutions to understand not just their aggregate costs but

their unit costs as well. In a cloud world it is not sufficient to know your aggregate costs to provide storage to your institution. It is also important to know what it costs to provision a terabyte of storage at a particular point in time. Likewise, understanding what it costs the IT organization to operate a server with a particular capacity per week, day, or hour will prepare institutions to be more sophisticated consumers of cloud offerings.

In larger universities the task of understanding current costs is even more complex. Many of the commodity computing services that might be candidates to move to the cloud are managed by individual departments outside of the central IT organizations. Developing a thorough understanding of the total costs to individual departments and to the university in aggregate of operating these distributed services is a prerequisite to building a case to move them to a public or private cloud.

All of this suggests a growing importance for having a financial analysis capacity within the IT organization with the skills to develop more sophisticated models of internal costs of services and to participate in analyzing the costs of cloud-based substitutes.

2. *Agile technology requires agile funding.* Part of the value proposition for cloud computing is the control it gives organizations over how much capacity they consume and when they consume it. Organizations should be able to reap cost savings by avoiding expenditures on infrastructure capacity that they are not ready to use or that they only require during predictable peaks in demand. If the cloud can live up to its promise in this regard, it would offer a powerful benefit to institutions. For example, infrastructure to operate virtual computing labs could be sized for the demand during normal periods of use and scaled up for the few weeks before the end of the semester, when usage is likely to spike. In the same way, institutions could buy additional computing capacity on demand for a researcher to run particularly complex modeling calculations when it is needed.

Taking advantage of the on-demand nature of the cloud requires IT organizations to control flexible funding streams. The agility of the cloud will be lost if IT organizations have to negotiate the budget to rent increased capacity each time it is needed. Today, most institutional budget processes follow a much more static model for acquiring server and storage infrastructure. One-time funds are allocated to IT to purchase the required hardware and then are pulled back from the budget until the equipment reaches its end of life and must be replaced.

The cloud turns infrastructure from a fixed to a variable cost. As institutions increase their utilization of public or private clouds, they will need the ability to fund their consumption of infrastructure as a variable operating expense. Conceptually, the hardware budget will become more like the budget for electricity. Modeling of current utilization, trends in demand, and trends in pricing will help forecast future costs. However, the ultimate expenditure for cloud-based infrastructure services will depend on actual demand and actual pricing.

Therefore, to capitalize on the flexibility the cloud provides, IT budgets will need to control a pool of funds to be allocated to on-demand infrastructure services. IT organizations must develop the capacity to model their current and future demand for infrastructure to help budget officers anticipate the level of expenditure that might be experienced within a given fiscal year. Transparent processes need to be in place to report actual consumption and explain any variances from the original plan. Without such financial flexibility, IT organizations will be forced to rent more capacity from the cloud than the institution needs out of concern that the money to acquire capacity on demand won't be there when it is needed. This would minimize one of the economic reasons for turning to the cloud in the first place.

3. *Be wary of internal chargebacks that stifle adoption.* The use of internal chargebacks to fund cloud services presents a dilemma for IT organizations. On the one hand, chargebacks are a means to access a variable revenue stream that aligns well with the variable nature of cloud computing costs. On the other hand, they can create an internal impediment to the adoption of cloud services that may have the effect of increasing total institutional IT costs. Therefore, how and where they are used requires careful consideration.

As discussed in the prior section, the agile nature of the cloud requires agile funding streams that enable IT organizations to only buy the capacity they need, when they need it. A regime of internal chargebacks can be used to create an automatic increment to the IT budget when utilization of cloud-based infrastructure needs to increase. It alleviates the problem that many IT organizations face of being asked to provide additional capacity or support without a concurrent increase in funding.

A cloud-based model also establishes a basis for the chargeback. Provider pricing models explicitly identify the costs to the institution for each unit of storage or computing capacity they consume. The fact that these charges are specified in agreements with public or private cloud providers creates a level of transparency and inevitability that consuming more resources requires more funding. This is not always the case with internally provided services.

However, there are significant drawbacks to relying exclusively on a chargeback model to fund adoption of cloud services. First, most departments will lack the sophistication to model their future demand for cloud capacity. As a result, they will require significant support from the central IT group to determine what level of funding they should reserve in their departmental budgets to anticipate their future consumption of cloud services. Otherwise, the IT organization will be left in the unenviable position of either denying additional capacity to a department that requires it but lacks the funds or providing it and subsidizing it out of the central IT budget. Second, distributing the fiscal responsibility for purchasing cloud services makes it more difficult to govern the institution's adoption of the cloud. If departments perceive that they are directly paying for their use of cloud capacity, they will also want to shop around and select their own cloud provider. This might complicate efforts to leverage the institution's buying power or for the IT group to assure that cloud services are being procured from reliable providers.



Finally, the presence of chargebacks often leads to decisions that may look ideal for an individual department but are suboptimal for the institution. In most institutions, departments don't bear the full costs of the technology they manage. A department's perceived costs of operating a technology do not include energy consumption or space costs. Likewise, the department may be paying some staffing costs to sustain their technology, but not to the same standards of security and reliability as a public or private cloud provider is offering. Therefore, the pricing of chargeback for a cloud service (or central IT-operated service for that matter) as a substitute for a department operating the service on its own might very well look more expensive from the department's perspective. The result is a reluctance to adopt a solution that is more cost effective for the institution as a whole.

Given the mix of both positive and negative consequences of adopting chargebacks, institutions should proceed cautiously in assuming that chargebacks are part of the financial model for services that will ultimately be procured from the cloud. Perhaps the best course of action is to proceed with the following principles in mind:

- Adopt chargebacks for IT services only if they are consistent with practices for other campus services.
  - Chargebacks should only be used for truly optional IT services, not essential ones.
  - Where chargebacks are used, they need to be supported by transparent pricing models.
4. *Maintain or enhance financial flexibility within the IT budget.* Cloud computing should not be a cause of financial inflexibility. However, its broader adoption is likely to exacerbate the increasing inflexibility of the IT budget and perhaps become the force that drives it to become untenable. IT budgets at most institutions are largely consumed by fixed costs for hardware and software contracts as well as inflexible allocations of personnel to sustain existing IT infrastructure and service commitments. In a 2004 ECAR study of IT funding, respondents reported that on average, 70% to 80% of their IT budgets were fixed or not easily reallocated.<sup>11</sup> Respondents described a deteriorating situation in which increasing portions of the IT budget were being consumed by fast-growing hardware and software maintenance costs and expanded IT services.<sup>12</sup> As a result, institutions had less flexibility to allocate resources to experiment with a new technology, meet an emerging need, or seed a new innovation. The level of inflexibility reported in 2004 would have already been considered problematic by corporate IT standards. In 2004, Mark Jeffrey, a professor and researcher at Northwestern University's Kellogg School of Management, in speaking to a joint NACUBO and EDUCAUSE forum of CFOs and CIOs, reported that his research in the corporate sector indicated that the ability to support innovation is placed in jeopardy once the fixed portion of the IT budget moves past 70%.

It seems safe to assume that the situation has likely worsened for most higher education IT organizations since 2004. The severe economic recession has hit all institutional

budgets hard and has led to repeated rounds of cuts. It is likely that discretionary resources and seed funding for innovation were among the first casualties. The situation is exacerbated by the declining availability of some of the traditional sources IT leaders could turn to in order to create flexibility from within their fixed costs. For a long time, IT organizations could count on telecommunications revenues providing surplus funds that could be reinvested to seed expanded services or innovative projects. Today, telecommunication revenues have all but disappeared, as student-owned cell phones have obviated the need for phone services in residence halls. Larger IT organizations could also use salary savings from open positions created by natural turnover as a source of discretionary funding. However, it is likely that the recession has slowed the pace of natural turnover and that the budget crisis has caused the central university to pull back any salary savings for central reallocation (or deficit reduction).

Moore's law has also been a long-time contributor of reinvestable savings for IT organizations. Hardware replacement costs have continued to drop over time as capacity has increased. This has enabled IT organizations to stretch desktop computer, server, and network equipment budgets and provide increased capacity at lower or equivalent costs. Some were even able to reinvest some of these savings to seed new services and innovations.

The ability to count on Moore's law to create future financial flexibility in IT budgets is directly threatened by the wide-scale adoption of cloud computing. In a cloud model, reductions in the cost of hardware are reaped by the cloud provider, not by institutional users of cloud services. If markets are highly competitive, some of these savings may be passed along to institutions in the form of lower prices for hours of server time or storage capacity. However, it is likely that much would be retained by the cloud provider in the form of additional profits. Even private clouds would face pressure to retain these savings to recoup initial investments in infrastructure or to expand services. Finally, if central IT budgets are merely a place through which the funds of other institutional departments pass on their way to cloud providers, then any savings that return to the institution will accrue to departmental budgets outside of IT. Paradoxically, the more aggressive an institution is in adopting cloud infrastructure, the more inflexible the IT budget could become.

This is not a reason to avoid adopting cloud services. If the promised economics of the cloud materialize, they represent an essential opportunity to reduce the costs of commodity IT services. Anticipation of further cloud adoption should be the reason IT leaders engage their institutions in discussions about creating discrete budgets to fund research, development, and innovation through technology. As the current financial shock dissipates and budgets begin to stabilize, IT leaders should begin to seek some discretionary funding for seeding new projects done in conjunction with other academic and administrative departments. Perhaps these funds can be provided in part through savings realized from moving services to the cloud.

## Key Questions to Ask

- To what degree does the IT organization fully understand the costs of self-operating services that it might ultimately want to source to public or private clouds?
- Where can we find a standard model for comparing the costs of self-operation to alternative sourcing strategies?
- How well do key financial people at our institution understand the economics of the cloud?
- How can the IT organization gain access to people with strong financial-analysis or cost-accounting backgrounds?
- Do the budget practices and policies of our institution provide the financial flexibility to leverage the “pay as you go” nature of the cloud?
- What is our IT organization’s philosophy regarding the effectiveness or chargebacks for IT services? Is our use of chargebacks conducive to adoption of cloud computing?
- What percentage of the central IT budget is fixed or not easily repurposed?
- Does our institution have a sustainable model for seeding technology innovation? Does the cloud threaten this model?

## Where to Learn More

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## Endnotes

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7. Goldstein, *Alternative IT Sourcing Strategies*, 95–108.
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## About the Author

*Philip Goldstein (philgoldstein@goldsteinassoc.com) is a Fellow with the EDUCAUSE Center for Applied Research (ECAR) and an independent higher education consultant.*

## Citation for This Work

Goldstein, Philip J. "Demystifying the Cloud: Implications for IT Funding in Higher Education" (Research Bulletin 4, 2010). Boulder, CO: EDUCAUSE Center for Applied Research, 2010, available from <http://www.educause.edu/ecar>.

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