Higher Education's Top-Ten Strategic Technologies for 2014

BY SUSAN GRAJEK | FEBRUARY 2014

- **This report introduces a complement to the popular EDUCAUSE top-ten IT issues: the top-ten strategic technologies in higher education.** Together, the two lists can provide more complete and nuanced guidance on institutional IT priorities.
- Analytics and mobile technologies dominate the 2014 strategic technologies list.
- IT leaders are advised to ensure they are familiar with both the top-ten technologies and key up-and-coming technologies highlighted in the report so they can then determine whether and how those technologies fit their institutions and develop a strategy for educating institutional leadership on the strategic technologies that are key for their institution.

Introduction and Overview

The annual EDUCAUSE top-ten IT issues in higher education receives a great deal of interest and attention in higher education. IT and higher education leaders use it to calibrate their IT-related activities and inform their strategic planning. This year EDUCAUSE is introducing a complementary list: the top-ten strategic technologies in higher education. Together, the two lists can provide more complete and nuanced guidance on institutional IT priorities.

Our definition of a strategic technology is based on the time, active attention, and priority a technology has at a given time. Mature, fully deployed technologies (such as financial information systems or networks) may be among the most mission-critical technologies, but they are more likely to be receiving operational than strategic attention. **"Strategic technologies" are relatively new technologies institutions will be spending the most time implementing, planning, and tracking in 2014.** They are therefore the technologies entering maturity, and, as a result, they are the ones whose value to the institution IT leaders and professionals are most interested in understanding and that need to be planned and deployed as effectively as possible. These technologies are still relatively new: Only 35–43% of institutions intend to plan or implement any of the top-ten strategic technologies (although more than half of institutions are at least tracking each technology in the top ten).

The top-ten strategic technologies were selected from the analysis of a vetted set of 78 technologies presented to EDUCAUSE members in a survey in fall 2013, as described in the Methodology section of this report. This report does not aim to describe or justify the importance of these technologies. A number of excellent existing resources already do that. The value of the EDUCAUSE list is that it is based on data about members' actual plans and thus sheds light not on what people are talking about but on what institutions are doing.

Key Findings

- Analytics dominates the list, with four of the ten technologies. Institutions are focusing on both learning and administrative analytics.
- Mobile apps are also prominent on the list, with two technologies and additional support for wireless networking.
- Institutions' other infrastructure priorities—unified communications, virtual desktops or PC applications, and identity and access management—show the influence of BYOE (bring your own everything) and preparation for moves to the cloud.
- Large and private doctoral institutions are paying more attention to more technologies than other institutional types. Relative to other institutional types, a smaller proportion of bachelor's institutions are paying attention to many of the technologies we asked about. Institutional approaches to technology—whether early adopters, mainstream, or lagging—also influence the technologies selected in the rankings.
- Public master's universities are spending more time with emerging educational technologies than other institutions.
- We predict that all ten technologies will be deployed in at least half of colleges and universities by 2017.
- Four additional technologies may be on the list in coming years because institutions are spending significant planning time on them in 2014: mobile device management, network capacity planning and management tools, mobile data protection, and online courses on mobile devices.
- Further out, institutions are devoting the most attention to tracking these technologies: adaptive learning, gamification, mobile data protection, predictive analytics, e-book readers/e-textbooks, infrastructure as a service (IaaS), the Internet of things, text content analytics, mashware, open content, and big data.

The Top Ten

STRATEGIC TECHNOLOGIES FOR 2014

1. Business intelligence reporting dashboards
2. Mobile apps for enterprise applications
3. Mobile app development
4. Enterprise identity and access management solutions
5. Learning analytics: Course level
6. Administrative or business performance analytics
7. Unified communications and collaboration
8. 802.11ac wireless networking standard
9. Virtual desktops or virtual PC applications
10. Learning analytics: Degree advising

The Top-Ten Strategic Technologies for 2014: Descriptions

1. **Business intelligence (BI) reporting dashboards**, sometimes also referred to as "enterprise dashboards," refer generally to any dashboard or visual display designed to relay business status information. These dashboards display data visualizations such as charts and graphs with metrics that monitor business processes and activities from enrollment and graduate rates to research funding and expenditures to strategic project status indicators. The purpose of the dashboard is to display the status of the underlying organization's business activities.

2. **Mobile apps for enterprise applications** refers generally to Internet applications that run on mobile devices such as smartphones and are designed to integrate with all aspects of an organization's businesses and processes. These apps make it possible to access enterprise-wide resources (such as course catalogs, student information systems, and human resource systems) and to conduct enterprise transactions from the mobile device.

3. **Mobile app development** is the organizational capability for the development of mobile applications. There are a number of development questions to answer as organizations consider mobile application development. Organizations must make decisions about native apps for specific devices and mobile web development strategies. Issues of accessibility, security, data protection, and responsive web design also must be addressed when considering mobile app development.

4. **Enterprise identity and access management solutions** are the policies, processes, and technologies that establish user identities and enforce rules about access to organizational digital resources. In these solutions, a user can employ a single digital identity to access all resources to which the user is entitled. These solutions also might include federated identity management solutions, which extends this approach above the enterprise level, creating a trusted authority for digital identities across multiple organizations.[1]

5. **Learning analytics: Course level** is the "use of analytics techniques and technologies to help target instructional, curricular, and support resources to support the achievement of specific learning goals."[2] Course-level learning analytics focuses on the collection, analysis, and reporting of data about learners in their coursework in order to improve student success.

6. **Administrative or business performance analytics** is the use of analytics techniques and technologies to help target organizational resources to support organizational goals. Administrative or business performance analytics focuses on the collection, analysis, and reporting of business data (e.g., financial or budgetary data) to improve organizational success.

7. **Unified communications and collaboration** refers to the integration of communication methods and technologies, both with each other and with other applications. These technologies converge and enable the use of multiple enterprise communication outlets.

8. **802.11ac wireless networking standard,** issued by the IEEE Standards Association, details wireless transmission speed specifications. IEEE 802.11ac builds on IEEE 802.11n and allows for higher data throughput. It was published in December 2013.

9. **Virtual desktops or virtual PC applications** deliver virtualization, an approach by which several applications—sometimes running on different operating systems—run on the same piece of hardware, creating multiple "virtual" servers from a single machine. Software manages the different applications and systems, resulting in an experience for end users that is indistinguishable from having each application on a dedicated machine. A virtualized environment provides an IT organization with greater flexibility to deploy new applications and manage existing ones.[3]

10. **Learning analytics: Degree advising** is an institutional capability to provide students, faculty, and staff with holistic information and services that contribute to the completion of a degree or other credential. These systems include coordinated education planning, progress tracking, advising, and early alerts that are often incorporated into enterprise-grade solutions.[4]

Institutional Differences

We found institutional differences in emphasis for about half the technologies.

Doctoral institutions, particularly private doctorals, are devoting more effort to planning, tracking, and implementing technologies than other institutions. The same trend applies to larger institutions. Relative to other institutional types, a smaller proportion of bachelor's institutions are paying attention to many of the technologies we asked about. Figures on pages 10–18 depict institutions' intentions for all 78 technologies in 2014.

Community Colleges

Paying more attention than others to:

- Online courses on mobile devices
- Network performance monitoring tools

Paying less attention to:

- Digital repositories for researchers and scholars
- E-portfolios
- Digital preservation of research data
- Gamification
- Cloud-based high-performance computing (HPC)
- Self-publishing

Bachelor's Institutions

Paying less attention than others to:

- Administrative or business performance analytics
- Online courses on mobile devices
- Big data
- Data center capacity planning and management tools
- Cloud-based office productivity suites
- Private-cloud storage
- Mashware
- Hybrid cloud computing
- IaaS
- Software-defined networks
- Content-aware data loss prevention (DLP)
- Talent workforce analytics
- Mesh networking

Public Master's Universities

Paying more attention than others to:

- E-book readers, e-textbooks
- E-portfolios
- Mashware
- Gamification

Public Doctoral Universities

Paying more attention than others to:

- Data center capacity planning and management tools
- Digital repositories for researchers and scholars
- Digital preservation of research data

Private Master's Universities

Paying more attention than others to:

- Network capacity planning and management tools

Paying less attention to:

- Unified communications and collaboration
- IT accessibility assessment tools
- Application platform as a service (PaaS)
- Cloud-based voice solutions
- Hadoop
- Augmented reality
- Quantum computing for researchers

Private Doctoral Universities

Paying more attention than others to:

- Unified communications and collaboration
- Administrative or business performance analytics
- Big data
- Cloud-based office productivity suites
- Hybrid cloud computing
- IT accessibility assessment tools
- IaaS
- PaaS
- Cloud-based HPC
- Content-aware DLP
- Talent workforce analytics
- Cloud-based voice solutions
- Self-publishing
- Mesh networking
- Hadoop
- Quantum computing for researchers

Paying less attention to:

- Network performance monitoring tools

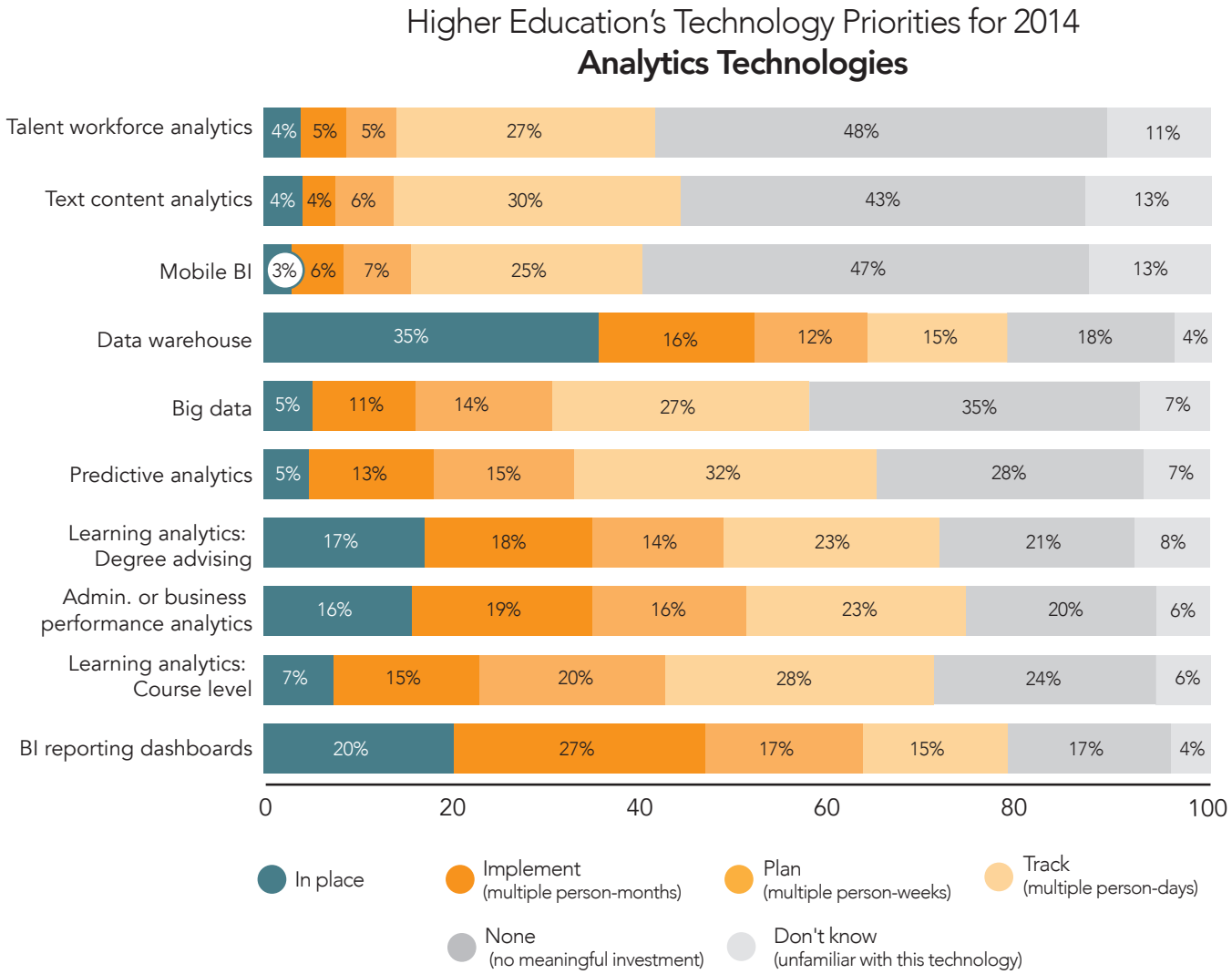
Institutional Size

Larger institutions are paying more attention than smaller institutions to:

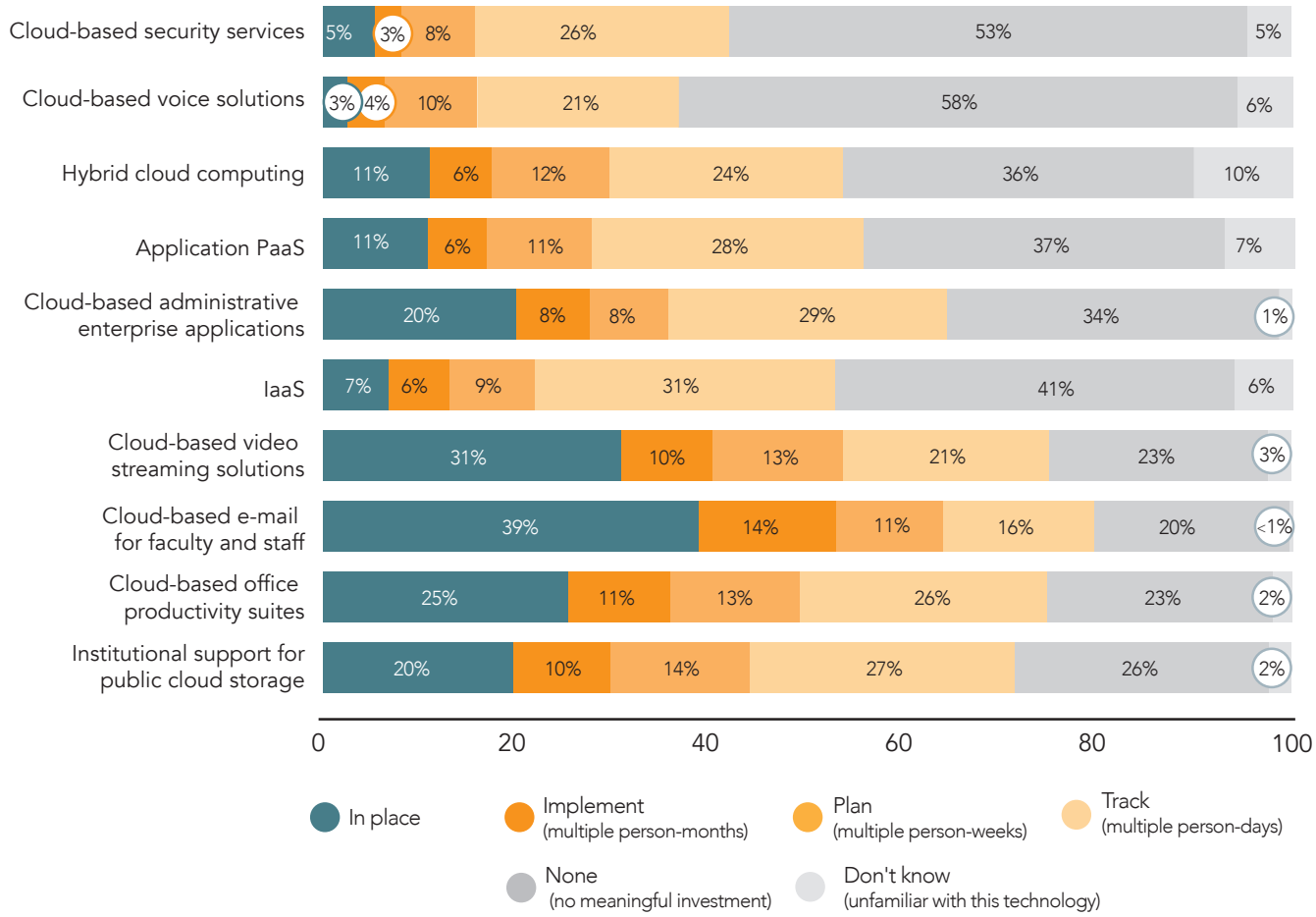
- Administrative or business performance analytics
- Application PaaS
- Big data
- Cloud-based e-mail for faculty and staff
- Cloud-based HPC
- Cloud-based office productivity suites
- Data center capacity planning and management tools
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Extreme-low-energy servers
- Hadoop
- Hybrid cloud computing
- IaaS
- Institutional support for public cloud storage
- IT accessibility assessment tools
- Mashware
- Mesh networking
- Mobile BI
- Online courses on mobile devices
- Open content
- Predictive analytics
- Private-cloud storage
- Quantum computing for researchers
- Self-publishing
- Service-level reporting tools
- Software-defined networks
- Text content analytics

A Deeper Look

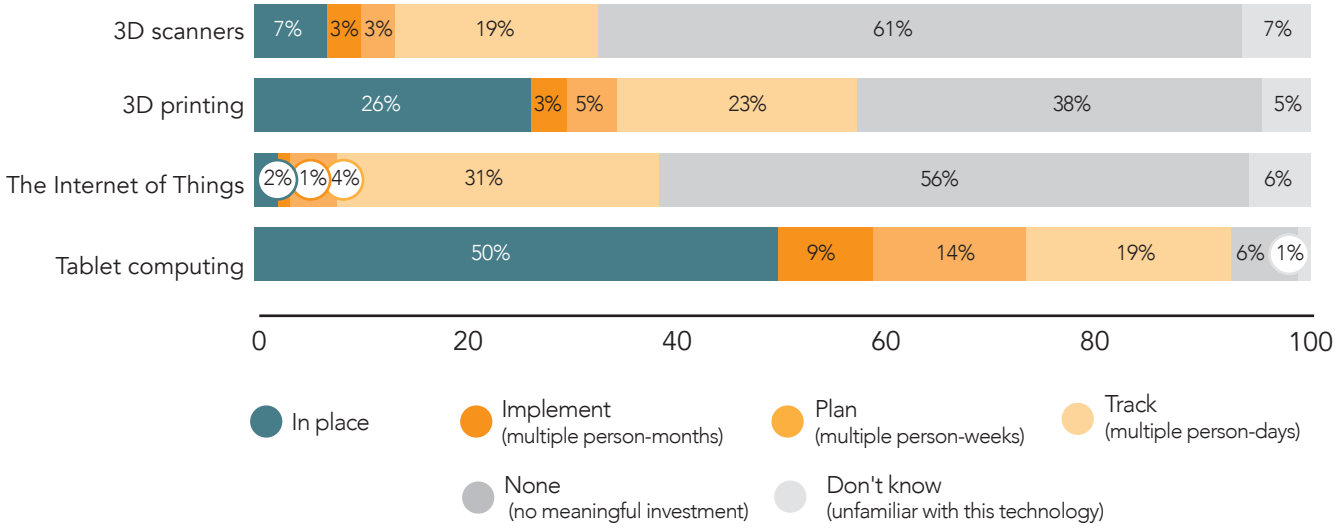
The top-ten technologies were identified from a list of 78 technologies organized into ten domain areas. Pages 10–18 summarize institutions' plans for the technologies within each domain.



Higher Education's Technology Priorities for 2014
Cloud Sourcing Technologies

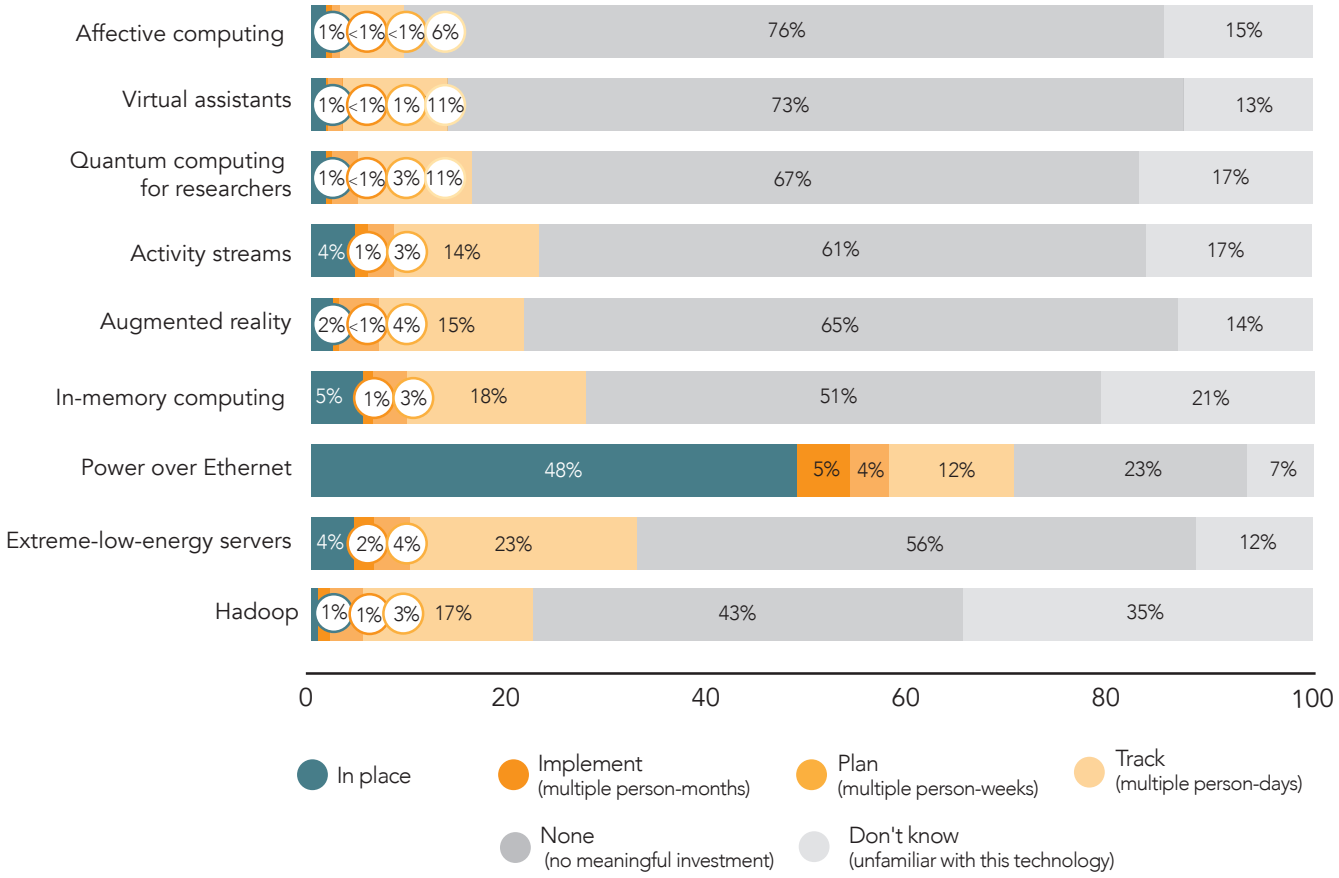


Higher Education's Technology Priorities for 2014
Devices

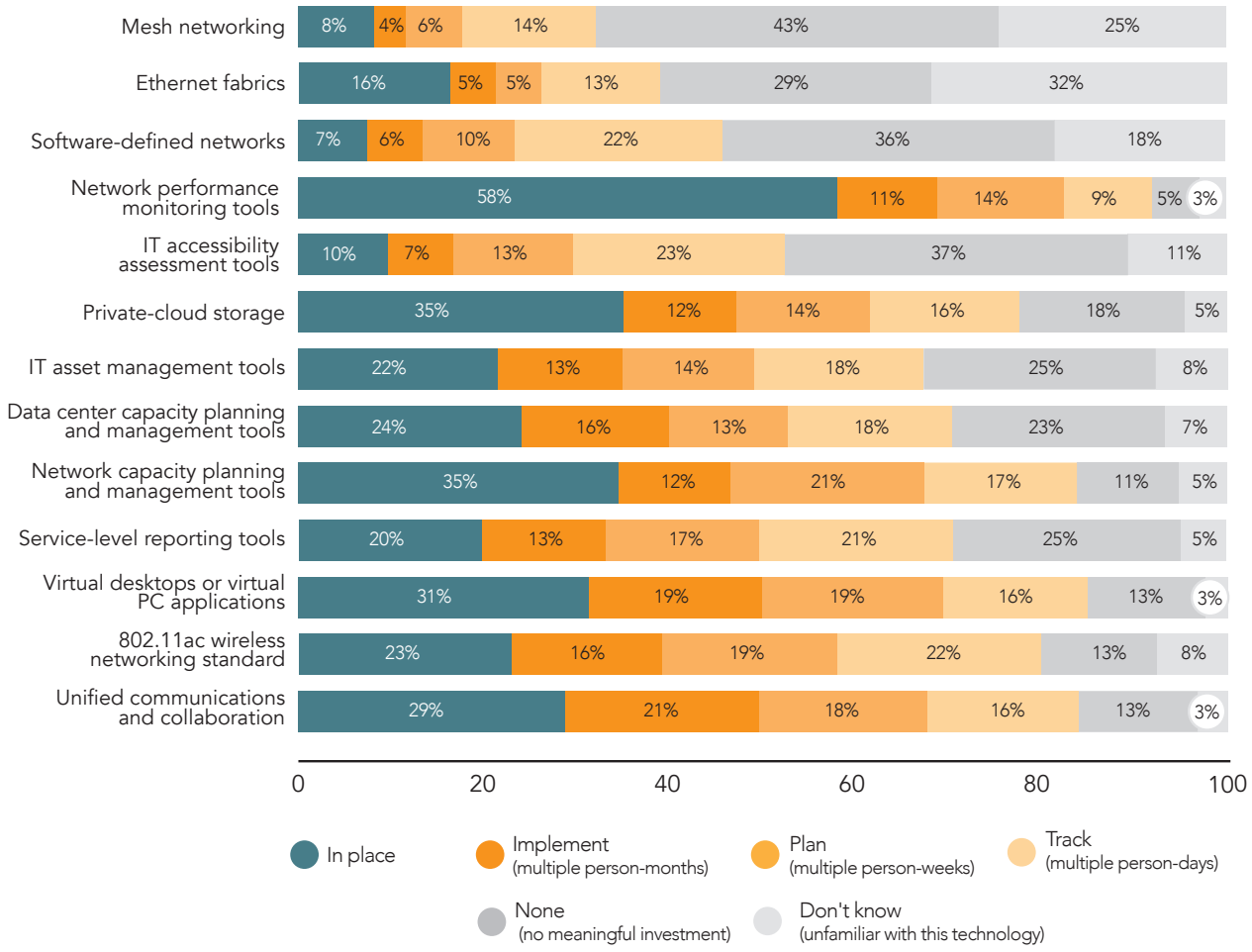


Higher Education's Technology Priorities for 2014

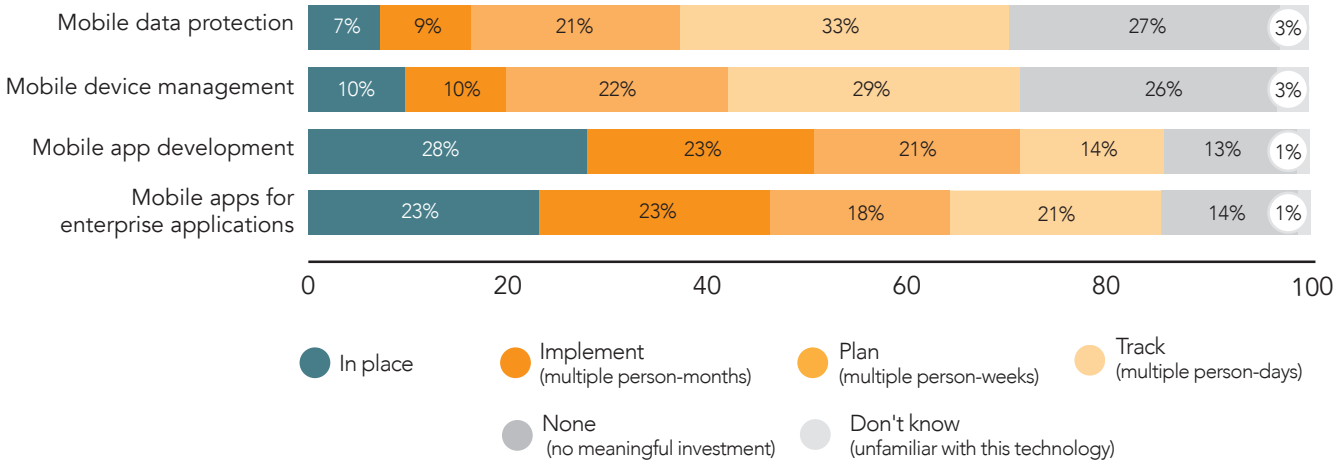
Emerging Technologies



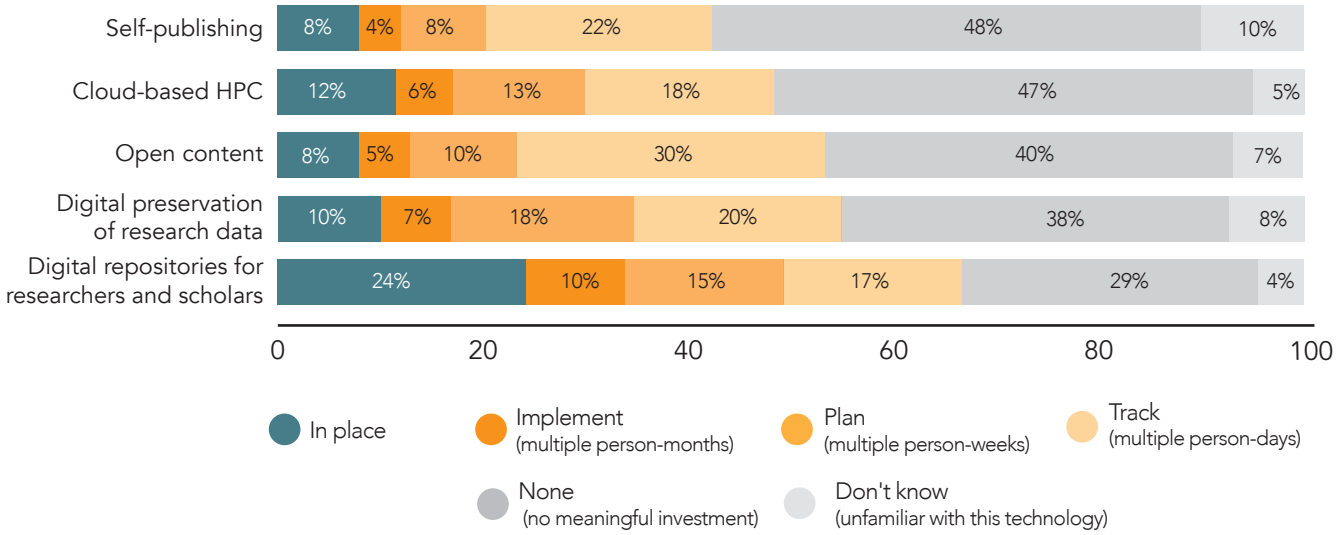
Higher Education's Technology Priorities for 2014
Infrastructure and Operations Technologies



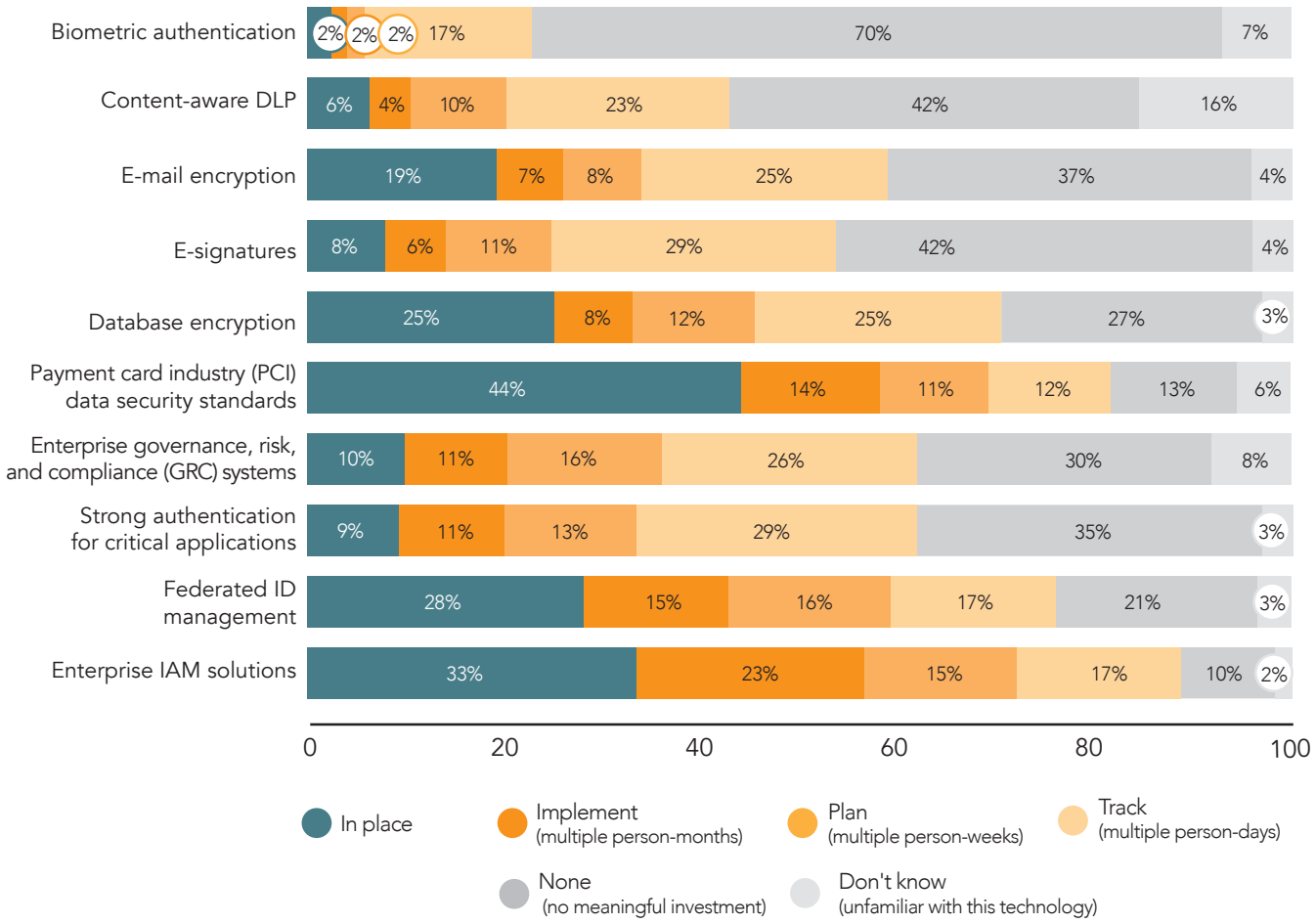
Higher Education's Technology Priorities for 2014
Mobile Technologies



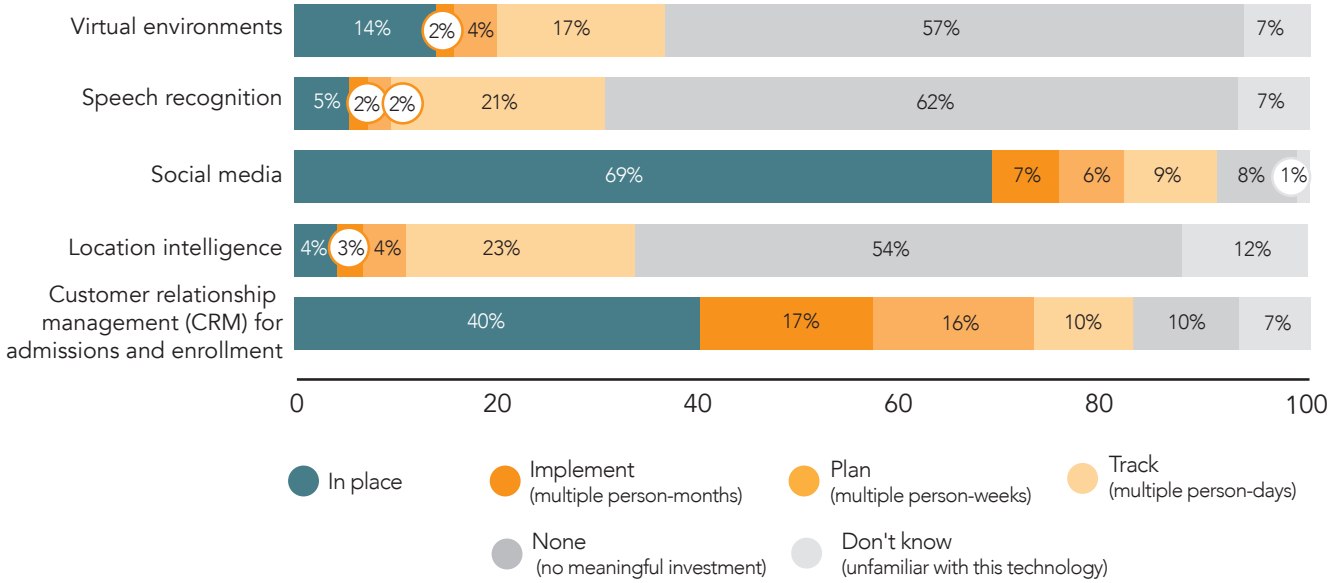
Higher Education's Technology Priorities for 2014
Research and Scholarship Technologies



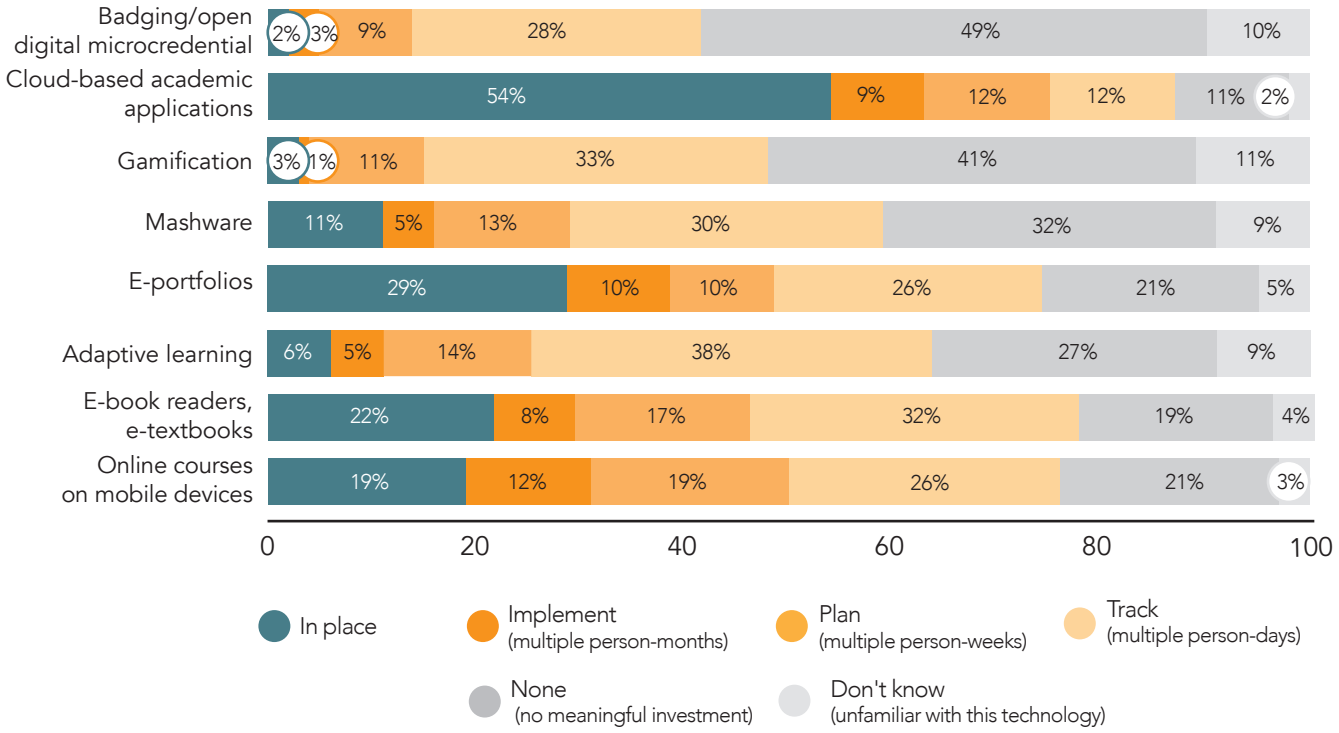
Higher Education's Technology Priorities for 2014
Security and Privacy Technologies



Higher Education's Technology Priorities for 2014
Social/Personal Technologies



Higher Education's Technology Priorities for 2014
Teaching and Learning Technologies



Where Do You Stand?

Leading edge? Early and mainstream adopters are spending more time than late adopters with:

- Open content
- Hybrid cloud computing
- IT accessibility assessment tools
- Software-defined networks

Solid mainstream? Mainstream adopters are paying more attention to unified communications and collaboration.

Catching up? Mainstream and late adopters will be spending more time than early adopters with network performance monitoring tools.

Bleeding edge? Institutions identifying themselves as early adopters of technology will be spending significantly more time than other institutions on these five technologies in 2014:

- Digital preservation of research data
- Cloud-based voice solutions
- Predictive analytics
- Hadoop
- Big data

What We Don't Understand

Quite a few respondents indicated they were unfamiliar with various technologies. The top-ten least-familiar technologies were:

1. **Hadoop** (35% unfamiliar). "An open-source software framework for storage and large-scale processing of data sets. Hadoop is an Apache project being built and used by a global community."*
2. **Ethernet fabrics** (32%). "A type of Ethernet that is aware of all its paths, nodes, requirements, and resources. Ethernet fabrics are able to automatically manage themselves to scale up or down depending on demand."†
3. **Mesh networking** (25%). "A network topology in which each node relays data for the network. All nodes cooperate in the distribution of data in the network. Mesh networks are typically wireless."*
4. **In-memory computing** (21%). "The storage of information in the main random access memory (RAM) of dedicated servers rather than in complicated relational databases operating on comparatively slow disk drives."†
5. **Software-defined networks** (18%). A simplified "approach to networking…[that] allows network administrators to manage network services through abstraction of lower-level functionality. This is done by decoupling the system that makes decisions about where traffic is sent from the underlying systems that forward traffic to the selected destination."*
6. **Quantum computing for researchers** (17%). Support for research in quantum computing, "computation that makes direct use of quantum-mechanical phenomena, such as superposition and entanglement, to perform operations on data." "The emergence of quantum computing is based on a new kind of data unit that could be called non-binary, as it has more than two possible values."†

* Wikipedia, http://www.wikipedia.org/. † Techopedia, http://www.techopedia.com/.

ARCHITECTURE

IT architecture informs and guides technology choices. A well-chosen and well-executed IT architecture can "maximize the impact of strategic thinking while reducing complexity and redundancy where possible."** When asked to describe their IT architecture, respondents were given three options (and allowed to select multiples):

- We follow the architecture of a primary system or suite (e.g., SCT, the Oracle applications suite, Workday, Kuali).
- We locally integrate the architectures of multiple major systems.
- We have local IT architecture standards and conform our local and vendor systems to that architecture.

(continued)

** Susan Grajek and the 2013–2014 EDUCAUSE IT Issues Panel, "Top-Ten IT Issues, 2014: Be the Change You See," *EDUCAUSE Review*, forthcoming March–April 2014, see sidebar by Jim Phelps.

7. **Activity streams** (17%). "An open-format specification for activity-stream protocols, which are used to make available summary or update feeds taken in social web applications and services, similar to those in Facebook's Newsfeed, FriendFeed, the Movable Type Action Streams plugin, etc."*

8. **Content-aware DLP** (16%). These "tools enable the dynamic application of policy based on the content and context at the time of an operation. They are used to address the risk of inadvertent or accidental leaks or the exposure of sensitive enterprise information outside authorized channels, using monitoring, filtering, blocking and remediation features."‡

9. **Affective computing** (15%). "Affective computing technologies sense the emotional state of a user (via sensors, microphone, cameras, and/or software logic) and respond with specific, predefined features, such as changing a quiz or recommending a set of videos to fit the mood of the learner. Affective computing tries to address one of the major drawbacks of online learning versus in-classroom learning—the instructor's ability to immediately adapt the pedagogical situation to the emotional state of the student."‡

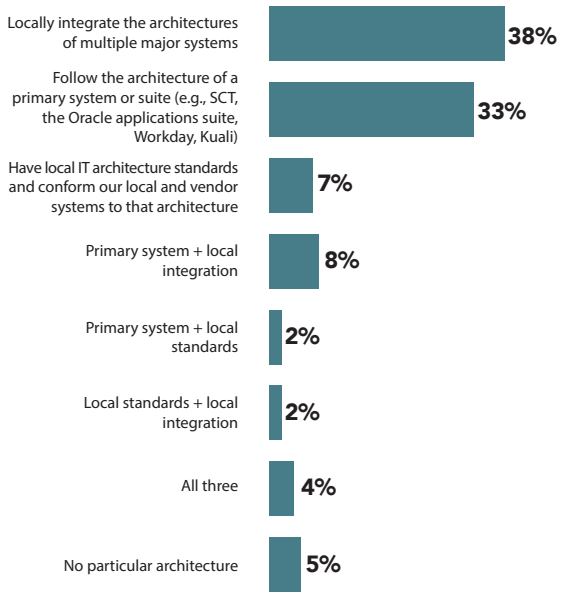
10. **Augmented reality** (14%). "A type of interactive, reality-based display environment that takes the capabilities of computer-generated display, sound, text, and effects to enhance the user's real-world experience. Augmented reality combines real and computer-based scenes and images to deliver a unified but enhanced view of the world."†

* Wikipedia, http://www.wikipedia.org/. † Techopedia, http://www.techopedia.com/. ‡ Gartner IT Glossary, http://www.gartner.com/it-glossary/

ARCHITECTURE, CONTINUED

Only 5% of institutions have not adopted any of these architectures. Most (79%) have adopted a single method, 12% use two, and 4% use all three.

Institutional IT Architecture Approaches



Implications

Where Are We Heading and How Fast?

What do these data tell us about the kinds of progress higher education might make with the technologies measured in this study? We used institutions' intentions to implement and plan technologies in 2014 to estimate deployment of these technologies by 2015 and then by 2016–17 (see figures on pages 24–28).

Of course there is a world of difference between plans and reality: technical, functional, cultural, and executional roadblocks are common; priorities change; and technology itself doesn't stand still. Making predictions is as risky as it is tempting, and these estimates should be highly subject to change.

We estimate that the top-ten strategic technologies will show the greatest increase in deployment.[5] We predict that all ten will be deployed in at least half of colleges and universities by 2017.

We identified 18 additional rapidly increasing technologies beyond the top ten:

- Big data
- Cloud-based e-mail for faculty and staff
- CRM applications for admissions and enrollment
- Data center capacity planning and management tools
- Data warehouse
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Enterprise GRC systems
- Federated identity management
- IT asset management tools
- Mobile data protection
- Mobile device management
- Network capacity planning and management tools
- Online courses on mobile devices
- PCI data security standards
- Predictive analytics
- Private-cloud storage
- Service level reporting tools

We estimate that deployment of each of these technologies will increase by 25 percentage points or more between now and 2017.

Up and Coming

Four technologies that did not make the overall top-ten list were among the top-ten technologies institutions intend to spend planning time on:

- Mobile device management
- Network capacity planning and management tools
- Mobile data protection
- Online courses on mobile devices

These are technologies that could make next year's top-ten list.

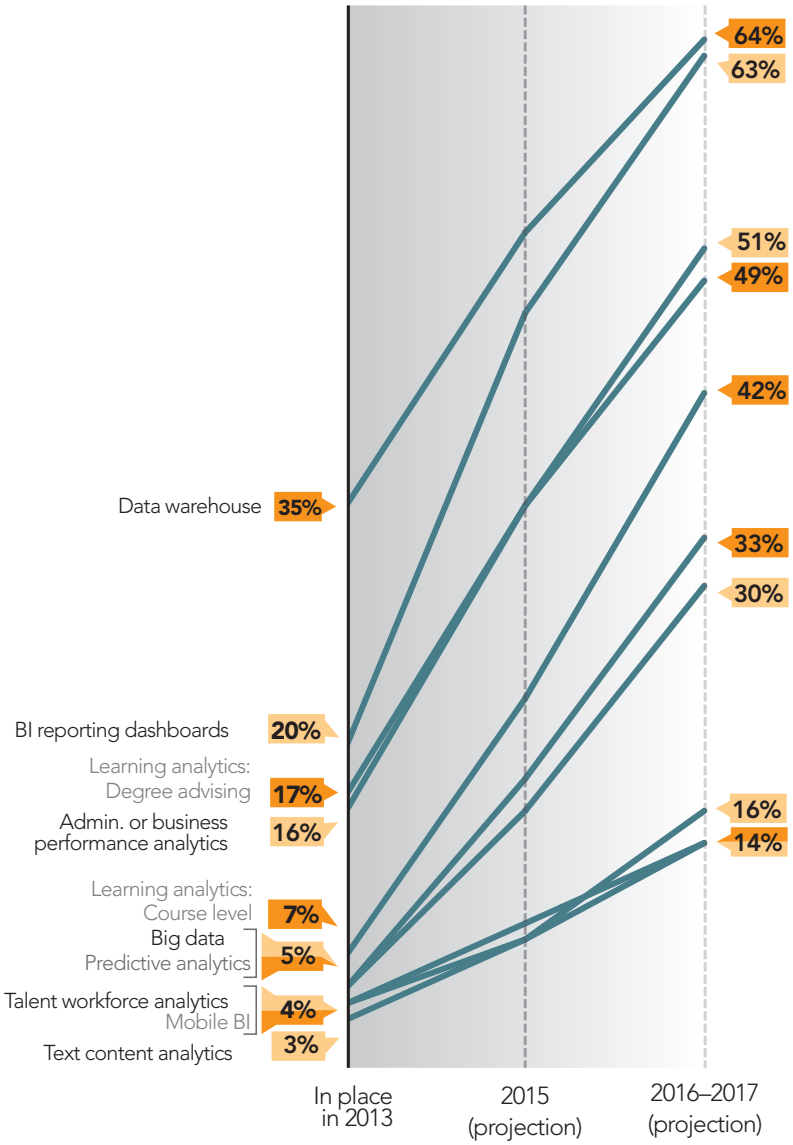
WHAT ARE WE TRACKING?

There is a degree of separation between technology planning and implementation versus technology tracking. None of the technologies institutions are most commonly tracking made the top-ten list. At least 30% of institutions are tracking these 11 technologies in 2014:

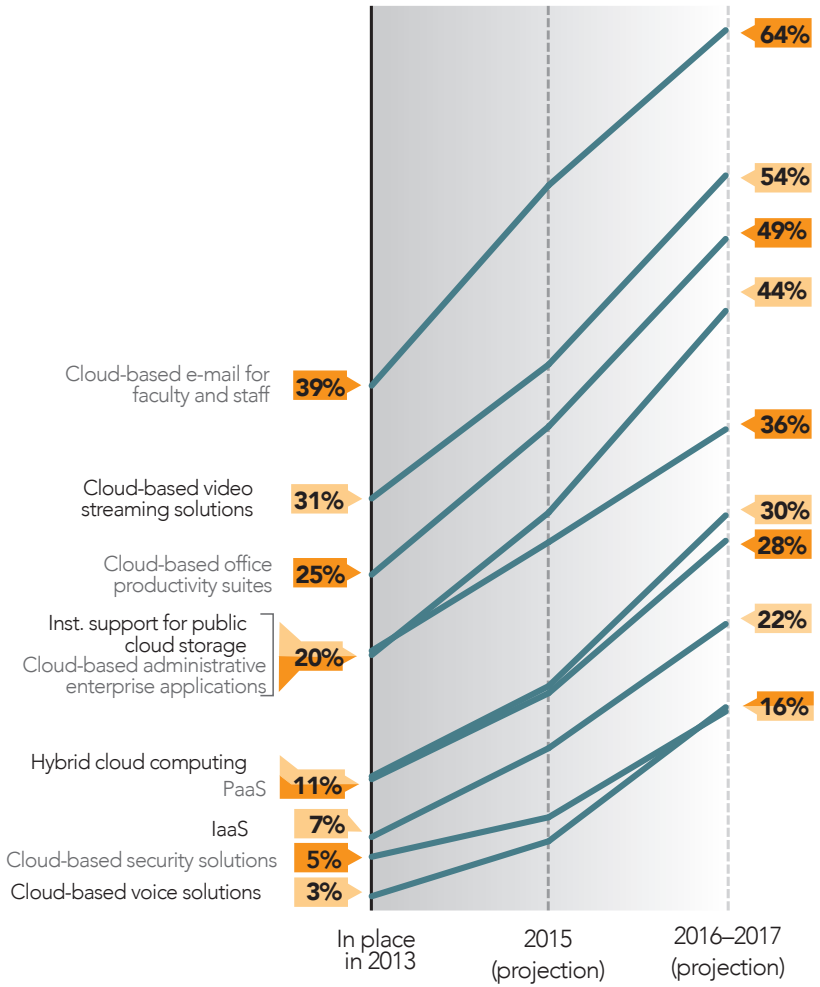
1. Adaptive learning (38% tracking)
2. Gamification (33%)
3. Mobile data protection (33%)
4. Predictive analytics (32%)
5. E-book readers, e-textbooks (32%)
6. IaaS (31%)
7. The Internet of Things (31%)
8. Text content analytics (30%)
9. Mashware (30%)
10. Open content (30%)
11. Big data (30%)

Implications—Implementation Estimates

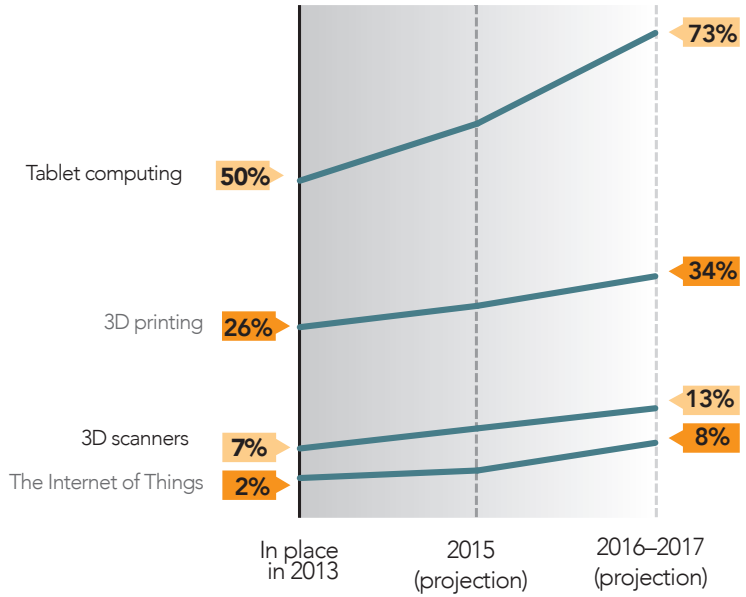
Analytics Technologies



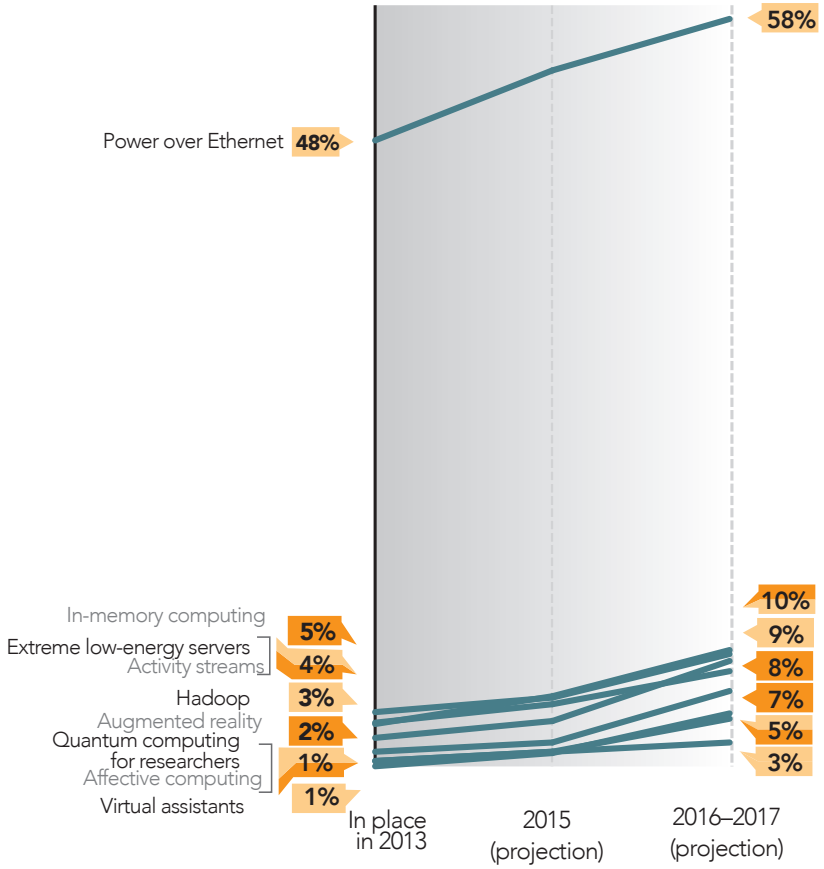
Cloud Technology



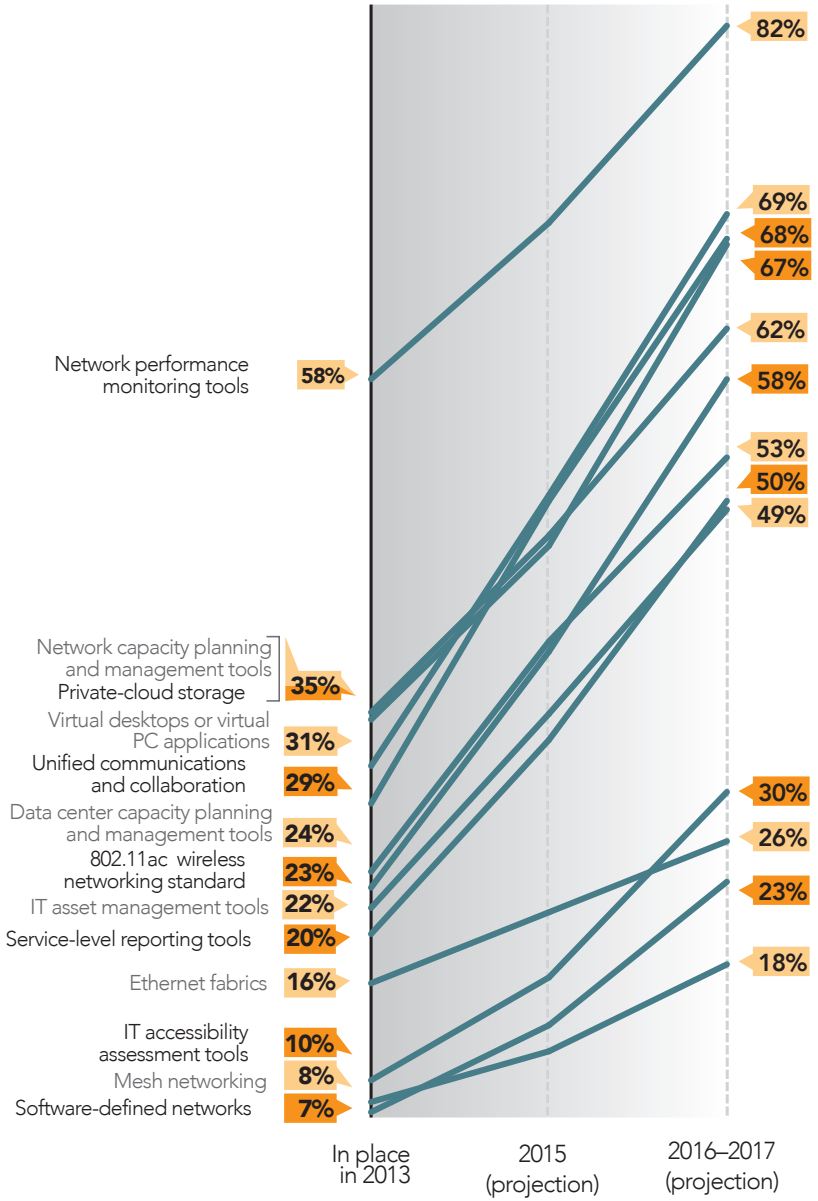
Devices



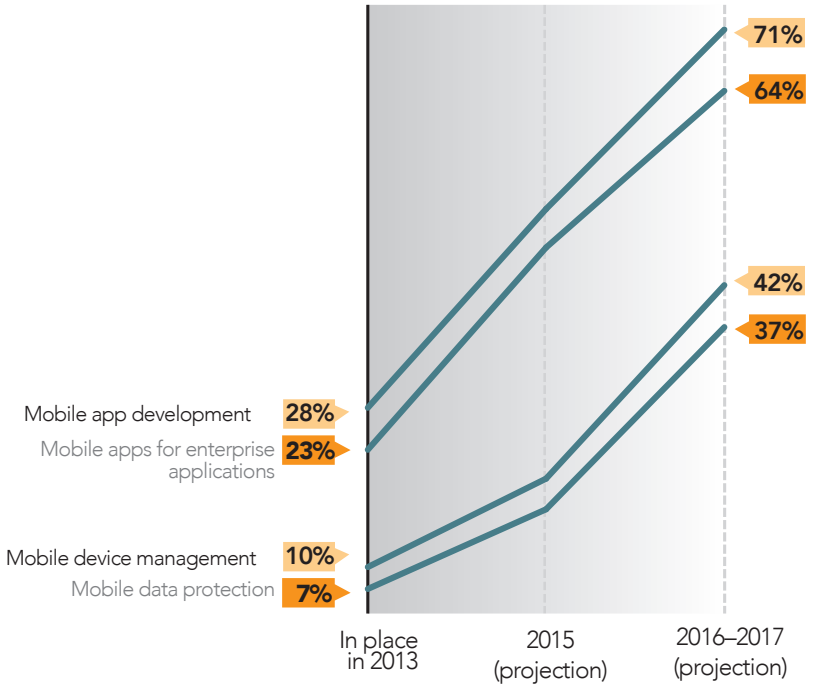
Emergent Technologies



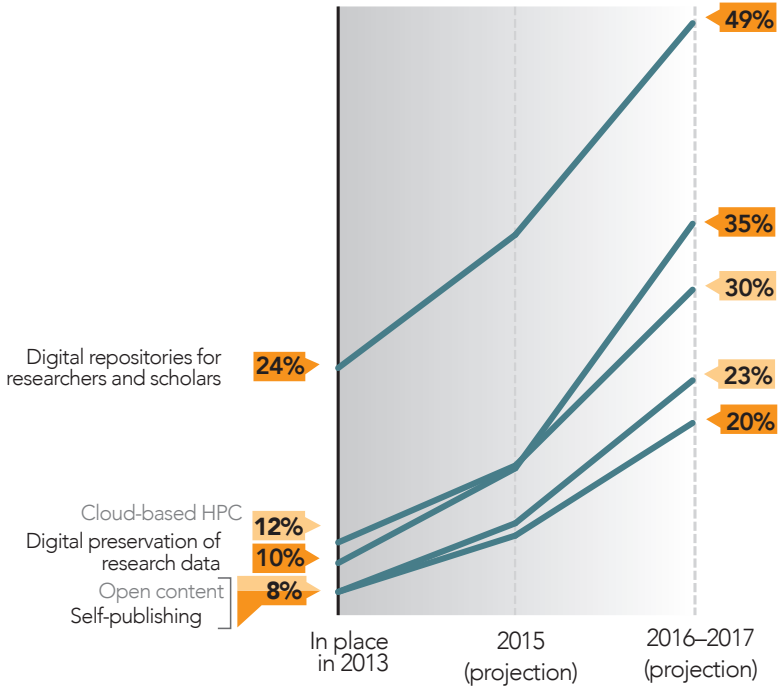
Infrastructure and Operations Technologies



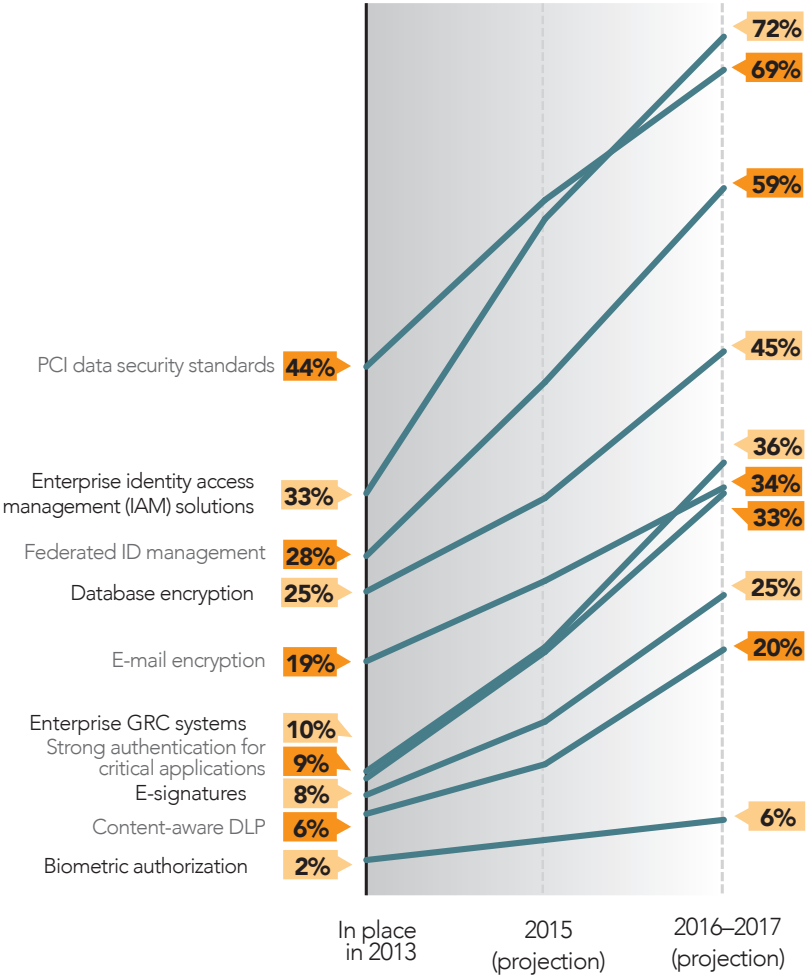
Mobile Technologies



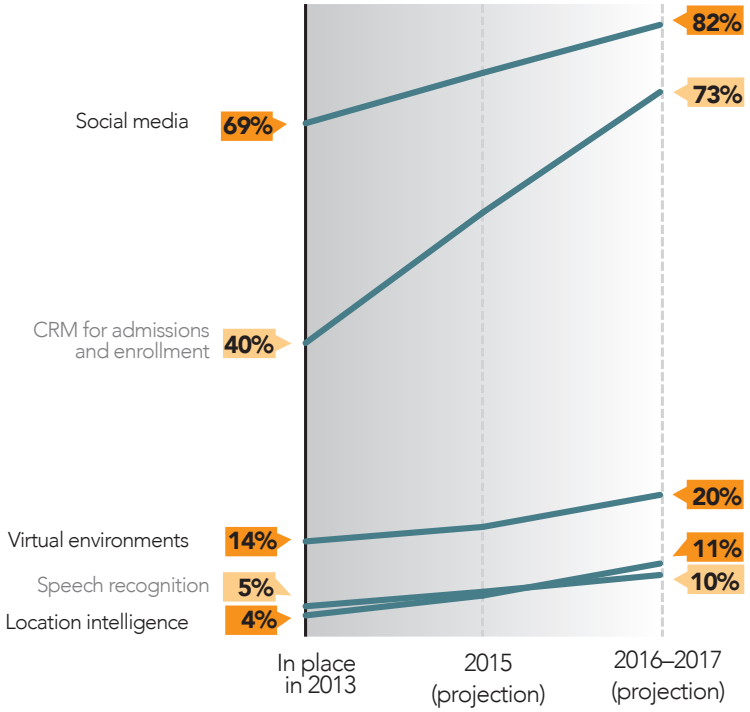
Research and Scholarship Technologies



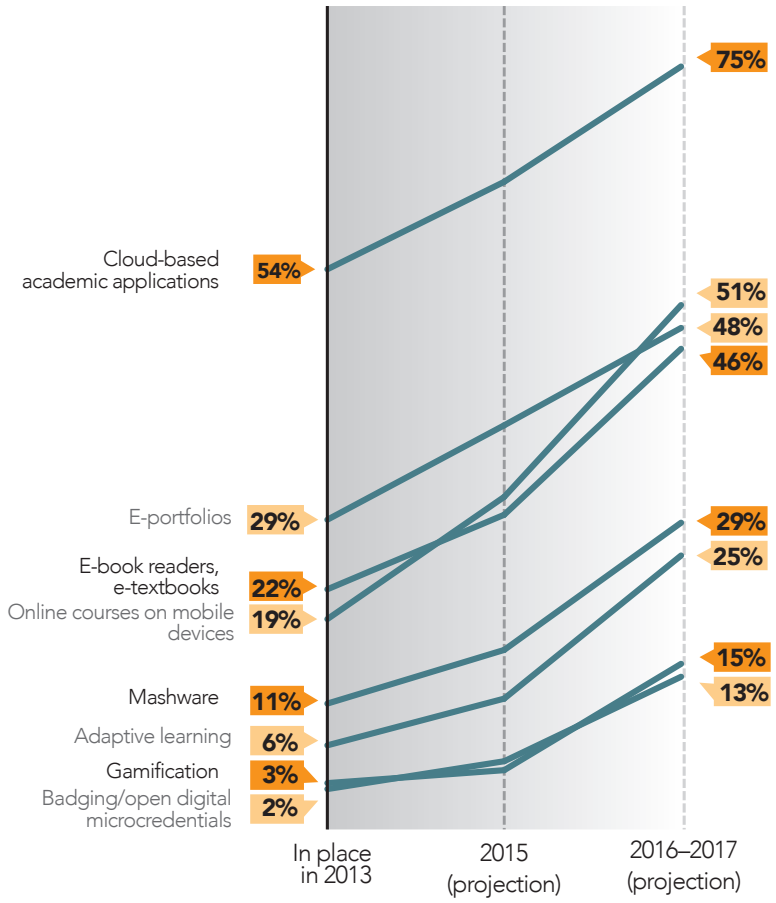
Security and Privacy Technologies



Social and Personal Technologies



Teaching and Learning Technologies



Advice

This list is no substitute for a strategic plan. IT leaders and professionals should always ensure that institutional strategy drives IT strategy and that IT strategy and architecture drive technology decisions.

Learn

- Ensure you are familiar with the top-ten strategic technologies as well as the up-and-coming technologies on page 23.
- Ensure you understand how each technology does, or does not, fit your IT architecture, speed of adoption, and strategic directions.
- Make tracking the most-relevant technologies an organizational priority by including this work in individual and unit goals and in organizational professional development and other activities. Network with peers and solution providers to extend and amplify your own knowledge.

Manage

- Adopt a conscious approach to IT architecture if you have not already done so. If you have, consider whether is it actually being used and truly delivering value.
- Develop a technology plan to accompany and support your institutional and IT strategic plan and update it at least annually.

Lead

- Be capable of serving as your institution's spokesperson for each of these technologies. Have a strategy for educating institutional leadership on the technologies that will be most strategic for your institution in the coming years.

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NOTES

1. EDUCAUSE, "7 Things You Should Know About Federated Identity Management" (Louisville, CO: EDUCAUSE, September 2009), http://www.educause.edu/library/resources/7-things-you-should-know-about-federated-identity-management.

2. Angela van Barneveld, Kimberly E. Arnold, and John P. Campbell, "Analytics in Higher Education: Establishing a Common Language," ELI paper (Louisville, CO: EDUCAUSE Learning Initiative, January 2012), http://net.educause.edu/ir/library/pdf/ELI3026.pdf.

3. EDUCAUSE, "7 Things You Should Know About Virtualization" (Louisville, CO: EDUCAUSE, October 2009), http://www.educause.edu/library/resources/7-things-you-should-know-about-virtualization.

4. Ronald Yanosky, *Integrated Planning and Advising Services: A Benchmarking Study*, research report (Louisville, CO: EDUCAUSE Center for Analysis and Research, forthcoming).

5. We chose to measure the increase in deployment by the absolute rather than relative increase in the percentage of institutions that have deployed a technology. So instead of looking at rate of change, we looked at increase in base: A technology that was in place at 20% of institutions today and estimated to be in place at 40% of institutions by 2017 was considered to be showing equivalent growth to one in place at 50% of institutions today and 70% by 2017.

6. Primary sources were *The Horizon Report*, Gartner's 2012 and 2013 Top Technology Trends, and multiple 2013 Gartner Hype Cycles (education, big data, cloud computing, cloud security, enterprise architecture, enterprise information management, GRC, IAM, IT operations management, privacy, business intelligence and analytics, and emerging technologies). We augmented those with several additional technologies, most notably in analytics.

Appendix: Methodology

The list of 78 technologies was derived from several authoritative sources that annually identify emerging and maturing technologies in higher education[6] and additional reviews by the ECAR Working Group Strategies Committee and other technical experts. Even so, we cannot claim the list is comprehensive. There are likely missing technologies (we might have included multifactor authentication), as well as misplaced technologies (some might argue that cloud-based e-mail for faculty and staff is too mature for this list). The technologies were slotted into ten major categories:

Analytics Technologies

- Administrative or business performance analytics
- BI reporting dashboards
- Big data
- Data warehouse
- Learning analytics: Course level
- Learning analytics: Degree advising
- Mobile BI
- Predictive analytics
- Talent workforce analytics
- Text content analytics

Cloud Sourcing Technologies

- Application PaaS
- Cloud-based administrative enterprise applications
- Cloud-based e-mail for faculty and staff
- Cloud-based office productivity suites
- Cloud-based security services
- Cloud-based video streaming solutions
- Cloud-based voice solutions
- Hybrid cloud computing
- IaaS
- Institutional support for public cloud storage

Devices

- 3D printing
- 3D scanners
- Tablet computing
- The Internet of Things

Emerging Technologies

- Activity streams
- Affective computing
- Augmented reality
- Extreme-low-energy servers
- Hadoop
- In-memory computing
- Power over Ethernet
- Quantum computing for researchers
- Virtual assistants

Infrastructure and Operations Technologies

- 802.11ac wireless networking standard
- Data center capacity planning and management tools
- Ethernet fabrics
- IT accessibility assessment tools
- IT asset management tools
- Mesh networking
- Network capacity planning and management tools
- Network performance monitoring tools
- Private-cloud storage
- Service-level reporting tools
- Software-defined networks
- Unified communications and collaboration
- Virtual desktops or virtual PC applications

Mobile Technologies

- Mobile app development
- Mobile apps for enterprise applications
- Mobile data protection
- Mobile device management

Research and Scholarship Technologies

- Cloud-based HPC
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Open content
- Self-publishing

Security and Privacy Technologies

- Biometric authentication
- Content-aware DLP
- Database encryption
- E-mail encryption
- Enterprise IAM solutions
- Enterprise GRC systems
- E-signatures
- Federated ID management
- PCI data security standards
- Strong authentication for critical applications

Social/Personal Technologies

- CRM for admissions and enrollment
- Location intelligence
- Social media
- Speech recognition
- Virtual environments

Teaching and Learning Technologies

- Adaptive learning
- Badging/open digital microcredentials
- Cloud-based academic applications
- E-book readers, e-textbooks
- E-portfolios
- Gamification
- Mashware
- Online courses on mobile devices

The survey was distributed to 10,393 EDUCAUSE members as part of the top-ten IT Issues survey; 444 members responded and indicated, for each technology, the attention their institution was planning to devote to each technology in 2014. Respondents selected one of six response options: no meaningful investment, track (multiple person-days), plan (multiple person-weeks), implement (multiple person-months), in place, or unfamiliar with the technology. Because the list was so long and to minimize "unfamiliar" responses, respondents were given the option of identifying their IT domains and responding only for them. The number of respondents rating individual technologies ranged from 276 to 321.

The final top-ten list of strategic technologies is a weighted average of institutions' plans, with the heaviest weight given to implementation, followed by planning, and then tracking. Other response options (no plans, in place, and unfamiliar with technology) were given a weight of zero in our scoring schema.