EDUCAUSE CENTER FOR ANALYSIS AND RESEARCH

Higher Education's Top 10 Strategic Technologies for 2015

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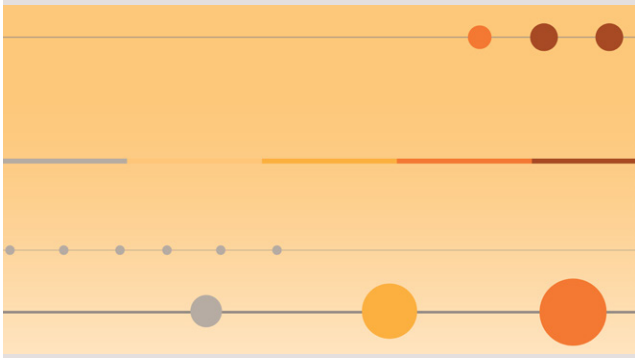
Contents

Introduction and Overview	3
Key Findings	4
The Top 10 Strategic Technologies for 2015	5
Descriptions	6
Findings	8
Graphics: Higher Education's Technology Priorities for 2015	8
Implications	27
Graphics: Estimated Five-Year Adoption Trends	29
Advice	37
Acknowledgments	38
Appendix: Methodology	39



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EDUCAUSE

EDUCAUSE is a nonprofit association and the foremost community of IT leaders and professionals committed to advancing higher education. EDUCAUSE programs and services are focused on analysis, advocacy, community building, professional development, and knowledge creation because IT plays a transformative role in higher education. EDUCAUSE supports those who lead, manage, and use information technology through a comprehensive range of resources and activities. For more information, visit educause.edu.

Introduction and Overview

The introduction and retooling of technologies is a major focus of higher education IT organizations and budgets. Institutions are introducing new technologies to leverage trends in analytics, mobile, social, and cloud; to respond to risks; and to up their games in teaching and learning, student success, and research. Very few institutions are resourced to move as comprehensively and quickly as might be desired. This report provides a snapshot of the new technological investments colleges and universities are actually planning and implementing in 2015, as well as technologies they are tracking or simply not addressing for the time being.

This report is focused on strategic technologies. We define a technology as "strategic" based on the time, active attention, and priority devoted to it at a given time. Mature, more commonly deployed technologies (such as financial information systems or networks) may be among the most mission-critical technologies, but they are generally more likely to receive operational than strategic attention. EDUCAUSE tracks those established technologies in the Core Data Service[1] because they are widespread enough to enable institution-level benchmarking. Strategic technologies, by contrast, are relatively new technologies institutions will be spending the most time implementing, planning, and tracking in 2015. IT leaders and professionals are particularly interested in whether and when to invest in these still-maturing technologies. Of the 107 technologies covered in this report, only 4 are currently in place in more than 30% of institutions, and among the top 10 strategic technologies, only one-third to one-half of institutions intend to plan or implement any of those technologies in 2015. However, each technology in the top 10 is at least being tracked by three-quarters of institutions.

The top 10 strategic technologies were selected from the analysis of a vetted set of 107 technologies presented to EDUCAUSE members in a survey in summer 2014, as described in the Methodology section of this report. This report does not aim to justify the importance of or examine 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.

The top 10 strategic technologies in higher education complement the popular EDUCAUSE top 10 IT issues.[2] Together, the two resources can provide more complete and nuanced guidance on institutional IT priorities. A new, third ECAR report summarizes the influence on institutional IT strategy of trends such as shared services, IT complexity, and agile approaches to change.[3] It provides yet more context and insight to guide IT strategy.

Key Findings

- The year 2015 is all about mobile. Seven of the 2015 top 10 strategic technologies are directly or indirectly (e.g., unified communications and collaboration) related to mobile computing.
- Analytics technologies still appear in the top 10 but not as prominently as in 2014. This year, only two of the top 10 are in the area of analytics, whereas in 2014 there were four.
- Three technologies that were among the 2014 top 10 dropped off the 2015 list: Course-level learning analytics dropped to 15, and degree-advising learning analytics and virtual desktops or virtual PC applications dropped into a tie at 11. This is not because fewer institutions are implementing, planning, or tracking these technologies in 2015. Rather, it reflects even greater attention being paid to other technologies, particularly the three that supplanted them: incorporation of mobile devices in teaching and learning, mobile data protection, and mobile apps for teaching and learning. Attention is not shifting; it is expanding.
- We predict that adoption of five of the top 10 technologies—BI/reporting dashboards, mobile app development, mobile apps for enterprise applications, enterprise identity and access management solutions, and 802.11ac wireless networking standard—will progress to Mainstream (deployed in 61–80% of institutions) by the end of this decade. The five other technologies in the top 10 will achieve Growing adoption (deployed in 41–60% of institutions): administrative/business performance analytics, incorporation of mobile devices in teaching and learning, mobile apps for teaching and learning, mobile data protection, and unified communications and collaboration.
- Grouping the 107 technologies into 15 technology domains, the 4 domains whose adoption we predict will make the most progress this decade are mobile, user support, enterprise IT, and, within doctoral universities, research and scholarship.
- Further out, institutions are devoting the most attention to tracking these technologies: adaptive learning, mobile data protection, e-textbooks, course-level learning analytics, and uses of the Internet of Things.

The Top 10 Strategic Technologies for 2015

Numbers in parentheses are the 2014 ranks.

1. BI/reporting dashboards (1)
2. Mobile app development (HTML5, responsive design, hybrid, etc.) (3)
3. Mobile apps for enterprise applications (2)
4. Administrative/business performance analytics (6)
5. 802.11ac wireless networking standard (8)
6. Enterprise identity and access management solutions (4)
7. Incorporation of mobile devices in teaching and learning*
8. Mobile data protection (11)
9. Unified communications and collaboration (7)
10. Mobile apps for teaching and learning†

* This technology appeared as *Online courses on mobile devices* and was 15th on the list.

† This technology was not in the 2014 survey

Descriptions

1. **Business intelligence (BI) reporting dashboards**, sometimes also known 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 graduation rates to research funding and expenditures to strategic project status indicators. Some allow drill-down, on-the-fly analytics. The purpose of the dashboard is to display the status of the underlying organization's business activities.

2. **Mobile app development** is the organizational capability for the development of mobile applications. A number of development questions need to be answered 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.

3. **Mobile apps for enterprise applications** refers generally to web-based 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 mobile devices.

4. **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 focus on the collection, analysis, and reporting of business data (e.g., financial or budgetary) to improve organizational success.

5. **The 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.

6. **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 extend this approach above the enterprise level, creating a trusted authority for digital identities across multiple organizations.

7. **Incorporation of mobile devices in teaching and learning** is a broad area that entails adopting these devices as tools to enhance the learning experience for students and the teaching experience for faculty. This could mean an extension of the classroom to the anytime, anywhere learning environment. This could also mean leveraging common mobile device features and applications to increase productivity, capture and archive course material, share information, and support the shift of students as consumers to students as creators. Moving beyond the novelty of using mobile devices to look up information or access course assignments, the unrealized value lies in using them to facilitate creativity, engagement, and interaction—all demonstrated to have a positive impact on student outcomes.

8. **Mobile data protection** protects data stored on laptops, tablets, removable media, and other mobile devices, as well as desktops and servers. Some definitions include cloud-based storage environments like Box or Google Drive. Protection is generally provided using encryption and access control.

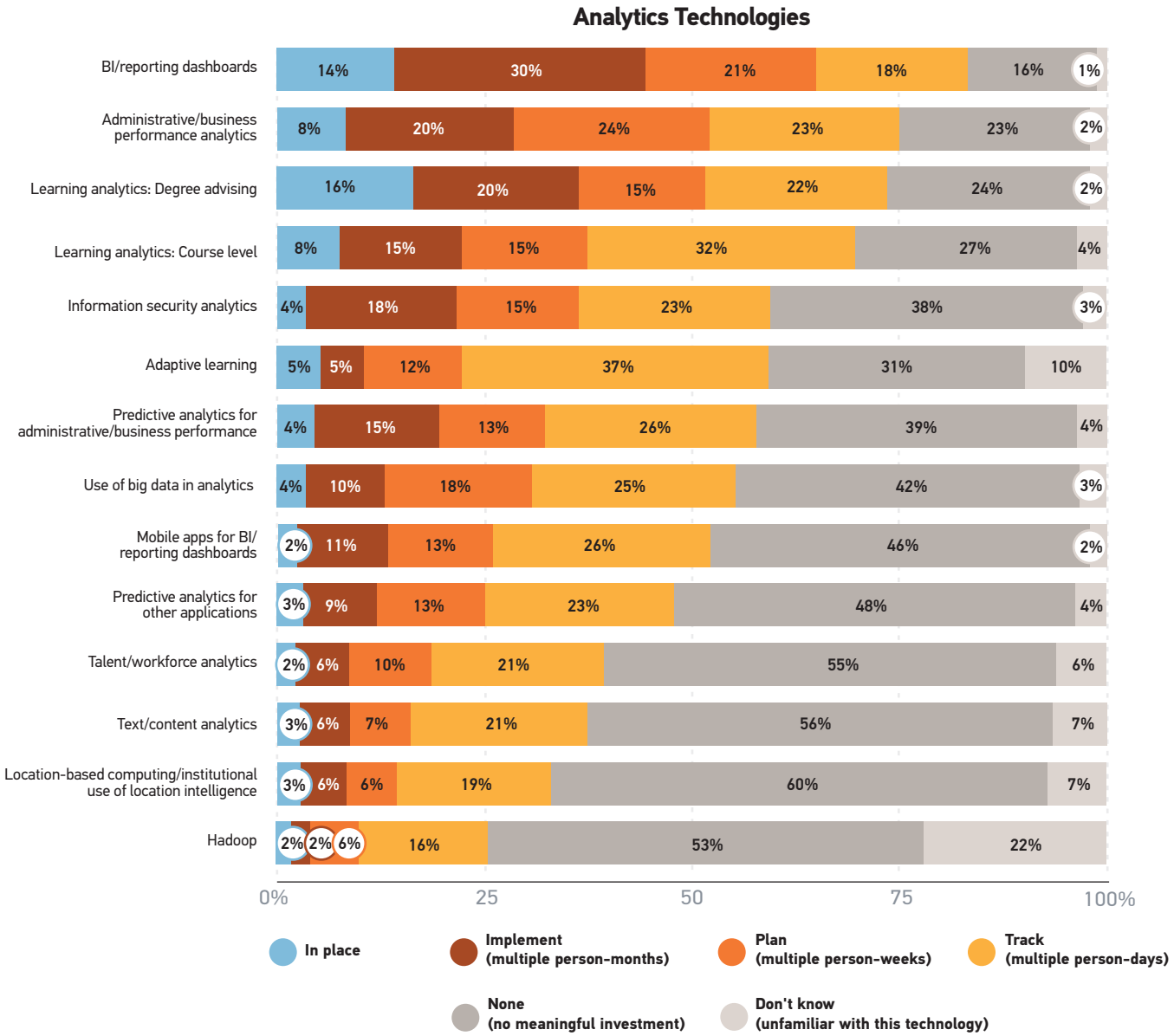
9. **Unified communications and collaboration** refers to the integration of communication methods and technologies, both with each other and with other applications. It can pertain to technologies such as instant messaging, telephony, videoconferencing, desktop sharing, data sharing, speech recognition, and unified messaging technologies (integrated voicemail, e-mail, SMS, and fax). These technologies converge and enable the use of multiple enterprise communication outlets.

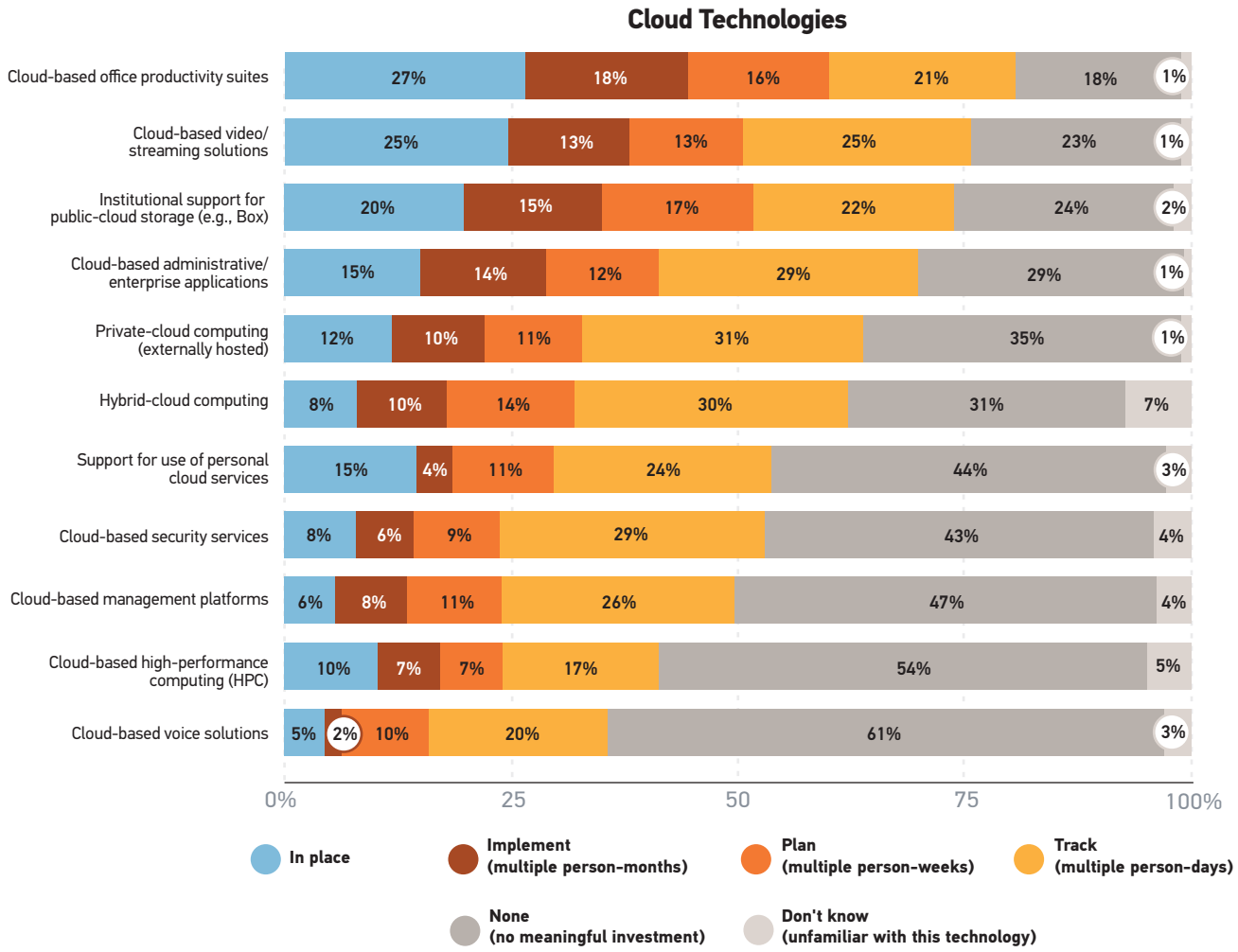
10. **Mobile apps for teaching and learning** support the use of general productivity, institutional, and course-specific resources and experiences on mobile devices. Mobile apps in the next-generation digital learning environment will allow faculty to customize the learning experience for students and will permit students to personalize the experience for themselves. These could be ultra-mobile-friendly and personalized LMS user interfaces; externally developed apps that are appropriate for a particular assignment, instructor, or subject; or internally developed apps that create campus-specific interaction and engagement experiences.

Findings

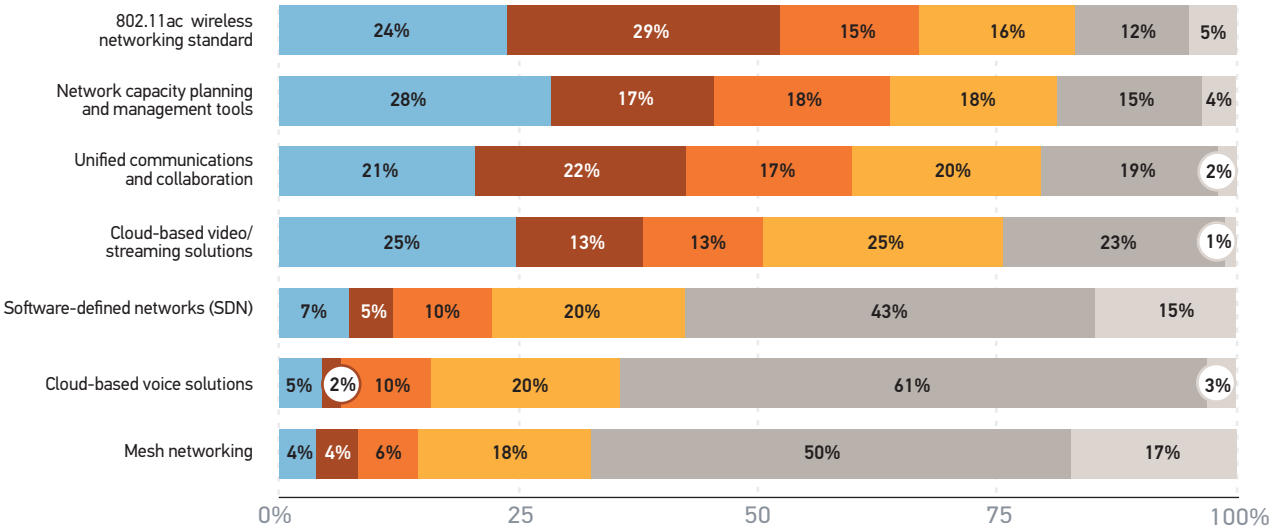
The top 10 technologies were identified from a list of 107 technologies organized into 15 domain areas. Some technologies were included in more than one domain. The figures on pages 8–20 summarize institutions' plans for the technologies within each domain.[4]

Higher Education's Technology Priorities for 2015

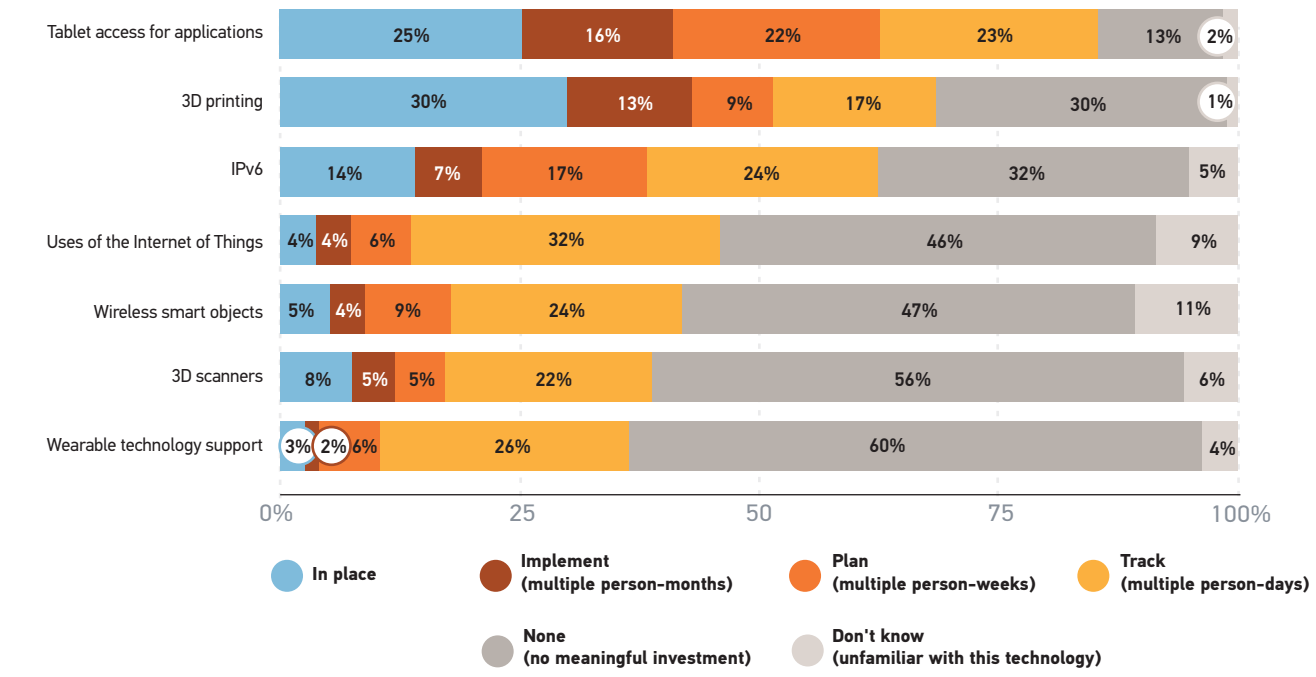


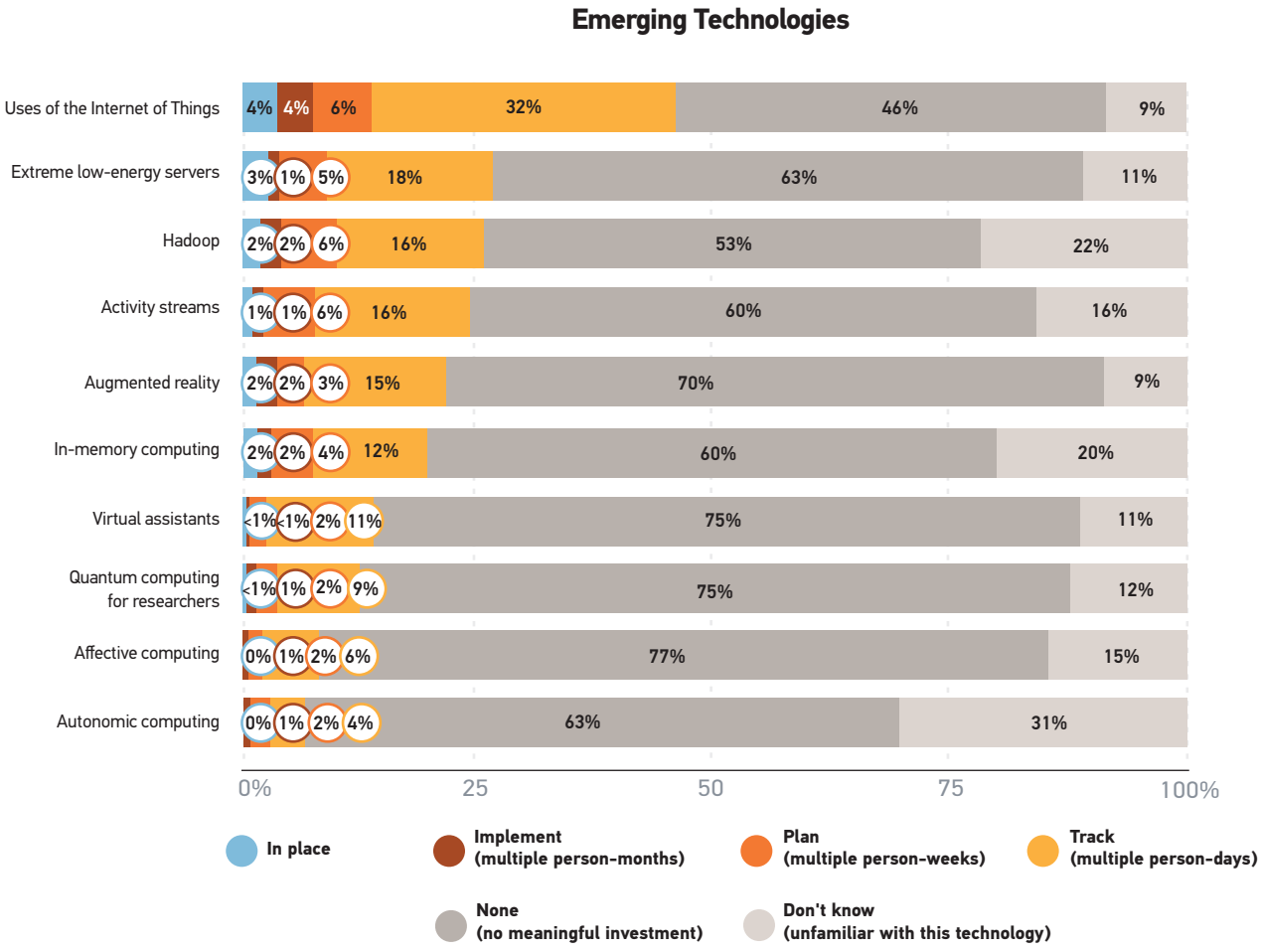

Cloud Technologies
Cloud-based office productivity suites
27%
18%
16%
21%
18%
1%
Cloud-based video/ streaming solutions
25%
13%
13%
25%
23%
1%
Institutional support for public-cloud storage (e.g., Box)
20%
15%
17%
22%
24%
2%
Cloud-based administrative/ enterprise applications
15%
14%
12%
29%
29%
1%
Private-cloud computing (externally hosted)
12%
10%
11%
31%
35%
1%
Hybrid-cloud computing
8%
10%
14%
30%
31%
7%
Support for use of personal cloud services
15%
4%
11%
24%
44%
3%
Cloud-based security services
8%
6%
9%
29%
43%
4%
Cloud-based management platforms
6%
8%
11%
26%
47%
4%
Cloud-based high-performance computing (HPC)
10%
7%
7%
17%
54%
5%
Cloud-based voice solutions
5%
2%
10%
20%
61%
3%
0%
25
50
75
100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)

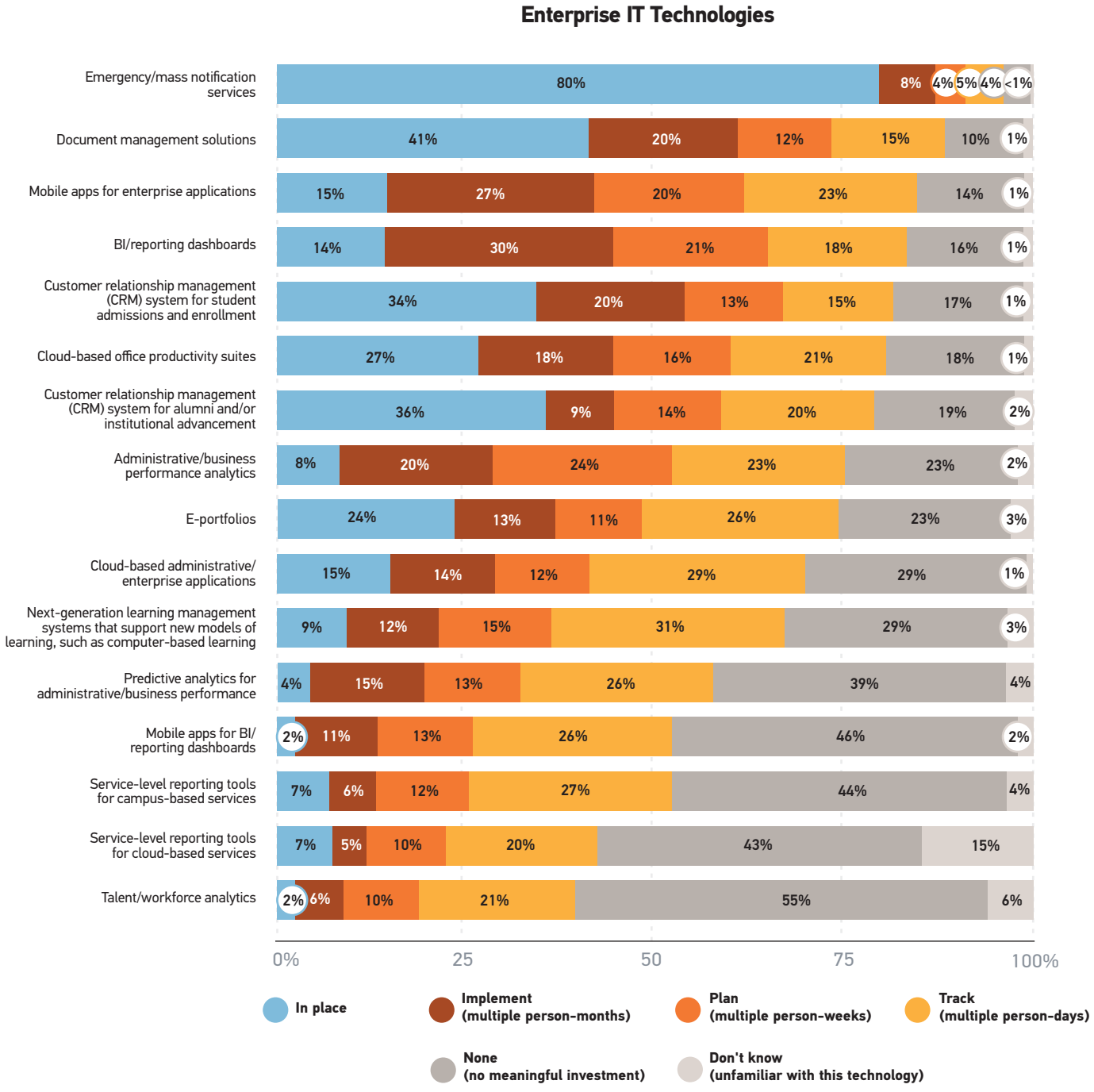
Communications/Networking Technologies

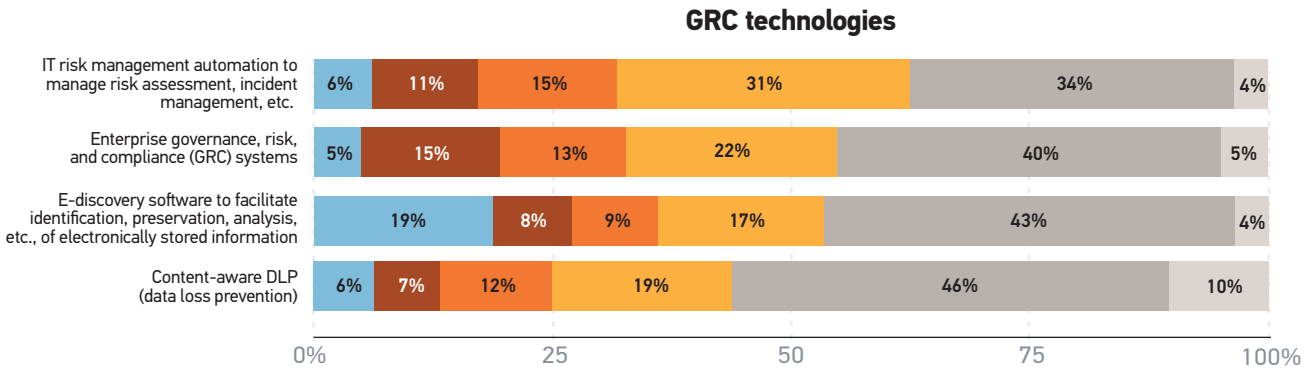


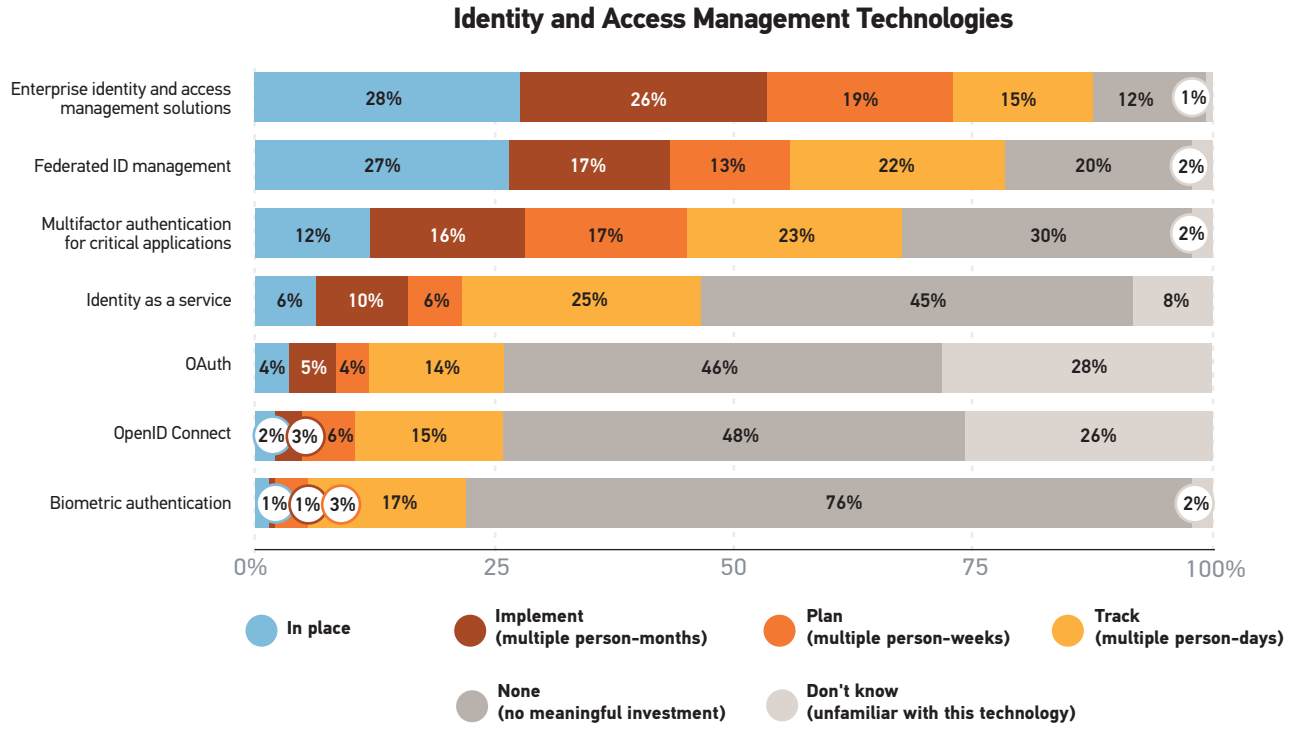
Devices

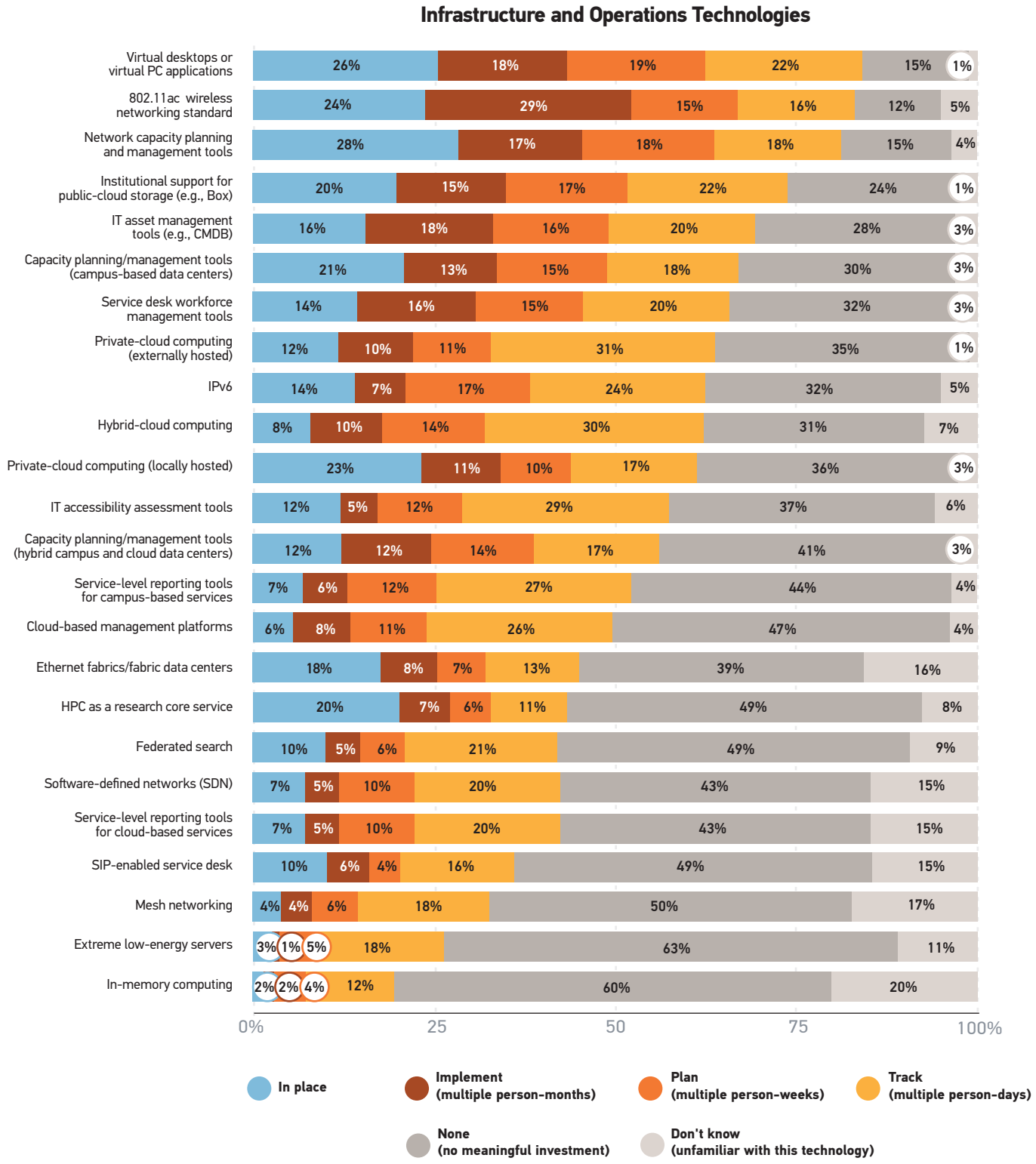


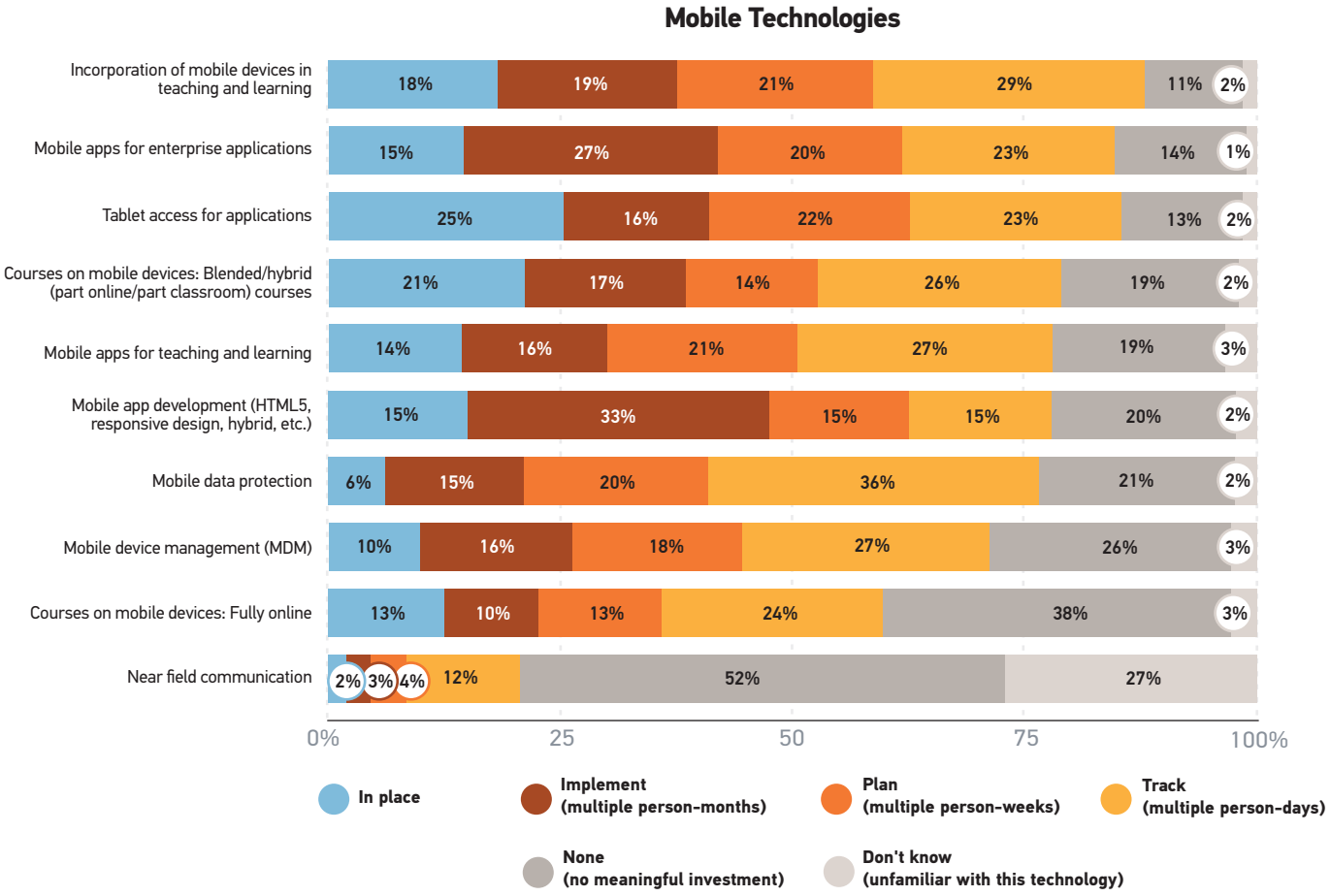

Emerging Technologies
Uses of the Internet of Things
4%
4%
6%
32%
46%
9%
Extreme low-energy servers
3%
1%
5%
18%
63%
11%
Hadoop
2%
2%
6%
16%
53%
22%
Activity streams
1%
1%
6%
16%
60%
16%
Augmented reality
2%
2%
3%
15%
70%
9%
In-memory computing
2%
2%
4%
12%
60%
20%
Virtual assistants
<1%
<1%
2%
11%
75%
11%
Quantum computing for researchers
<1%
1%
2%
9%
75%
12%
Affective computing
0%
1%
2%
6%
77%
15%
Autonomic computing
0%
1%
2%
4%
63%
31%
0%
25
50
75
100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)


Enterprise IT Technologies
Emergency/mass notification services
80%
8%
4%
5%
4%
<1%
Document management solutions
41%
20%
12%
15%
10%
1%
Mobile apps for enterprise applications
15%
27%
20%
23%
14%
1%
BI/reporting dashboards
14%
30%
21%
18%
16%
1%
Customer relationship management (CRM) system for student admissions and enrollment
34%
20%
13%
15%
17%
1%
Cloud-based office productivity suites
27%
18%
16%
21%
18%
1%
Customer relationship management (CRM) system for alumni and/or institutional advancement
36%
9%
14%
20%
19%
2%
Administrative/business performance analytics
8%
20%
24%
23%
23%
2%
E-portfolios
24%
13%
11%
26%
23%
3%
Cloud-based administrative/ enterprise applications
15%
14%
12%
29%
29%
1%
Next-generation learning management systems that support new models of learning, such as computer-based learning
9%
12%
15%
31%
29%
3%
Predictive analytics for administrative/business performance
4%
15%
13%
26%
39%
4%
Mobile apps for BI/ reporting dashboards
2%
11%
13%
26%
46%
2%
Service-level reporting tools for campus-based services
7%
6%
12%
27%
44%
4%
Service-level reporting tools for cloud-based services
7%
5%
10%
20%
43%
15%
Talent/workforce analytics
2%
6%
10%
21%
55%
6%
0%
25
50
75
100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)

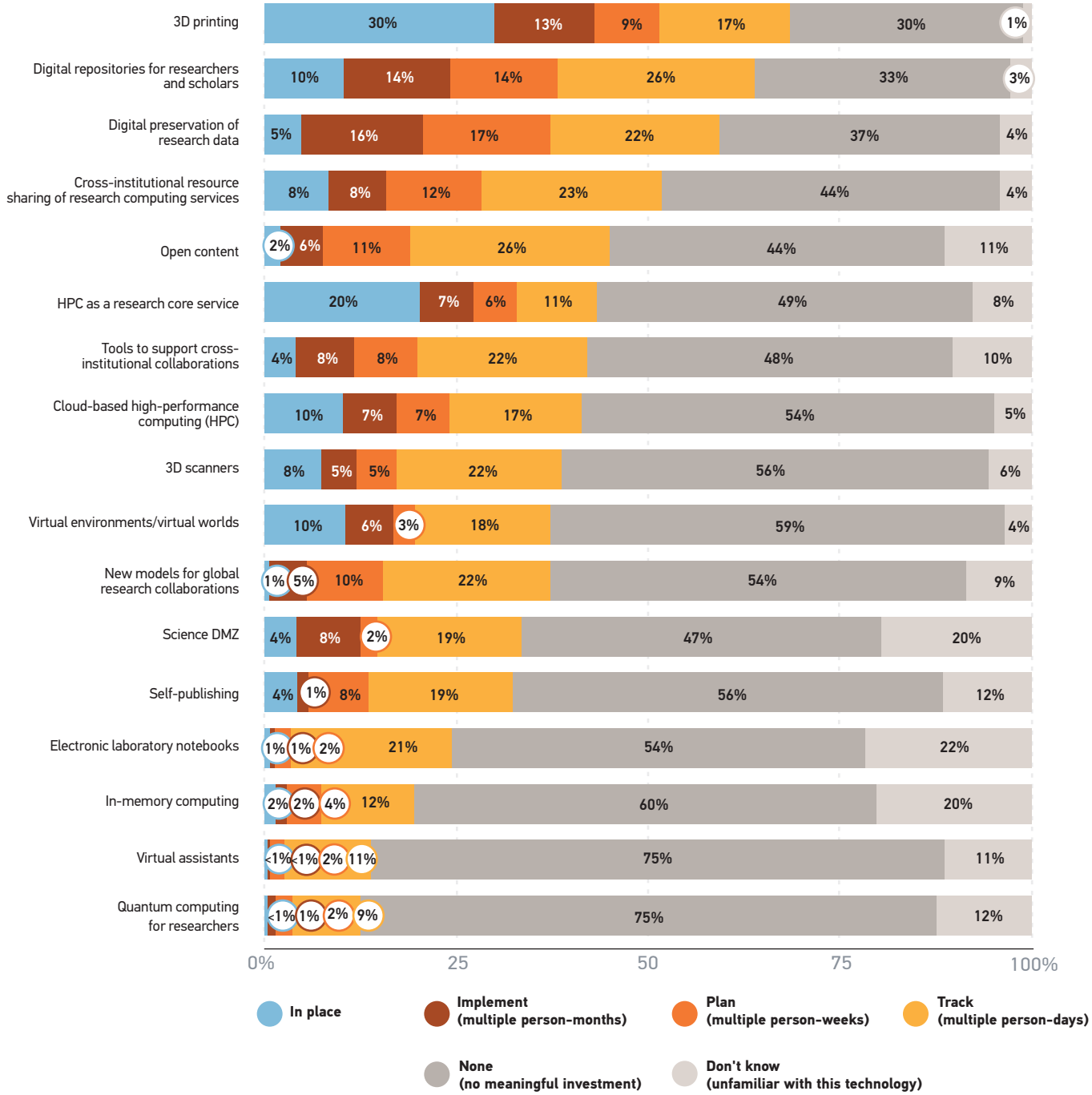

GRC technologies
IT risk management automation to manage risk assessment, incident management, etc.
6%
11%
15%
31%
34%
4%
Enterprise governance, risk, and compliance (GRC) systems
5%
15%
13%
22%
40%
5%
E-discovery software to facilitate identification, preservation, analysis, etc., of electronically stored information
19%
8%
9%
17%
43%
4%
Content-aware DLP (data loss prevention)
6%
7%
12%
19%
46%
10%
0%
25
50
75
100%


Identity and Access Management Technologies
Enterprise identity and access management solutions
28%
26%
19%
15%
12%
1%
Federated ID management
27%
17%
13%
22%
20%
2%
Multifactor authentication for critical applications
12%
16%
17%
23%
30%
2%
Identity as a service
6%
10%
6%
25%
45%
8%
OAuth
4%
5%
4%
14%
46%
28%
OpenID Connect
2%
3%
6%
15%
48%
26%
Biometric authentication
1%
1%
3%
17%
76%
2%
0%
25
50
75
100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)

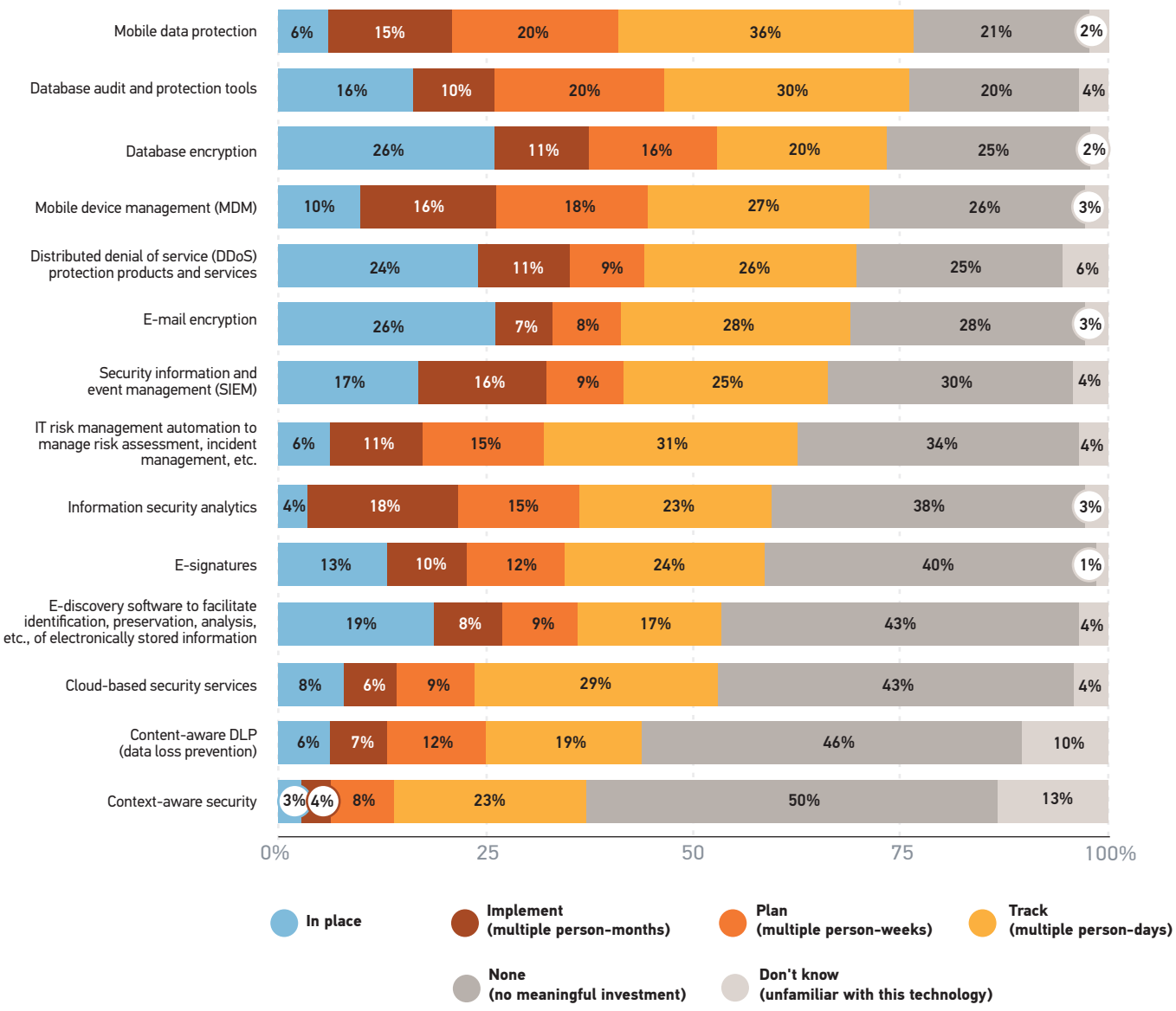

Infrastructure and Operations Technologies
Virtual desktops or virtual PC applications
26% 18% 19% 22% 15% 1%
802.11ac wireless networking standard
24% 29% 15% 16% 12% 5%
Network capacity planning and management tools
28% 17% 18% 18% 15% 4%
Institutional support for public-cloud storage (e.g., Box)
20% 15% 17% 22% 24% 1%
IT asset management tools (e.g., CMDB)
16% 18% 16% 20% 28% 3%
Capacity planning/management tools (campus-based data centers)
21% 13% 15% 18% 30% 3%
Service desk workforce management tools
14% 16% 15% 20% 32% 3%
Private-cloud computing (externally hosted)
12% 10% 11% 31% 35% 1%
IPv6
14% 7% 17% 24% 32% 5%
Hybrid-cloud computing
8% 10% 14% 30% 31% 7%
Private-cloud computing (locally hosted)
23% 11% 10% 17% 36% 3%
IT accessibility assessment tools
12% 5% 12% 29% 37% 6%
Capacity planning/management tools (hybrid campus and cloud data centers)
12% 12% 14% 17% 41% 3%
Service-level reporting tools for campus-based services
7% 6% 12% 27% 44% 4%
Cloud-based management platforms
6% 8% 11% 26% 47% 4%
Ethernet fabrics/fabric data centers
18% 8% 7% 13% 39% 16%
HPC as a research core service
20% 7% 6% 11% 49% 8%
Federated search
10% 5% 6% 21% 49% 9%
Software-defined networks (SDN)
7% 5% 10% 20% 43% 15%
Service-level reporting tools for cloud-based services
7% 5% 10% 20% 43% 15%
SIP-enabled service desk
10% 6% 4% 16% 49% 15%
Mesh networking
4% 4% 6% 18% 50% 17%
Extreme low-energy servers
3% 1% 5% 18% 63% 11%
In-memory computing
2% 2% 4% 12% 60% 20%
0% 25 50 75 100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)

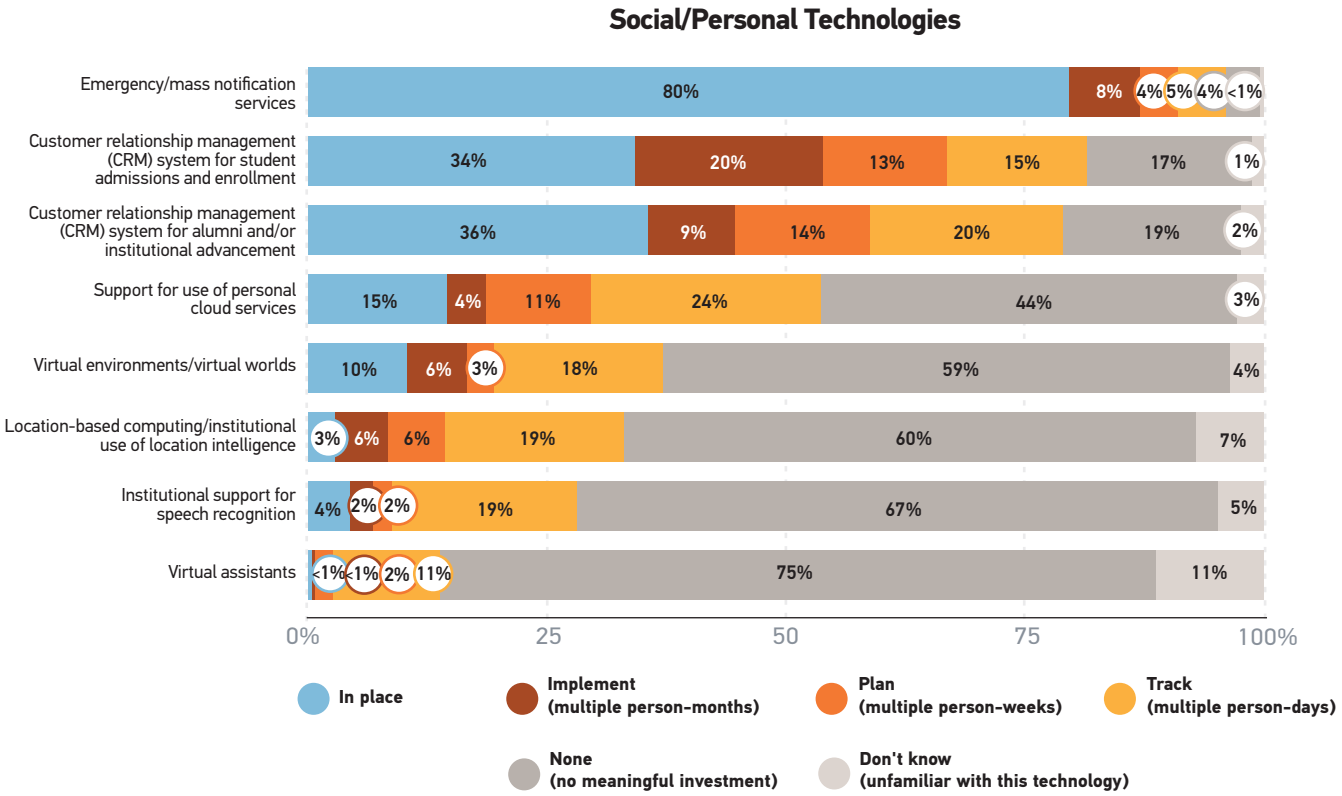

Mobile Technologies
Incorporation of mobile devices in teaching and learning
18% 19% 21% 29% 11% 2%
Mobile apps for enterprise applications
15% 27% 20% 23% 14% 1%
Tablet access for applications
25% 16% 22% 23% 13% 2%
Courses on mobile devices: Blended/hybrid (part online/part classroom) courses
21% 17% 14% 26% 19% 2%
Mobile apps for teaching and learning
14% 16% 21% 27% 19% 3%
Mobile app development (HTML5, responsive design, hybrid, etc.)
15% 33% 15% 15% 20% 2%
Mobile data protection
6% 15% 20% 36% 21% 2%
Mobile device management (MDM)
10% 16% 18% 27% 26% 3%
Courses on mobile devices: Fully online
13% 10% 13% 24% 38% 3%
Near field communication
2% 3% 4% 12% 52% 27%
0% 25 50 75 100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)

Research and Scholarship Technologies

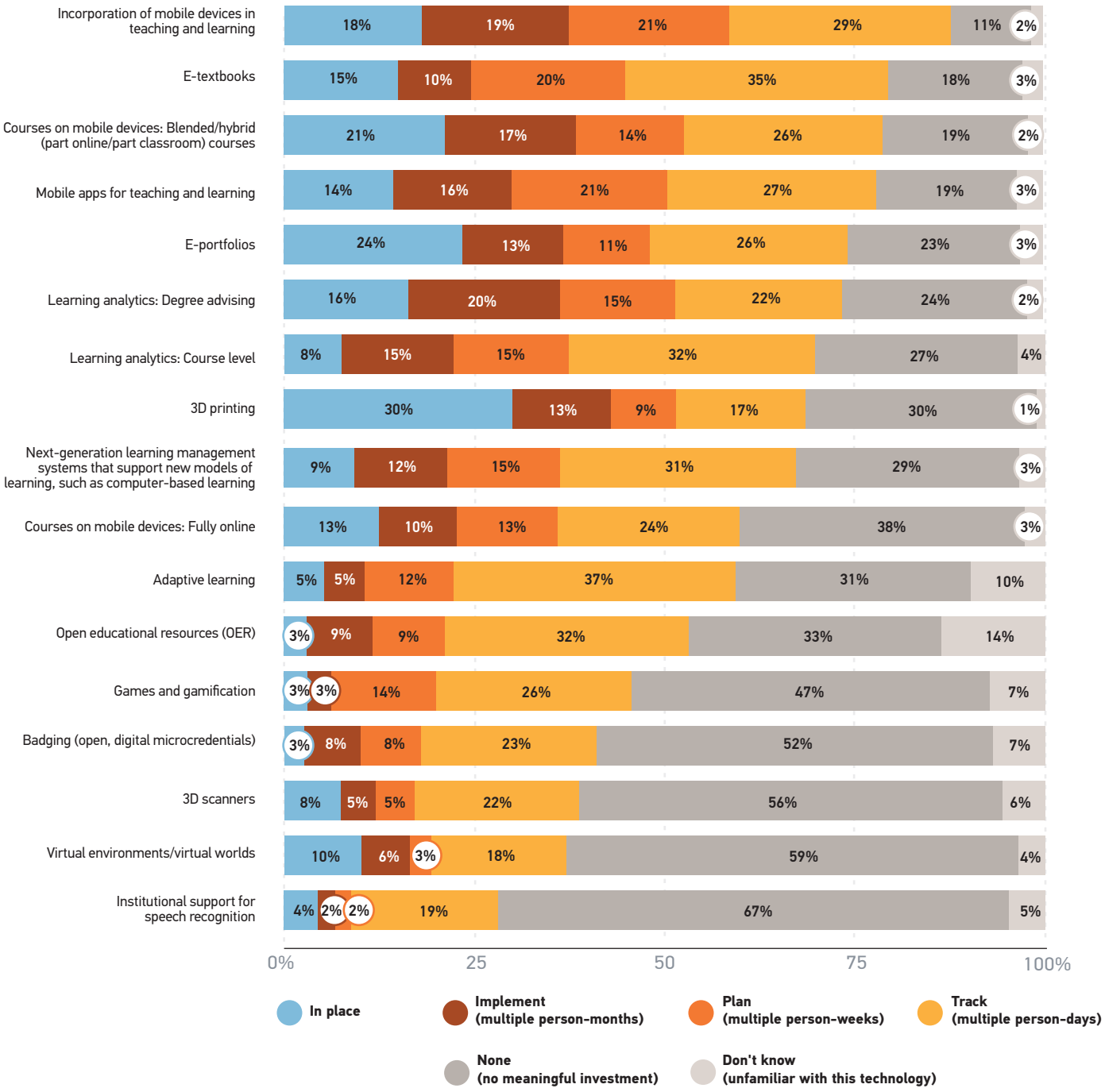


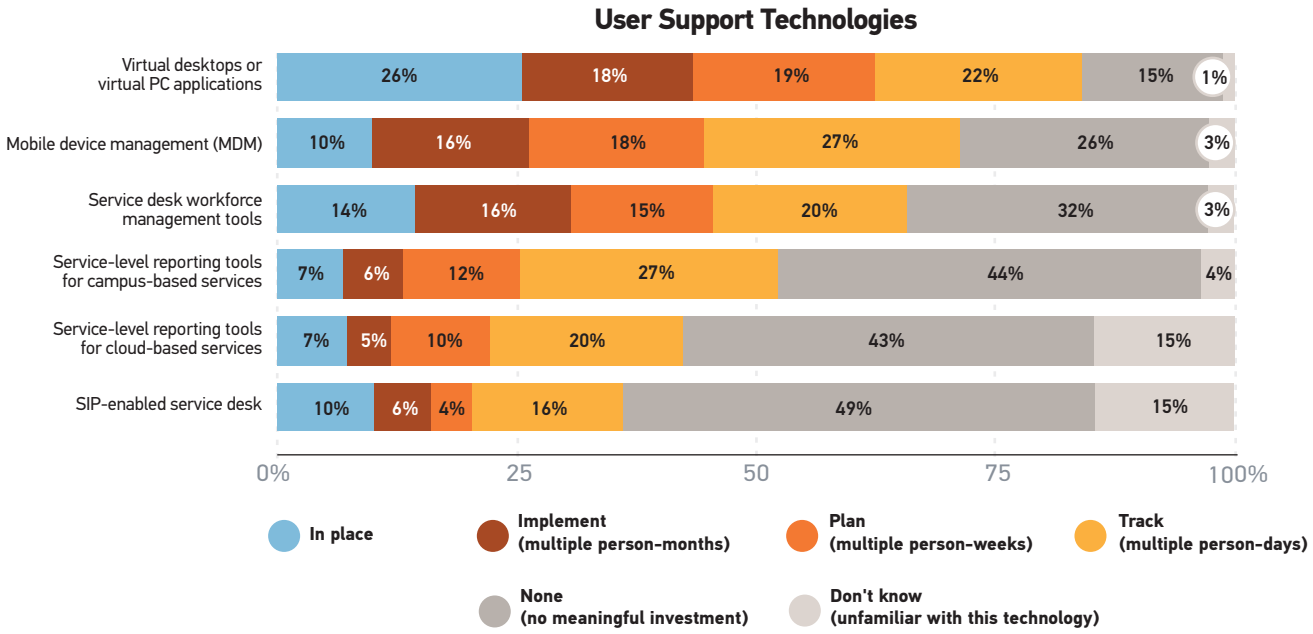
Security and Privacy Technologies




Social/Personal Technologies
Emergency/mass notification services
80%
8%
4%
5%
4%
<1%
Customer relationship management (CRM) system for student admissions and enrollment
34%
20%
13%
15%
17%
1%
Customer relationship management (CRM) system for alumni and/or institutional advancement
36%
9%
14%
20%
19%
2%
Support for use of personal cloud services
15%
4%
11%
24%
44%
3%
Virtual environments/virtual worlds
10%
6%
3%
18%
59%
4%
Location-based computing/institutional use of location intelligence
3%
6%
6%
19%
60%
7%
Institutional support for speech recognition
4%
2%
2%
19%
67%
5%
Virtual assistants
<1%
<1%
2%
11%
75%
11%
0%
25
50
75
100%
In place
Implement (multiple person-months)
Plan (multiple person-weeks)
Track (multiple person-days)
None (no meaningful investment)
Don't know (unfamiliar with this technology)

Teaching and Learning Technologies





Institutional Differences

Each technology was assigned an "attention" score that was a weighted combination of intentions to plan, track, or implement a technology in 2015 (see the Methodology section for more details). We found institutional differences in emphasis for about one-third of the technologies. Many of the differences could be attributed to institutional mission. Doctoral institutions and larger institutions are generally devoting more effort to planning, tracking, and implementing technologies than other institutions. Nondoctorals are not surprisingly paying less attention to technologies that support research. Other technologies nondoctorals are paying less attention to include network and IT service management technologies like software-defined networks or service desk workforce management tools.

What is perhaps striking about the top 10 technologies is that most of them are important to all types of institutions. They made the list because attention being paid to them is universally high. Two exceptions were administrative/business performance analytics and enterprise identity and access management solutions. Larger institutions and institutions that tend to adopt technology earlier than others are paying more attention to administrative/business performance analytics. Enterprise identity and access management solutions are of more interest to larger institutions, private doctoral and master's universities, and community colleges and of less interest to bachelor's colleges.

Community Colleges

Paying more attention than others to:

- Enterprise identity and access management solutions
- Near field communication

Paying less attention to:

- Augmented reality (digitally enhanced physical objects)
- Cloud-based high-performance computing (HPC)
- Cross-institutional resource sharing of research computing services
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Games and gamification
- Hadoop
- HPC as a research core service
- In-memory computing
- Mesh networking
- Private-cloud computing (externally hosted)
- Science DMZ
- Self-publishing
- Tools to support cross-institutional collaborations (e.g., Globus)

Bachelor's Institutions

Paying less attention than others to:

- Cloud-based high-performance computing (HPC)
- Courses on mobile devices: Fully online
- Enterprise identity and access management solutions
- Hybrid-cloud computing
- IT asset management tools (e.g., CMDB)
- Service-level reporting tools for campus-based services

Public Master's Institutions

Paying less attention than others to:

- Cloud-based high-performance computing (HPC)
- Digital preservation of research data
- Digital repositories for researchers and scholars
- OpenID Connect

Private Master's Institutions

Paying less attention than others to:

- Cloud-based high-performance computing (HPC)
- Cross-institutional resource sharing of research computing services
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Emergency/mass notification services
- HPC as a research core service
- IT asset management tools (e.g., CMDB)
- Science DMZ
- Self-publishing
- Service desk workforce management tools
- Service-level reporting tools for campus-based services
- Software-defined networks (SDN)
- Tools to support cross-institutional collaborations (e.g., Globus)

Public Doctoral Institutions

Paying more attention than others to:

- Cloud-based high-performance computing (HPC)
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Hadoop
- HPC as a research core service
- Learning analytics: Course level
- Mesh networking
- New models for global research collaborations
- Private-cloud computing (externally hosted)
- Science DMZ
- Self-publishing
- Service desk workforce management tools
- Software-defined networks (SDN)
- Tools to support cross-institutional collaborations (e.g., Globus)

Private Doctoral Institutions

Paying more attention than others to:

- Biometric authentication
- Cloud-based high-performance computing (HPC)
- Cross-institutional resource sharing of research computing services
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Enterprise identity and access management solutions
- Ethernet fabrics/fabric data centers
- Games and gamification
- Hadoop
- HPC as a research core service
- Hybrid-cloud computing
- IT asset management tools (e.g., CMDB)
- Learning analytics: Course level
- New models for global research collaborations
- Private-cloud computing (externally hosted)
- Private-cloud computing (locally hosted)
- Science DMZ
- Service-level reporting tools for campus-based services

Institutional Size

Larger institutions (especially those with 15,000 or more students, faculty, and staff) are paying more attention than smaller institutions to:

- Administrative/business performance analytics
- Cloud-based high-performance computing (HPC)
- Cloud-based security services
- Courses on mobile devices: Fully online
- Data center capacity planning and management tools for hybrid campus and cloud data center configurations
- Digital preservation of research data
- E-portfolios
- Enterprise identity and access management solutions
- Ethernet fabrics/fabric data centers
- Hadoop
- HPC as a research core service
- Hybrid-cloud computing

- Learning analytics: Course level
- Multifactor authentication (two factors, tokens, smart cards) for critical applications
- New models for global research collaborations
- Open content
- Private-cloud computing (externally hosted)
- Private-cloud computing (locally hosted)
- Science DMZ
- Service desk workforce management tools
- Software-defined networks (SDN)

Early, Mainstream, and Late Adopters

We also looked at the relationship between institutional pace of technology adoption (late, mainstream, or early) and the attention institutions plan to pay in 2015 to the technologies on our list. Early adopters tend to pay more attention to technologies than mainstream adopters, who pay more attention still than late adopters.

Falling behind? Late adopters are spending less time than others with:

- Adaptive learning
- Administrative/business performance analytics
- Badging (open, digital microcredentials)
- E-portfolios
- IT risk management automation to manage risk assessment, incident management, compliance mapping/reporting, etc.
- Learning analytics: Course level
- Mesh networking
- Mobile apps for BI/reporting dashboards
- Open educational resources (OER)
- Predictive analytics for administrative/business performance
- Predictive analytics for applications other than administrative/business performance
- Text/content analytics
- Use of big data in analytics (mining massive amounts of structured and unstructured data)

Architecture

IT architecture informs and guides technology choices. It is a particularly important IT issue: *Developing an enterprise IT architecture that can respond to changing conditions and new opportunities* ranked ninth among the EDUCAUSE Top 10 IT Issues for 2015. Good enterprise IT architecture can make the IT organization and the institution more effective. By the same token, bad enterprise IT architecture can make the IT organization and the institution less effective. When asked to describe their institutional approach to IT architecture, over half of U.S. respondents (56%) reported that they locally integrate the architectures of multiple major systems, almost one-third (32%) follow the architecture of a primary system or suite (e.g., SCT, the Oracle applications suite, Workday, Kuali), and 1 in 10 have local IT architecture standards and conform their local and vendor systems to that architecture. We found no statistically significant differences in approach due to institutional type or size or to the speed of technology adoption.

Competitive advantage? Early adopters are spending more time than late adopters with:

- 3D scanners
- Administrative/business performance analytics
- Augmented reality (digitally enhanced physical objects)
- Cloud-based high-performance computing (HPC)
- E-signatures
- Enterprise governance, risk, and compliance (GRC) systems
- Institutional support for public-cloud storage (e.g., Box)
- IT risk management automation to manage risk assessment, incident management, compliance mapping/reporting, etc.
- Learning analytics: Course level
- Open educational resources (OER)
- Predictive analytics for applications other than administrative/business performance
- Security information and event management (SIEM)
- Service-level reporting tools for campus-based services
- Service-level reporting tools for cloud-based services
- Software-defined networks (SDN)
- Talent/workforce analytics
- Use of big data in analytics (mining massive amounts of structured and unstructured data)
- Virtual desktops or virtual PC applications

What We Don't Understand

Quite a few respondents indicated they were unfamiliar with various technologies. What might be described as the Top 10 Confusing Technologies were:

1. **Autonomic computing** (31% unfamiliar) is a response to the continued increase in complexity of computing environments. It aims to develop self-healing, self-configured, self-protected, and self-managed systems and infrastructure that would simplify infrastructure and operations management. The name and goals intentionally reference the biological autonomic nervous system.

2. **OAuth** (28%) is an open-source authorization protocol that allows websites or applications to access a user's data without the user's needing to share login credentials. It allows users to use, for example, their Google, Facebook, or Twitter credentials to access other websites without worrying about their access credentials (e.g., usernames and passwords) being compromised by a breach of those third parties or having to create a new account on the website.[5]

3. **Near field communication** (27%) is a short-range wireless technology standard that uses interacting electromagnetic radio fields to limit transmissions to very small distances. It is useful in situations such as payments, in which physical proximity is required to maintain security.

4. **OpenID Connect** (26%) is an open-standard identity and access management protocol that uses a third-party service (such as Google, Microsoft, Yahoo!, etc.) to authenticate users to websites. This allows users to use, for example, their Gmail account username and password to sign into multiple unrelated websites without having to register with their information on each website. The OpenID protocol is layered onto OAuth.

5. **Hadoop** (22%) "is an Apache Software Foundation project and open source software platform for scalable, distributed computing. Hadoop can provide fast and reliable analysis of both structured data and unstructured data."[6] Hadoop is among the more prominent solutions being developed for storing and processing big data.

6. **Electronic laboratory notebooks** (22%) are wiki-like document or protocol repositories with better tags, date/time stamps, and digital tools for time and version control that can promote collaboration among researchers. They can be hosted on campus or in the cloud.

7. **In-memory computing** (20%) refers to "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."[7]

8. **Science DMZ** (20%) bypasses the administrative or campus network to connect supercomputer centers or large HPC clusters directly to the Internet using data transfer node (DTN) devices that sit outside the firewall and are designed to transmit data very quickly. The Science DMZ model allows institutions to optimize network equipment, configuration, and security policies for research computing.[8]

9. **Mesh networking** (17%) describes "a network topology in which each node (called a mesh node) relays data for the network. All nodes cooperate in the distribution of data in the network.... Mesh networks are typically wireless."[9]

10. **Activity stream** (16%) is "a publish-and-subscribe notification mechanism and conversation space typically found in social networking. It lists activities or events relevant to a person, group, topic or everything in the environment. A participant subscribes to, or 'follows,' entities (e.g., other participants or business application objects) to track their related activities."[10]

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' 2015 intentions for implementing and planning technologies to estimate deployment of these technologies by 2016–17 and also by 2018–20.

We changed our prediction methodology from last year to better reflect the imprecision inherent in these sorts of data. The figures on pages 29–35 provide progress estimates for the individual technologies and for 15 technology domains (some technologies were assigned to multiple domains). The figures estimate when each technology and domain is expected to be:

- Experimental (deployed in 20% or less of institutions)
- Emergent (deployed in 21–40% of institutions)
- Growing (deployed in 41–60% of institutions)
- Mainstream (deployed in 61–80% of institutions)
- Universal (deployed in 81–100% of institutions)

We predict that the top 3 technologies—BI/reporting dashboards, mobile app development (HTML5, responsive design, hybrid, etc.), and mobile apps for enterprise applications—will progress from Experimental to Mainstream by the end of this decade. Two other technologies in the top 10, already Emergent, will also become Mainstream by the end of the decade: enterprise identity and access management solutions, and 802.11ac wireless networking standard. Unified communications and collaboration will move from Emergent to Growing.

The remaining four technologies will advance from Experimental to Growing:

- Administrative/business performance analytics
- Incorporation of mobile devices in teaching and learning
- Mobile apps for teaching and learning
- Mobile data protection

We identified 18 additional technologies outside the top 10 that are also rapidly increasing:

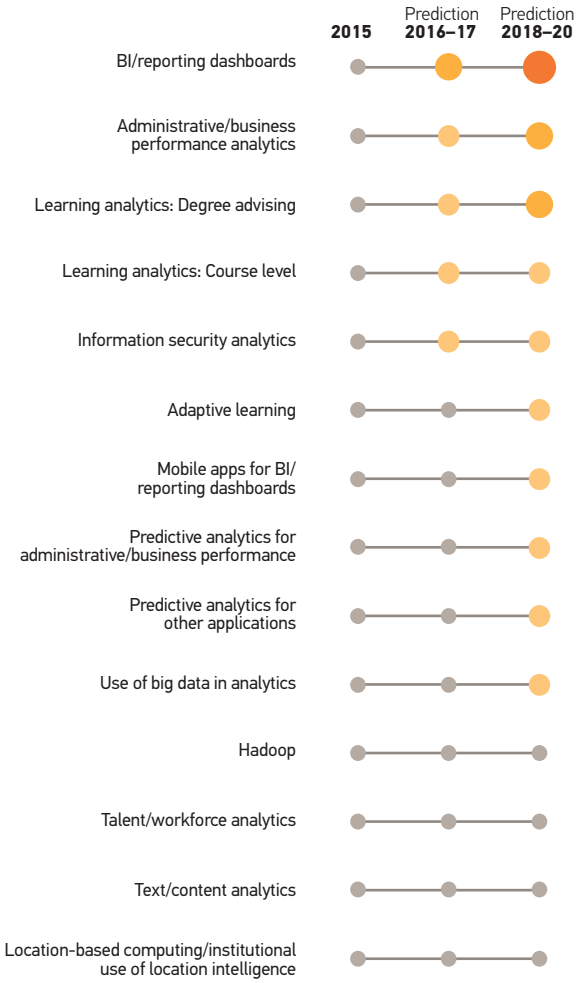
Technology	Today	By 2020
Data collection and sophisticated analytics methodologies	Experimental	Emergent
Digital preservation of research data	Experimental	Emergent
Learning analytics: Course level	Experimental	Emergent
Mobile device management (MDM)	Experimental	Growing
Multifactor authentication (two factors, tokens, smart cards) for critical applications	Experimental	Growing
Service desk workforce management tools	Experimental	Growing
E-textbooks	Experimental	Growing
IT asset management tools (e.g., CMDB)	Experimental	Growing
Database audit and protection tools	Experimental	Growing
Learning analytics: Degree advising	Experimental	Growing
Institutional support for public-cloud storage (e.g., Box)	Experimental	Growing
Courses on mobile devices: Blended/hybrid (part online/part classroom) courses	Emergent	Growing
Tablet access for applications	Emergent	Mainstream
Virtual desktops or virtual PC applications	Emergent	Mainstream
Cloud-based office productivity suites	Emergent	Mainstream
Network capacity planning and management tools	Emergent	Mainstream
Customer relationship management (CRM) system for student admissions and enrollment	Emergent	Mainstream
Document management solutions	Growing	Mainstream

Three of these were among the top 10 technologies on which institutions intend to spend planning time in 2015:[11]

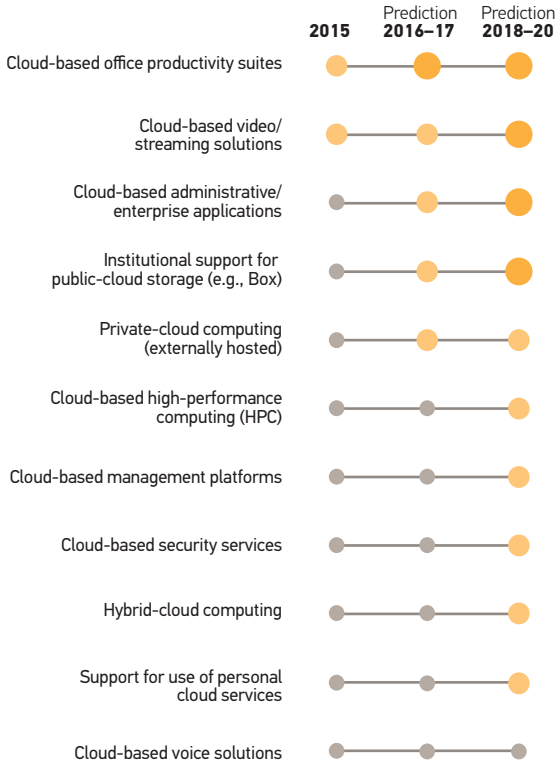
- Tablet access for applications
- Database audit and protection tools
- E-textbooks

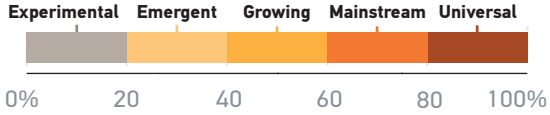
Estimated Five-Year Adoption Trends

Analytics Technologies

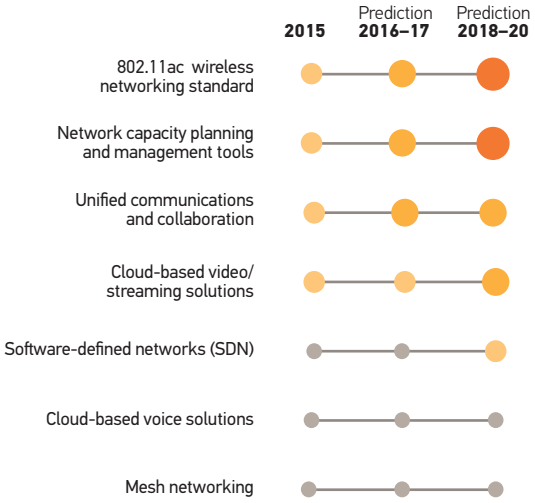


Cloud Technologies

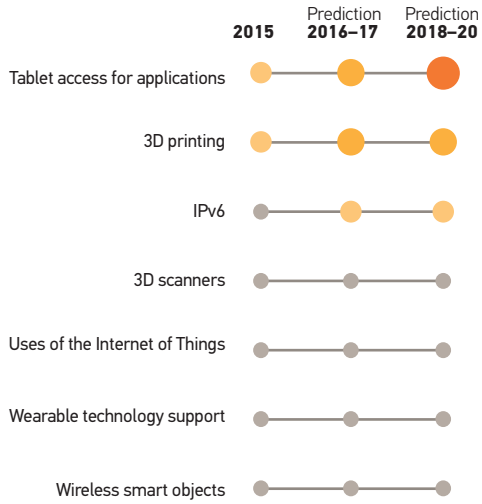


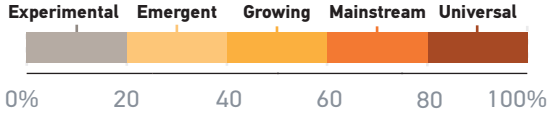


Communications/Networking Technologies

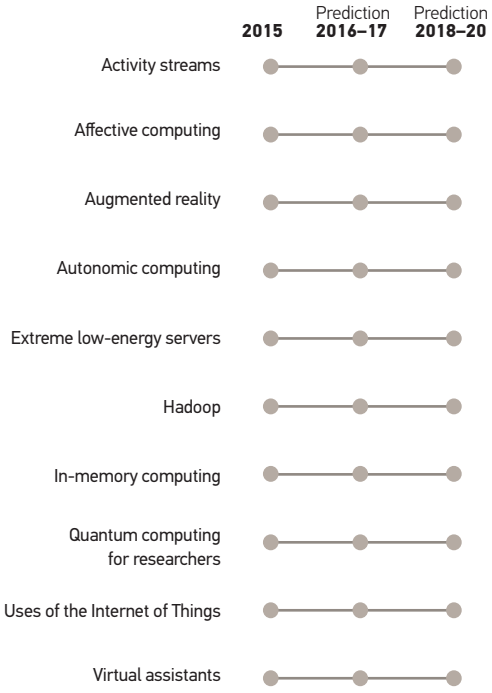


Devices

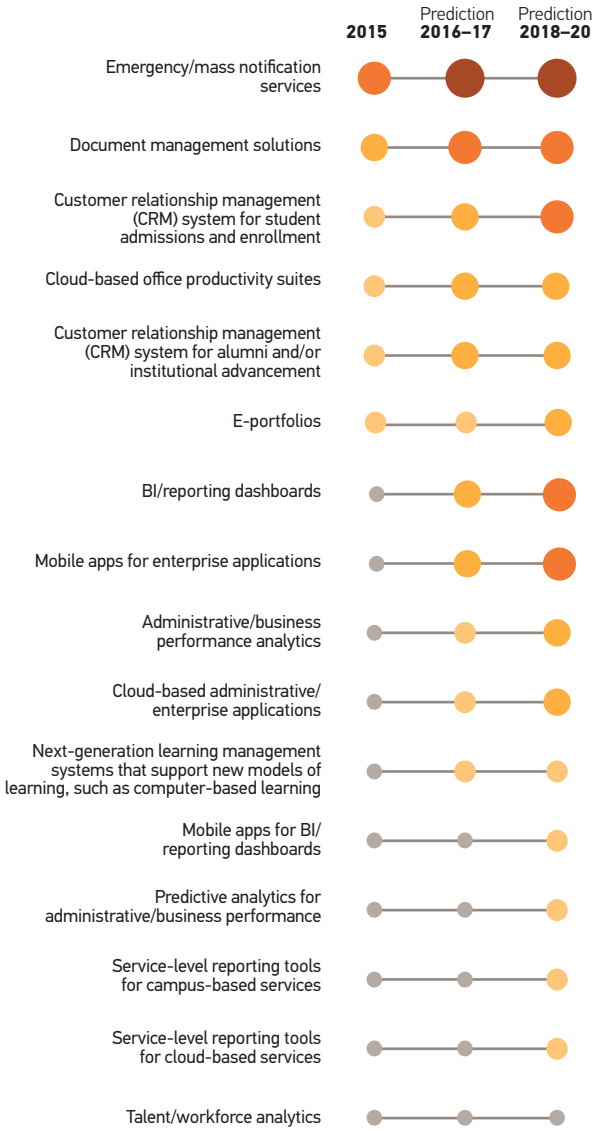


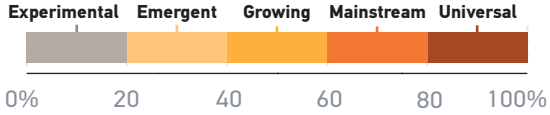


Emerging Technologies

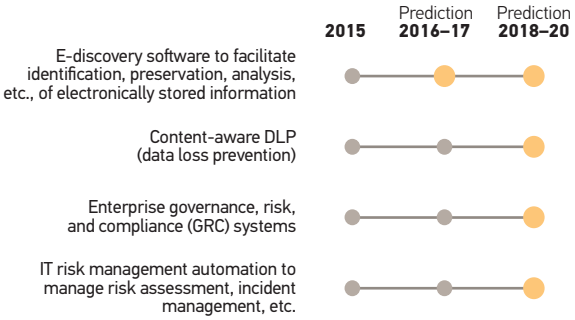


Enterprise Technologies

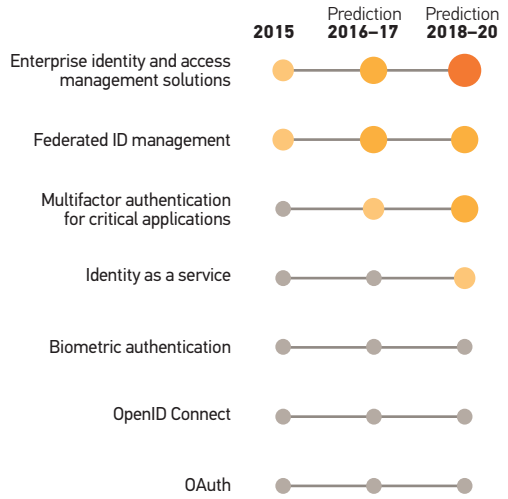


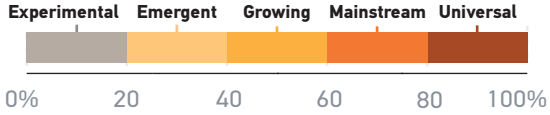


GRC Technologies

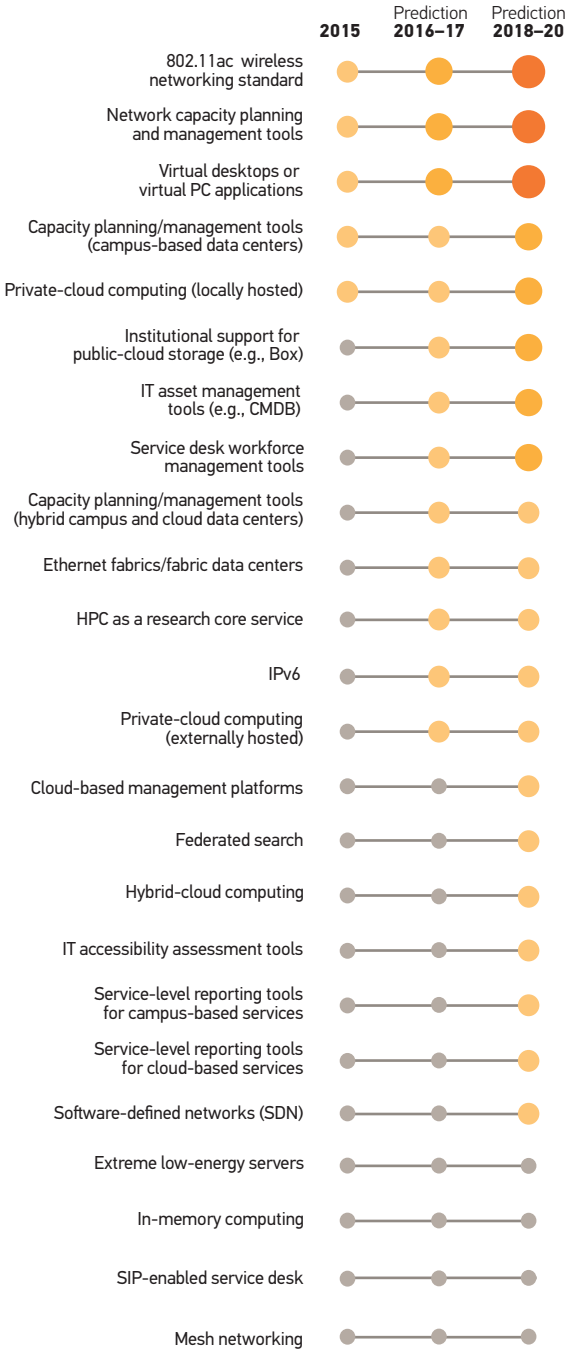


Identity and Access Management Technologies

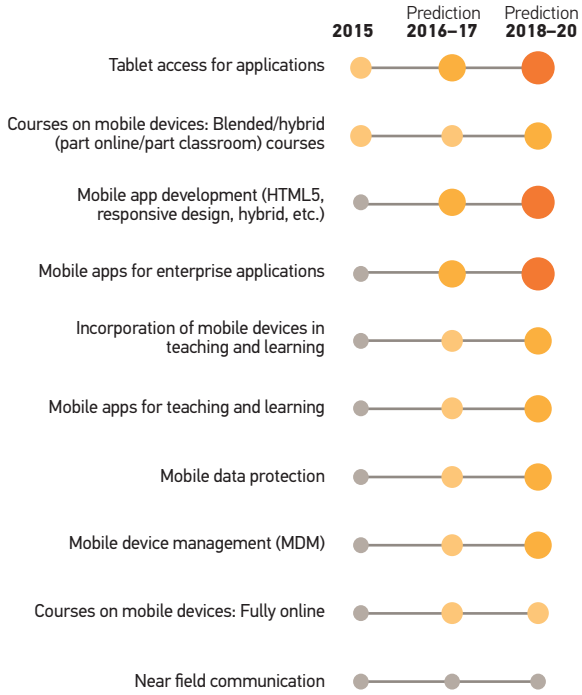


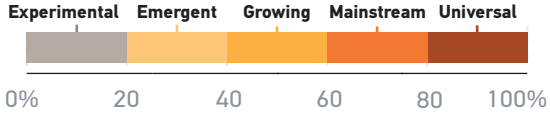


Infrastructure and Operations Technologies

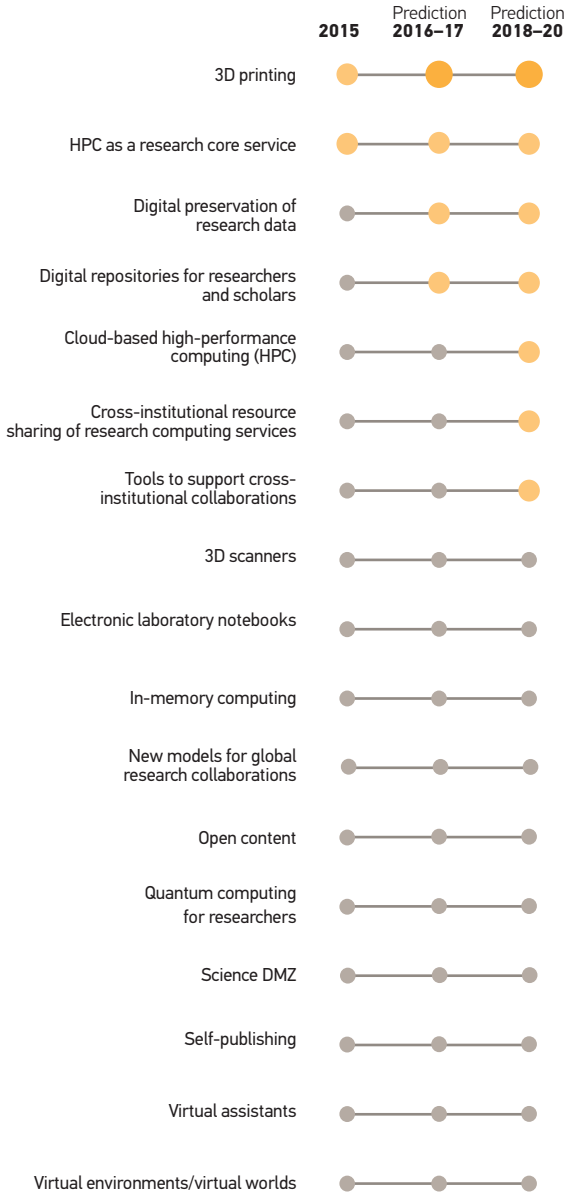


Mobile Technologies

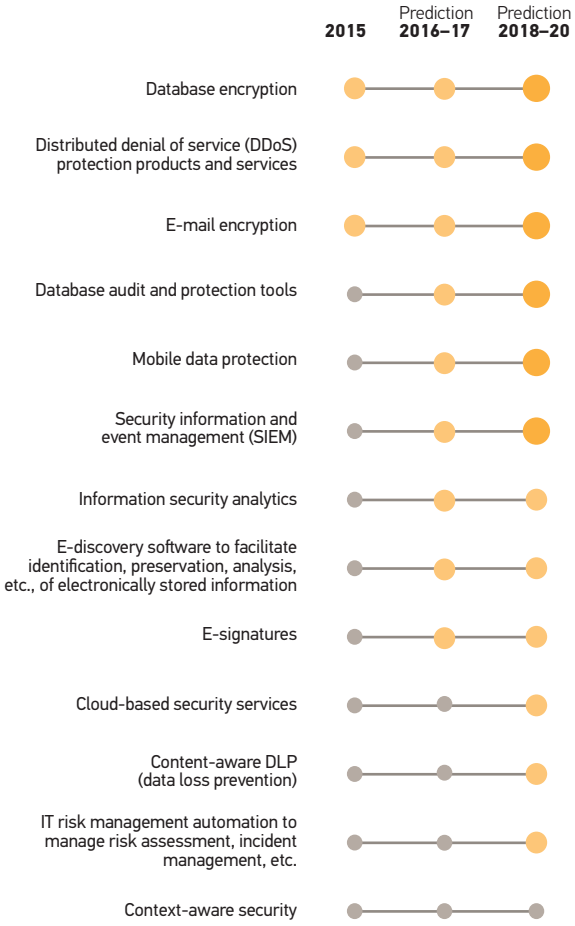


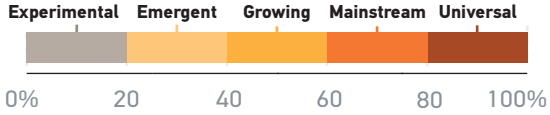


Research and Scholarship Technologies

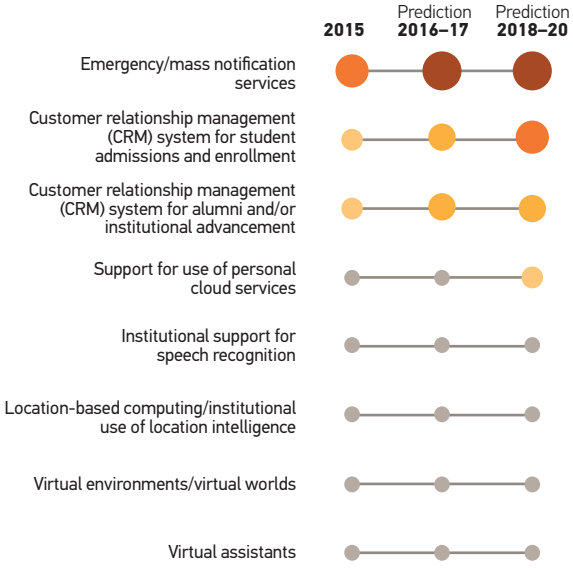


Security and Privacy Technologies

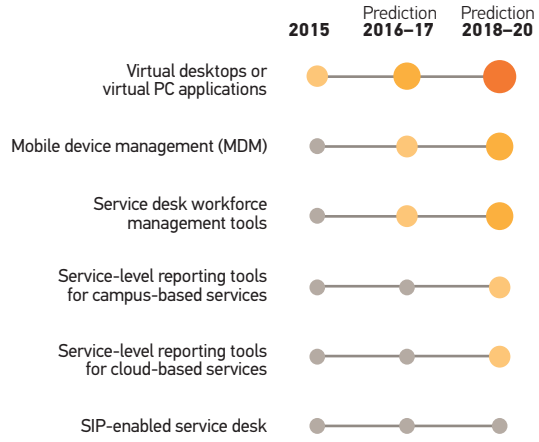




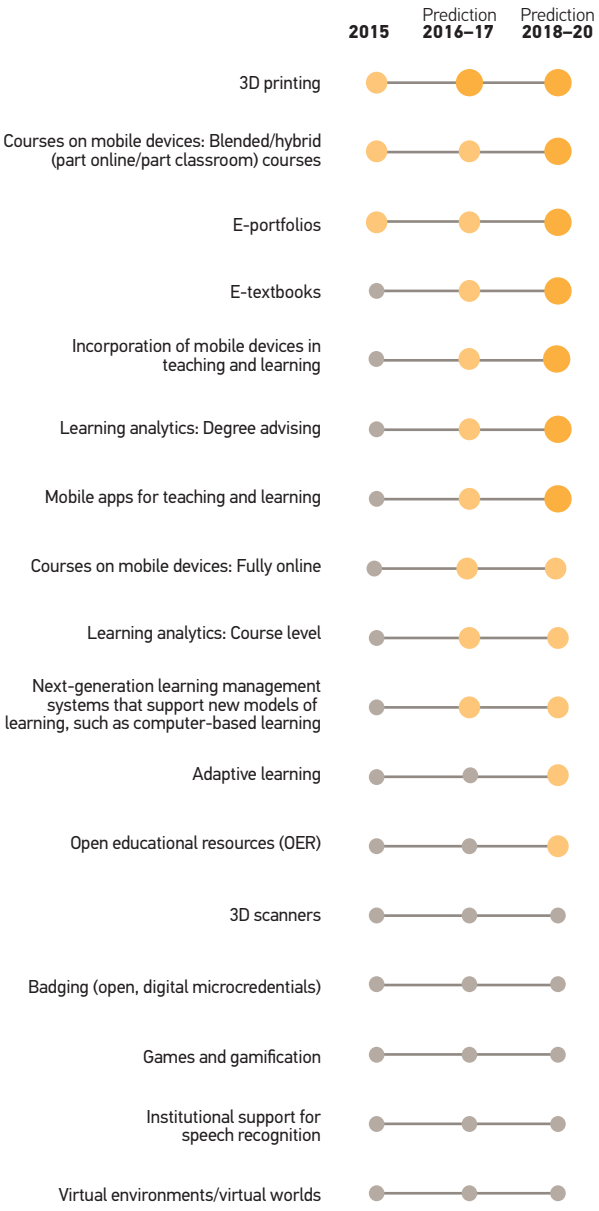
Social/Personal Technologies

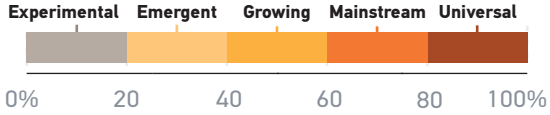


User Support Technologies

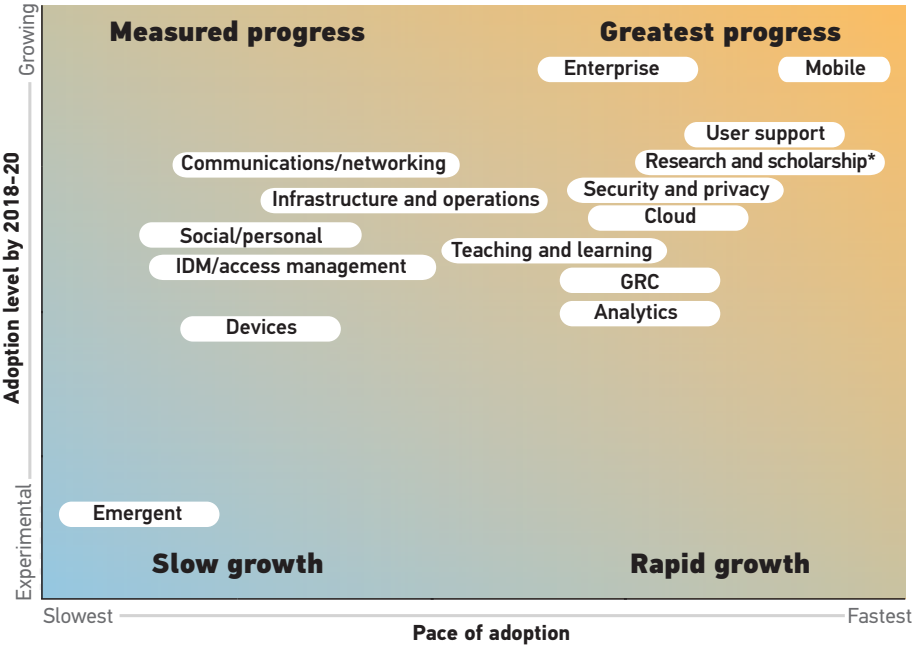


Teaching and Learning Technologies





The figure below compares the pace of adoption among the 15 technology domains. The four domains whose adoption we predict will make the most progress this decade are mobile, enterprise IT, user support, and, within doctoral universities, research and scholarship.



*Among DR institutions only

Advice

This list can inform—but should not 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

- Become familiar with the top 10 strategic technologies, the up-and-coming technologies (see the sidebar), and the technologies in each domain that are receiving the most attention in 2015.
- Understand how each technology does or does not fit your IT architecture, speed of adoption, and strategic directions.

Benchmark

- Compare your progress to that of others. Determine whether your institution is moving quickly enough to keep pace with technology advances and opportunities.
- Find peer role models and communities of practice to help you understand how best to introduce and deploy key emerging technologies.

Lead

- Use this report, the top 10 IT issues report, and the new technology trends report to brief leadership at your institution.
- Initiate discussions and reviews of institutional strategic plans to consider whether your institution is investing in the technologies that will be key to its future.
- Take a risk-management approach: Will your institution's current technology and plans reduce or increase institutional risk in the coming years?

Up-and-Coming Technologies

Knowing which technologies institutions are most commonly tracking can provide a preview further into the future. We found a distinction between technology planning and implementation versus technology tracking. Only one of the technologies institutions are most commonly tracking (mobile data protection, 36% of institutions) made the overall top 10 list. At least 30% of institutions are tracking these 11 technologies in 2015:

1. Adaptive learning (37% tracking)
2. Mobile data protection (36%)
3. E-textbooks (35%)
4. Learning analytics: Course level (32%)
5. Uses of the Internet of Things (32%)
6. Open educational resources (32%)
7. Next-generation learning management systems that support new models of learning, such as computer-based learning (31%)
8. Private-cloud computing (externally hosted) (31%)
9. IT risk management automation to manage risk assessment, incident management, compliance mapping/reporting, etc. (31%)
10. Hybrid-cloud computing (30%)
11. Database audit and protection tools (30%)

Acknowledgments

Many thanks are due to the EDUCAUSE staff who made this report possible. Pam Arroway led the statistical analysis, and Kate Roesch developed the many graphics that help bring this information to life. Betsy Tippens Reinitz, Eden Dahlstrom, and Joanna Grama advised on the choices, definitions, and categorization of technologies. Leah Lang helped coordinate this content with the Core Data Service content to minimize overlap. Gregory Dobbin provided his usual expert editorial review. And Joanna Grama kept all the pieces of this project coordinated and moving ahead.

Appendix: Methodology

The list of 107 technologies was derived from several authoritative sources that annually identify emerging and maturing technologies in higher education[12] and from the 2013 list that involved additional reviews by the ECAR Working Group Strategies Committee and other technical experts. Even so, the list could be improved. There are likely missing technologies, misplaced technologies (emergency/mass notification services and probably also document management solutions are too mature for this list). At the other end of the scale, most of the emergent technologies are still too nascent in higher education to warrant inclusion.

The survey was distributed to 10,004 EDUCAUSE members as part of the Top 10 IT Issues survey; 368 members responded and indicated, for each technology, the attention their institution was planning to devote to each technology in 2015. 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 to items within those domains. Further, if several members completed the survey from a single institution, only one rating was included (we used the CIO as the primary rater). As a result, the number of respondents rating individual technologies ranged from 139 to 275 respondents.

The final top 10 list of strategic technologies is a weighted average of institutions' plans, with the heaviest weight (5) given to implementation, followed by planning (3), and then tracking (2). Other response options (no plans, in place, and unfamiliar with technology) were given a weight of zero in our scoring schema.

Complete List of Technologies

Analytics

- Adaptive learning
- Administrative/business performance analytics
- BI/reporting dashboards
- Data collection and sophisticated analytics methodologies
- Hadoop
- Learning analytics: Course level
- Learning analytics: Degree advising
- Location-based computing/institutional use of location intelligence
- Mobile apps for BI/reporting dashboards

- Predictive analytics for administrative/business performance
- Predictive analytics for applications other than administrative/business performance
- Talent/workforce analytics
- Text/content analytics
- Use of big data in analytics (mining massive amounts of structured and unstructured data)

Cloud Sourcing

- Cloud-based high-performance computing (HPC)
- Cloud-based management platforms (for access management and service management of cloud services and resources)
- Cloud-based office productivity suites
- Cloud-based security services
- Cloud-based video/streaming solutions
- Cloud-based voice solutions
- Hybrid-cloud computing
- Institutional support for public-cloud storage (e.g., Box)
- Private-cloud computing (externally hosted)
- Support for use of personal cloud services

Communications/Networking

- 802.11ac wireless networking standard
- Cloud-based video/streaming solutions
- Cloud-based voice solutions
- Mesh networking
- Network capacity planning and management tools
- Software-defined networks (SDN)
- Unified communications and collaboration

Devices

- 3D printing
- 3D scanners
- IPv6
- Tablet access for applications
- Uses of the Internet of Things
- Wearable technology support
- Wireless smart objects

Emerging

- Activity streams (subscription-based notification services about individuals, applications, or physical objects)
- Affective computing (systems and devices that can recognize, interpret, process, and simulate emotion)
- Augmented reality (digitally enhanced physical objects)
- Autonomic computing
- Extreme low-energy servers
- Hadoop
- In-memory computing
- Quantum computing for researchers
- Uses of the Internet of Things
- Virtual assistants (conversation-based, computer-generated interface)

Enterprise IT

- Administrative/business performance analytics
- BI/reporting dashboards
- Cloud-based administrative/enterprise applications
- Cloud-based office productivity suites
- Customer relationship management (CRM) system for alumni and/or institutional advancement
- Customer relationship management (CRM) system for student admissions and enrollment
- Document management solutions
- E-portfolios
- Emergency/mass notification services
- Mobile apps for BI/reporting dashboards
- Mobile apps for enterprise applications
- Next-generation learning management systems that support new models of learning, such as computer-based learning
- Predictive analytics for administrative/business performance
- Service-level reporting tools for campus-based services
- Service-level reporting tools for cloud-based services
- Talent/workforce analytics

GRC

- Content-aware DLP (data loss prevention)
- E-discovery software to facilitate identification, preservation, analysis, etc., of electronically stored information
- Enterprise governance, risk, and compliance (GRC) systems
- IT risk management automation to manage risk assessment, incident management, compliance mapping/reporting, etc.

Identity and Access Management

- Biometric authentication
- Enterprise identity and access management solutions
- Federated ID management
- Identity as a service
- Multifactor authentication (two factors, tokens, smart cards) for critical applications
- OAuth
- OpenID Connect

Infrastructure and Operations

- 802.11ac wireless networking standard
- Cloud-based management platforms (for access management and service management of cloud services and resources)
- Data center capacity planning and management tools for campus-based data centers
- Data center capacity planning and management tools for hybrid campus and cloud data center configurations
- Ethernet fabrics/fabric data centers
- Extreme low-energy servers
- Federated search
- HPC as a research core service
- Hybrid-cloud computing
- In-memory computing
- Institutional support for public-cloud storage (e g, Box)
- IPv6
- IT accessibility assessment tools
- IT asset management tools (e.g., CMDB)
- Mesh networking
- Network capacity planning and management tools
- Private-cloud computing (externally hosted)

- Private-cloud computing (locally hosted)
- Service desk workforce management tools
- Service-level reporting tools for campus-based services
- Service-level reporting tools for cloud-based services
- SIP-enabled service desk
- Software-defined networks (SDN)
- Virtual desktops or virtual PC applications

Mobile

- Courses on mobile devices: Blended/hybrid (part online/part classroom) courses
- Courses on mobile devices: Fully online
- Incorporation of mobile devices in teaching and learning
- Mobile app development (HTML5, responsive design, hybrid, etc.)
- Mobile apps for enterprise applications
- Mobile apps for teaching and learning
- Mobile data protection
- Mobile device management (MDM)
- Near field communication
- Tablet access for applications

Research and Scholarship

- 3D printing
- 3D scanners
- Cloud-based high-performance computing (HPC)
- Cross-institutional resource sharing of research computing services
- Digital preservation of research data
- Digital repositories for researchers and scholars
- Electronic laboratory notebooks
- HPC as a research core service
- In-memory computing
- New models for global research collaborations
- Open content
- Quantum computing for researchers
- Science DMZ
- Self-publishing
- Tools to support cross-institutional collaborations (e.g., Globus)
- Virtual assistants (conversation-based, computer-generated interface)
- Virtual environments/virtual worlds

Security and Privacy

- Cloud-based security services
- Content-aware DLP (data loss prevention)
- Context-aware security
- Data collection and sophisticated analytics methodologies
- Database audit and protection tools
- Database encryption
- Distributed denial of service (DDoS) protection products and services
- E-discovery software to facilitate identification, preservation, analysis, etc., of electronically stored information
- E-mail encryption
- E-signatures
- IT risk management automation to manage risk assessment, incident management, compliance mapping/reporting, etc.
- Mobile data protection
- Mobile device management (MDM)
- Security information and event management (SIEM)

Social/Personal

- Customer relationship management (CRM) system for alumni and/or institutional advancement
- Customer relationship management (CRM) system for student admissions and enrollment
- Emergency/mass notification services
- Institutional support for speech recognition
- Location-based computing/institutional use of location intelligence
- Support for use of personal cloud services
- Virtual assistants (conversation-based, computer-generated interface)
- Virtual environments/virtual worlds

Teaching and Learning

- 3D printing
- 3D scanners
- Adaptive learning
- Badging (open, digital microcredentials)
- Courses on mobile devices: Blended/hybrid (part online/part classroom) courses
- Courses on mobile devices: Fully online
- E-portfolios

- E-textbooks
- Games and gamification
- Incorporation of mobile devices in teaching and learning
- Institutional support for speech recognition
- Learning analytics: Course level
- Learning analytics: Degree advising
- Mobile apps for teaching and learning
- Next-generation learning management systems that support new models of learning, such as computer-based learning
- Open educational resources (OER)
- Virtual environments/virtual worlds

User Support

- Mobile device management (MDM)
- Service desk workforce management tools
- Service-level reporting tools for campus-based services
- Service-level reporting tools for cloud-based services
- SIP-enabled service desk
- Virtual desktops or virtual PC applications

Notes

1. EDUCAUSE Core Data Service.
2. Susan Grajek and the 2014-2015 EDUCAUSE IT Issues Panel, "The Top 10 IT Issues, 2015: Inflection Point," *EDUCAUSE Review* 50, no. 1 (January/February 2015).
3. Susan Grajek and Betsy Tippens Reinitz, "2015 Strategic Technology Trends Report," forthcoming February 2015.
4. All values in the charts are rounded to the nearest whole number.
5. "OAuth," *Wikipedia*, retrieved December 19, 2014.
6. "Apache Hadoop," *Webopedia*, retrieved January 5, 2015.
7. "In-Memory Computing," *Techopedia*, retrieved December 19, 2014.
8. "Science DMZ: A Scalable Network Design Model for Optimizing Science Data Transfer," ESnet.
9. "Mesh Networking," *Wikipedia*, retrieved December 19, 2014.
10. "Activity Stream," *Gartner IT Glossary*, retrieved January 5, 2015.
11. As a reminder, we asked whether institutions would be tracking, planning, or implementing technologies to calculate an overall attention score that served as the basis for the top 10 technologies. These three technologies were among the top 10 technologies institutions will be *planning* in 2015.
12. Primary sources were *The Horizon Report*, Gartner's Top 10 Strategic Technology Trends for 2014, and multiple 2014 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.