

A Forrester Consulting Thought Leadership Paper Commissioned By Cisco Systems

Cloud Bursts Into Higher Education

It's Here Whether You Want It Or Not

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FORRESTER

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Executive Summary

Institutions of higher education are dipping their toes into the cloud computing waters, just as we see organizations in the broader market doing. Our research found that, across geographic regions, universities are embracing cloud computing services and models for research, student engagement, and cross-university collaboration but struggle to determine the best way to use these services given high security concerns. As a result, we are seeing strong interest and investment in private cloud solutions and interest in community clouds specific to the higher education sector. This report focuses on the degree of cloud adoption by 12 universities in the US, the UK, Australia, New Zealand, and India, primarily around learning, collaboration, and research and secondarily around administration. Forrester conducted 30-minute interviews with CIOs and IT directors. We wanted to find out what cloud technologies they were using — private, public, hybrid, or community — and what drove them to move to cloud. We also wanted to determine what benefits they received from the cloud and the challenges they faced. Eight of the universities had significant cloud implementations; the other four were at various stages of implementation. We were also interested in IT leaders' evaluation of the vendor(s) they used and the kind of additional service vendors could provide.

Key Findings

Based on this study, Forrester identified five key findings from interviews with 12 university CIOs or IT directors:

- **Functionality, scalability, and agility are the most valued cloud features.** All of the interviewees believed that their IT staff could not build the features of cloud functionality cost-effectively, provision with the same speed as cloud providers, and scale resources up and down to meet institutional needs. In addition, cloud implementations allow IT employees to refocus their efforts to work more directly with academic departments and devote staff to institutions' other critical technology needs.
- **Employee empowerment and shadow IT are key factors in cloud interest and adoption.** The direct sourcing and consumerization of cloud services make it possible for savvy professors and staff to act as their own IT resource and set up their own cloud instances through services, which makes provisioning infrastructure and applications faster and more cost-effective than going through central IT. As a result, we see that many departments and individual university employees are driving the use of these services.
- **Formal IT leaders prefer private clouds.** Whether for research or collaboration, the private cloud is the preferred implementation of education IT leaders. All the universities interviewed expressed reluctance to trust any intellectual property (IP) or sensitive data to a third-party service. While security was their overriding concern about cloud computing, some hybrid clouds (combining some in-house resources with public cloud services) exist and they expected to increase their use of this model.
- **Universities have a strong interest in community clouds.** As collaboration between universities continues to grow in importance, so too does the desire to connect their cloud efforts or jointly participate in a shared cloud service like a community cloud. Most of the interest in this model was to support research and student learning.
- **Higher education IT doesn't trust cloud security.** University IT leaders are very nervous about IP and student data getting into the wrong hands; thus, security is the No. 1 roadblock to cloud service adoption. Faculty, staff, and IT employees were all open to a greater understanding of cloud security and peer successes with confidential

data, indicating a willingness (if not desire) to use cloud services with this data, assuming that the provider can give the proper assurances. Institutions with IT leaders from a corporate background reported having more confidence in dealing with this issue, due to past experiences.

- **Universities want flexible, long-term partnerships with vendors.** University IT leaders expect the vendor to understand higher education, be an expert on cloud implementation, make suggestions, and share best practices — but also to be open to developing a vendor/university partnership where each organization learns from the other. This relationship needs to be flexible enough to allow for educational and technology changes and developments during the life of the contract. Universities do not want to feel locked into a contract.

Cloud Technology Takes Off In Higher Education — With Some Caution

Fast access to resources, easy and instantaneous collaboration, and an economic model where you pay only for what you use hold strong appeal in the increasingly competitive world of higher education. So it's no surprise that cloud computing is penetrating this market rapidly. Forrester Consulting has found that the majority of large higher education institutions are exploring the use of cloud computing services in patterns similar to those of large enterprises. Early adoption is often led by forward-thinking and independent-minded professors and staff members who can provision the services themselves for a specific class or project. Formal adoption by university IT staff lags due to concerns over IP protection. Institutions want more flexibility in using technology but are very concerned about data security, especially in the public cloud — or any hosted environment, for that matter. Formal IT is much more accepting of private cloud solutions that deliver data from an on-campus data center or through collaborative efforts in a higher-ed community cloud.

Pro-Cloud Institutions Show Certain Characteristics

The majority of large institutions of higher education are exploring cloud technologies with different levels of interest. Those institutions that are most pro-cloud show certain characteristics:

- **Knowledge and past experience of the IT leader.** The universities doing the most with cloud have a CIO or director of IT who understands the benefits of cloud technology and has had direct experience with successful cloud use. In many cases, these leaders have worked in the corporate sector and were hired to move the university's technology environment forward to meet new workplace and student demands. These leaders make it a priority to educate faculty and other university staff members about the value of cloud technologies. They endeavor to alleviate concerns by setting up pilot programs, inviting other departments to see the operation, sharing market research, and evaluating results for student learning, technology viability, and instructor perspectives.

“For any technology we are thinking about getting, we are moving to a policy where we have to ask, ‘Can we do it in the cloud?’” (IT director at a US public university)

- **Nature of the institution.** Some institutions have stronger programs of study in highly technical areas and thus benefit the most from cloud technology investments. Our research shows that tech-savvy professors are far more likely to spin up a cloud for academic projects and assignments. Universities that tend to be farther along in cloud

implementations have — in addition to a computer science department — a large IT training program or other degree programs like fashion or animation that can benefit the most from cloud agility. Cloud technology can make it easy to set up tools that students and professors can use for projects during a course; and it makes it easy to tear them down at course end. One of the institutions Forrester interviewed had an open source research chair appointment that gave it a competitive advantage over other universities in the region for exploring cutting-edge technology — which attracts like-minded students.

- **Geographic location.** US institutions appear much farther ahead in their thinking about and use of cloud services and solutions (see Figure 1). These institutions appear to have a head start of 12 months or more in exploring cloud challenges and potential pitfalls and educating faculty and other university decision-makers about the benefits of the cloud. Lack of knowledge and understanding about the features of the cloud plagued institutions in most of the other geographies where we conducted interviews. This knowledge gap is not stopping these institutions from exploring the cloud, but they are progressing slowly and cautiously while keeping abreast of the successes and challenges of other institutions.

Figure 1

US Institutions Are Further Ahead In Cloud



Base: 2,438 North American and European software decision-makers

*Base: 57 North American software decision-makers in the education and social services industry

Source: Forrsights Software Survey, Q4 2011, Forrester Research, Inc.

Cloud Vocabulary Is Often A Challenge

Confusion exists in institutions over what cloud means. Forrester defines cloud computing as a *standardized software capability that includes service, software, or infrastructure delivered in a pay-for-use, self-service way*. There are three layers of cloud: software-as-a-service (SaaS), infrastructure-as-a-service (IaaS), and platform-as-a-service (PaaS) (see

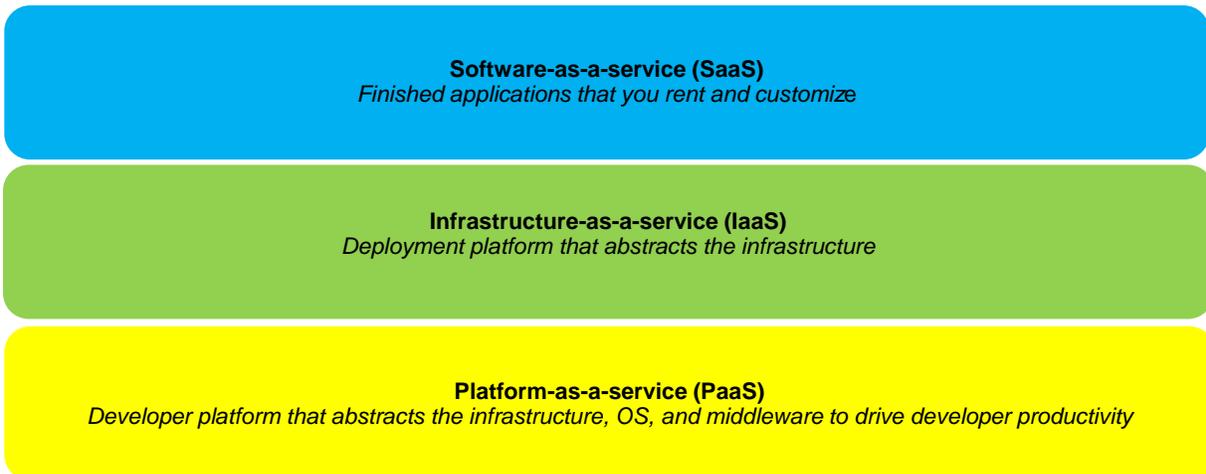
Figure 2). And Forrester defines five cloud deployment models: public cloud, internal private cloud, hosted virtual private cloud, hybrid cloud, and community cloud (see Figure 3).

Higher education institutions are most comfortable with a private internal cloud in their data centers, sometimes as a virtualized private cloud. Most of the 12 institutions around the globe that Forrester Consulting spoke with are using some form of hybrid, hosting student-related information on their own servers and putting email or research docs into the cloud. As institutions continue to work with each other, community cloud is expected to grow, especially among research institutions and those that share online learning courses.

“With professors adding and removing machines at random, I’m not sure I could provide the flexibility students need and still control costs. Maybe I’ll be able to do it as the technology matures.” (CIO of a US university)

Figure 2

Three Layers Of Cloud



Source: Forrester Research, Inc.

Figure 3
Cloud Deployment Models

Public cloud	Private cloud (internal)	Hosted virtual private cloud	Hybrid cloud	Community cloud
<p>Quick facts:</p> <ul style="list-style-type: none"> • Outsourced • Your data lives on the same machines as other companies' data. • Many have security fears. • Best way to save money with cloud 	<p>Quick facts:</p> <ul style="list-style-type: none"> • In your own data center • You are the cloud provider. • Most just buy software to put over their resources to make a cloud. • Biggest perk: agility 	<p>Quick facts:</p> <ul style="list-style-type: none"> • Outsourced • Data separated from other organizations' data 	<p>Quick facts:</p> <ul style="list-style-type: none"> • Can be a mix of any two environments, including internal/external and cloud/noncloud. • Most enterprises want this in the future. 	<p>Quick facts:</p> <ul style="list-style-type: none"> • Private cloud shared by multiple institutions. • Research data stored in cloud for all members to assess. • Individuals and groups collaborate using community cloud.

Source: Forrester Research, Inc.

IT's Role In Higher Education Becomes More Academically Integrated

A key factor in the propensity to use cloud technology appears to be the organizational structure of IT and where it sits in the transition to what Forrester calls business technology (BT). The traditional central IT department in higher education is no longer the university's technology hub and order-taker. The growing use of self-service technologies, such as cloud computing, social media, and mobile, is dismantling the idea of central IT and dispersing it into branches and academic departments. Dispersed IT can work more closely with these "business" groups and more directly show how technology investments help the university meet its overall goals. While central IT continues to provide support for the mission-critical and shared services functions of the institution, IT staff is permeating the various academic departments of the university, working in partnership with academics. This change in IT deployment has the following implications:

- **IT is moving into the business of the university.** As a partner, BT helps craft the various technologies that support student learning, including collaboration and research.¹ BT makes plans in cooperation with the academic departments, suggests the most appropriate technologies, and helps faculty and students get the most out of their investment.
- **Funding for IT is taking on a different structure.** Central IT funding will decrease as more money goes to distributed IT in various university departments. Joint funding proposals with IT and the academic departments will become common. This movement to BT is already happening in the corporate world. For example, an IT leader at a UK institution told us that IT is moving out into departments while the institution is outsourcing many central IT functions.

“New realities are driving more direct control of technology by leaders of non-IT organizations, internal users, and customers — empowered by their own technology use. These changes herald an IT organization in which CIOs build agile and nimble teams that enable empowered employees and customers to be successful directly using technology for education.” (Head of information technology at a New Zealand university)

- **Long-range academic plans involve IT.** Forrester has seen a trend for IT and academic departments to partner. The VP for academic and education excellence at one institution has partnered with the university’s CIO to jointly develop a three-year plan for academics and IT. The academic leader said:

“We have a lot of different environments — from a content creation suite to aircraft simulators — requiring very different IT environments. At the same time, our plan for the institution is to advance the use of educational technology for teaching and learning and to push boundaries with faculty to change teaching practices. Our academic IT is a rich tech environment for faculty and students.” (VP for academic and education excellence)

Universities Explore All Kinds Of Cloud Technology

Institutions of higher education are not new to cloud technology. Some have had a kind of cloud implementation for five years or more. They vary in their cloud confidence; that affects the willingness to use certain cloud offerings. But all institutions are exploring the possibilities and have plans to embrace those areas that they see as a commodity — something that someone else can do better. Our interviews revealed the following views of the various cloud technologies:

- **Public clouds are in widespread use.** The most consistent use of cloud technologies by all of the universities interviewed was the use of SaaS solutions for student services such as email. Others common uses — again, mostly SaaS — were driven by academic pursuits, such as cloud-based labs and collaboration environments that are spun up for a certain length of time to supplement courses. Some use a tracking, course collaboration, and management eLearning application as SaaS; others have it installed on their servers. These uses of public cloud are focused on student learning, and students are able to log in using all of their various devices. Two institutions were using public cloud for admissions and customer relationship management (CRM), and one was planning to move all payroll and human capital management to the cloud.
- **Educational IT prefers private clouds.** Technology leaders in higher education are very concerned about commercially valuable IP or confidential data getting into the hands of others. As a result, all of the institutions’ IT leaders were much more comfortable with a private cloud installed and delivered through an on-campus data center.

“Buying space on someone else’s cloud does not go over well in higher education. We want to create our own cloud or work with other universities.” (Professor of IT at a university in India)

The higher education leaders we interviewed said that they plan to provide a wide variety of services through this capability, including research data, student services, eLearning, collaboration, and any other commodity services.

- **Public and private efforts will come together in the end.** While education IT leaders prefer the private cloud environment, they acknowledge that it has limitations and are thus open to supplementing their private environments with public cloud services. One university sees great benefit from this, especially during enrollment

time when there is too much traffic. Shifting some services, such as class selection, to the public cloud will let them better handle the volume of requests without a disruption of service. Early success with these types of solutions has spurred interest in using the same procedure for exam results and other administrative activities that have similar seasonal spikes. The hybrid cloud also has strong benefits for teaching; the institution can easily supplement classroom instruction with online learning (live virtual or self-paced or eLearning). Most interviewees said that they were discussing how to extend certain academic programs into a hybrid cloud model.

“My dream is nothing on-site anywhere except network kit or desktops. I would like to see BYOD for students and staff. No on-site services — all services and data would be in the cloud or in a virtual hybrid cloud across universities.” (IT director at a UK university)

- **Community clouds are most popular for sharing research.** Most interviewees said they were part of or contemplating a community cloud with other universities, primarily to share research. Some universities are working together to share storage space and processing capabilities and looking at ways to provide accessible lists of data stores. Groups of universities are establishing communities to facilitate joint projects where sharing information is essential. Higher education research networks such as Internet2, Orion, Canarie, and Janet provide base capabilities upon which these community clouds are built.

The Cloud Has Many Benefits

The benefits of the cloud have convinced institutions to increase their use of it for applications and infrastructure. The implementation process is minimal except for migration and integration issues, and higher education has seen very positive results, especially in scalability, flexibility, and self-service. For IT professionals, putting commodity items in the cloud frees staff to address other university business. Although cost savings is the first consideration in many implementations, it is not where the strongest benefits lie today.

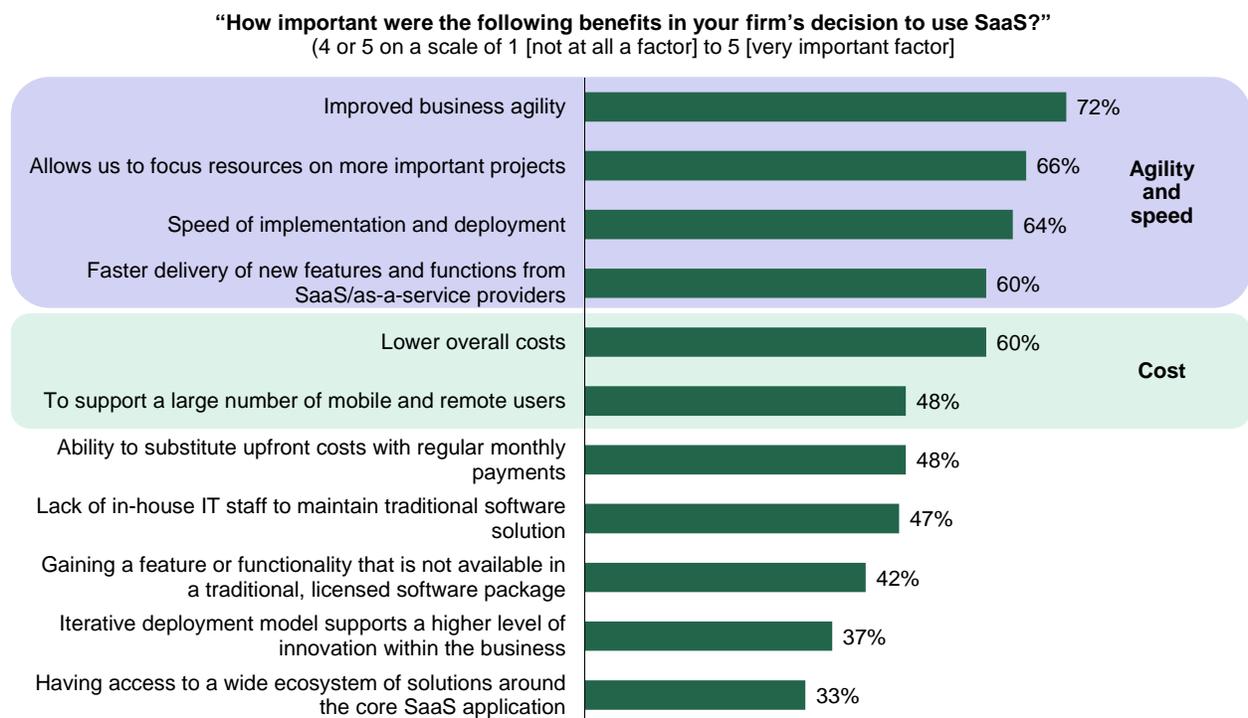
- **Productivity is typically the first reason to explore cloud options.** The cloud environment can grow or shrink easily, depending on class projects or cross-disciplinary team work. For example, students can develop a marketing campaign or an engineering design project, share it in the cloud, and get feedback from classmates and instructors. It also enables students to access data at any time from any location. This self-service aspect is very important to many institutions we interviewed.

“We can move IT away from the academic programs and allow professors and students to work ad hoc because technology is elastic and on-demand. When projects and courses finish, whatever was provisioned will be automatically removed — it’s a fully automated intelligent self-service.” (IT director at a US university)

- **Cost savings are expected but not always delivered.** Many institutions said the second most common driver was cost savings — not just from direct service costs but from reducing internal administration and support costs. One interviewee said that the institution saves \$500,000 to \$750,000 per year by using cloud services. Another CIO estimated that using the cloud has saved about one-third of the capex to buy new equipment. This does not count support staff savings. And institutions are overwhelmingly adopting cloud-based email, which eliminates provisioning costs for university servers. Economies of scale are significant, as a vendor specializing in cloud can provision faster, better, and cheaper. One interviewee had an internal email system that would have required a \$1

million expenditure to make it fit for purpose — but for \$100,000, a cloud implementation gave the institution a flexible, scalable service. Another institution said it saves about \$300,000 per year by outsourcing email. The use of SaaS applications like eLearning software significantly reduced upfront costs, but expanded use of the service over three to seven years raised the cost of SaaS to nearly even with the cost of a perpetual license and on-premises deployment. However, one must factor in the cost of equipment and the time of IT staff along with the flexibility of the service — this again favors the SaaS model. Universities are much like companies in their reasons for adopting cloud (see Figure 4).

Figure 4
Companies Look To Cloud Computing To Improve Agility And Speed



Base: 920 software decision-makers at firms who are using or planning to use SaaS

Source: Forrsights Software Survey, Q4 2011, Forrester Research, Inc.

- Cloud functionality exceeds that of internal IT and can eliminate expensive equipment.** One of the key benefits of SaaS to education clients is the pace of innovation that SaaS vendors can deliver to their clients — something that interviewees said far exceeded what they could do with internal staff. And as the use of new features like mobile capabilities expanded, there was no infrastructure impact they had to accommodate. Some IT directors said that they didn’t feel that owning data equipment added any value, because they put a lot of effort into managing the environment for data centers, installing equipment, and moving it around, which takes IT staff away from other critical work. One university CIO was emphatic about this:

“I’m pushing operational people to look seriously at getting rid of data center equipment and replacing it with [cloud services]. This is not driven by cost; there’s probably no cost/benefit analysis. Rather, it is freeing our skilled staff up to focus more on our core business. The availability of features and functionality of many cloud services far outweigh anything we can build internally in any reasonable amount of time. The time saved and the ability to focus on university-critical technology makes for a more efficient and effective central IT department.”
(CIO of a UK university)

- **Commodity services may be best served by the cloud.** All of the university IT leaders agreed that commodity services belonged in the cloud. Some had as many as 120 apps in the cloud, which students and faculty can access from any device at any time. They saw this as a major advantage over trying to control the apps internally. The cloud also provides economies of scale. Over and over again we heard comments like:

“IT organizations are not able to do things important to the institution because they are too busy delivering basic services. We’re able to channel energy into new areas by divesting ourselves of commodity services. For example, we buy equipment, manage systems, and apply patches internally, when we could give that to a vendor and allow our IT staff to engage in more creative pursuits to benefit the institution.” (CIO of a US university)

Another IT leader talked about better service to users:

“By putting commodity areas in the cloud, IT services become more accessible, agile, and even resilient because we can move virtual machines out of campus to another location and keep running without a problem. Also, students and staff like it, and it works, so what’s not to like?” (CIO of an Australian university)

As Institutions Embrace Cloud, Challenges Surface

Security is the overwhelming concern that institutions of higher education have with cloud. However, even with all the concern over challenges, the bottom-line realization is that “We have to embrace the cloud and try to find the right control methods, because people will use it anyway.”

- **Security concerns center on data getting into the wrong hands.** If data, including personally identifiable information, is hosted in the cloud, institutions want to be sure it’s not viewed by unauthorized people. Many institutions talked about their fear of shifting their IP to service providers. Concerns arise over where hosted data is housed; a private cloud delivered from a university data center does not raise the same flags. Government rules in some countries prohibit data from being stored outside the country. Two universities brought up bring-your-own-device (BYOD) as a fast-approaching challenge — what data will institutions allow people to store on individual devices? One IT executive mused about the current state:

“Data is being shared whether we want it or not, and it’s not easy to stop. It’s a practice that exists today. IT is not going to be able to prevent it, even if we try to provide secure services that are just as easy to use as the cloud — it’s probably too late.” (Director of information, media, and technology at a UK university)

“I don’t think the technology will fall short; the challenge is around people’s trust.” (Information technology strategy manager at a New Zealand university)

- **Bandwidth is a diminishing concern.** Although only three interviewees mentioned that they had bandwidth concerns — most did not view it as a major issue — bandwidth to the cloud service may be an issue for distance

learning programs and students logging into university services from home. Just as university data centers have a fixed physical location, so do most cloud services.² Uploading large quantities of research data was cited as a particular challenge.

- **Lack of customization presents a challenge.** When universities talk about self-service, they want customized data-driven experiences. For example, a student enrolls in three courses. Based on predefined needs for courses and student profiles, three capabilities are provisioned for the student for each course. This is intelligent self-service based on who the student is and which courses the student is enrolled in. The present challenge is about additional data-driven functionalities that tie into the identity of the user.
- **Licensing arrangements cause concern.** Multiple issues exist here, but there are two primary concerns: 1) SaaS license growth with expanded use and 2) on-premises software licensing agreements that impede or block deployment to cloud environments. On the SaaS front, one university indicated that licensing costs for cloud offerings increased by ten times as academics and students discovered the service and began using it or began using it more extensively. When universities wanted to move traditional on-premises applications to cloud environments, including private clouds, they found that the vendors' licensing terms either did not support deployment to a cloud or substantially increased in cost. The most common culprit was licenses tied to physical devices.

KEY RECOMMENDATIONS

Given the growing use of cloud services by academic departments and the need to shift central IT behavior to better match the agility and productivity these services provide, IT leaders in education need to focus their efforts on three key areas: 1) transitioning the organization from IT to BT to strengthen ties to academic departments; 2) transitioning the internal infrastructure to a private cloud; and 3) learning to embrace a hybrid cloud future. IT leaders in higher education must:

- **Recognize that central IT is no longer the heart of technology at universities.** Central IT will become more business-focused and act as a resource for the university's academic and organizational departments. Thus, it needs to broker stronger relationships with its academic community and move away from supplying technology capabilities and toward advising and consulting on how technologies can enhance the academic mission.³
- **Start the private cloud journey with an understanding of what makes a private cloud different.** Virtualization does not equal cloud. To deliver a cloud-like experience from your data center, you will need to deliver on the greater values of cloud: self-service, automation, and pay-per-use.⁴ This has greater operational implications than technology.⁵ Your design point should be to offer a solution that can match the experience of the leading public clouds.
- **Test cloud services.** One institution stemmed its worries about the privacy and security of Google apps by conducting a month-long trial for 3,000 students. Feedback from students and lawyers indicated no issues. The university had termination clauses over a four-year period and plans for migration if needed. Another institution performed a risk assessment of a cloud vendor and felt that the measures the vendor had put in place were extensive and within the university's comfort zone. Another institution gave providers a detailed questionnaire and performed penetration testing of the providers' development environments. The institution's CIO makes it clear that vulnerability is part of the process:

"Put strong measures in place, monitor them, and verify them. Truthfully, I don't see anything more inherently secure about on-site. As a university, we have to operate in as open a network as possible, as we work with external professors

and outside organizations. Our security challenge is to make those parts that need it very secure without locking down the whole system.” (CIO at a US research university)

- **Set up a pilot program.** Pilot programs can provide examples of how the private cloud works and help educate faculty and staff about security measures.

“What we’ll do is build an environment, move administrative or learning material into it, and then work, as a pilot, with people to identify use cases that work in that environment. Based on that experience, we will expand out to the less technical groups that have a similar need and help them self-provision.” (CIO at a US university)

- **Build a true cloud by starting with a preintegrated vendor solution.** The fast path to cloud value comes through starting with a solution that was designed specifically to deliver this value. From here you can accelerate your understanding of what makes a cloud solution different; as you gain experience with it, you can transition other existing services and infrastructure to this new model.⁶
- **Get a public cloud use policy in place today.** If you have concerns about key data getting into the wrong hands by using cloud services, it’s best if you evangelize this concern and give clear guidance to non-IT university employees on what they can and cannot do in the cloud. Several universities have publicly available cloud policies that can be used as templates for creating your own.
- **Identify the key cloud services academics are already using as shadow IT and learn to manage them.** If your professors and students have already woven cloud services into their academic curriculum, you probably won’t have a lot of success stopping them from doing this. The better path — and one that will support your transition from IT to BT — is to embrace this use today and focus your efforts on learning best practices for managing these cloud services and using them securely. In this way, you can add value to the academic departments’ use of these services and perhaps evangelize good practices to other departments.
- **Weave cloud services into the overall portfolio.** As you become comfortable with how cloud services enhance academic and internal IT productivity, you can start to ensure they become part of the standard practices of your university. This means 1) building operational skills in the integration of cloud and noncloud services; 2) implementing identity management in a hybrid model; and 3) optimizing IT spending across cloud boundaries. Concentrate on organizational productivity and finding a balance between these pursuits and the security and governance demands you face.
- **Work with third-party cloud providers to demonstrate their capabilities and maintain IT relevance.** Discuss your cloud strategy and concerns with your key service and outsourcing partners so you can discern if they have cloud services that would be of value for you to provide to your constituents centrally. In addition, these third parties can help you educate faculty and staff on uses of the cloud within the university context. However, be sure to vet their solutions to ensure they are indeed cloud services.

Appendix A: Methodology

For this study, Forrester conducted 12 interviews with IT managers at higher education institutions in the US, Canada, the UK, Australia, and New Zealand. Interview participants were asked about their challenges and current capabilities in the cloud. An incentive was offered in return for the interview. The study began in May 2012 and was completed in June 2012.

Appendix B: Endnotes

¹ CIOs increasingly play a vital role in developing business strategy and defining the technology direction for the organization to achieve competitive advantage. Source: “Develop Effective BT Strategy,” Forrester Research, Inc., May 2, 2012.

² Many leading infrastructure and operations professionals looking for more innovative ways to reduce costs and increase operational flexibility are choosing public IaaS cloud computing solutions. Source: “Infrastructure-As-A-Service (IaaS) Clouds Are Local And So Are Their Implications,” Forrester Research, Inc., February 9, 2010.

³ Over the next 10 years, three sets of forces will change the relationship of business, technology, and the IT organization. Source: “BT 2020: IT’s Future In The Empowered Era,” Forrester Research, Inc., January 7, 2011.

⁴ Although many companies are benefiting from public cloud computing services today, the vast majority of enterprise infrastructure and operations (I&O) professionals view outside-the-firewall cloud infrastructure, software, and services as too immature and insecure for adoption. Their response: “I’ll bring these technologies in-house and deliver a private solution — an internal cloud.” However, cloud solutions aren’t a thing, they’re a how, and most enterprise I&O shops lack the experience and maturity to manage such an environment. Source: “You’re Not Ready For Internal Cloud,” Forrester Research, Inc., July 26, 2010.

⁵ Source: “Assess Your Cloud Maturity,” Forrester Research, Inc., May 29, 2012.

⁶ This market overview examines the landscape of vendors providing solutions designed to accelerate the implementation of an infrastructure-as-a-service (IaaS) cloud in a customer’s data center. Several standard criteria and a selection of differentiating factors are examined. All the solutions evaluated provide the core IaaS functions: self-service, standardization, automation, and pay-per-use. Source: “Market Overview: Private Cloud Solutions, Q2 2011,” Forrester Research, Inc., May 17, 2011.